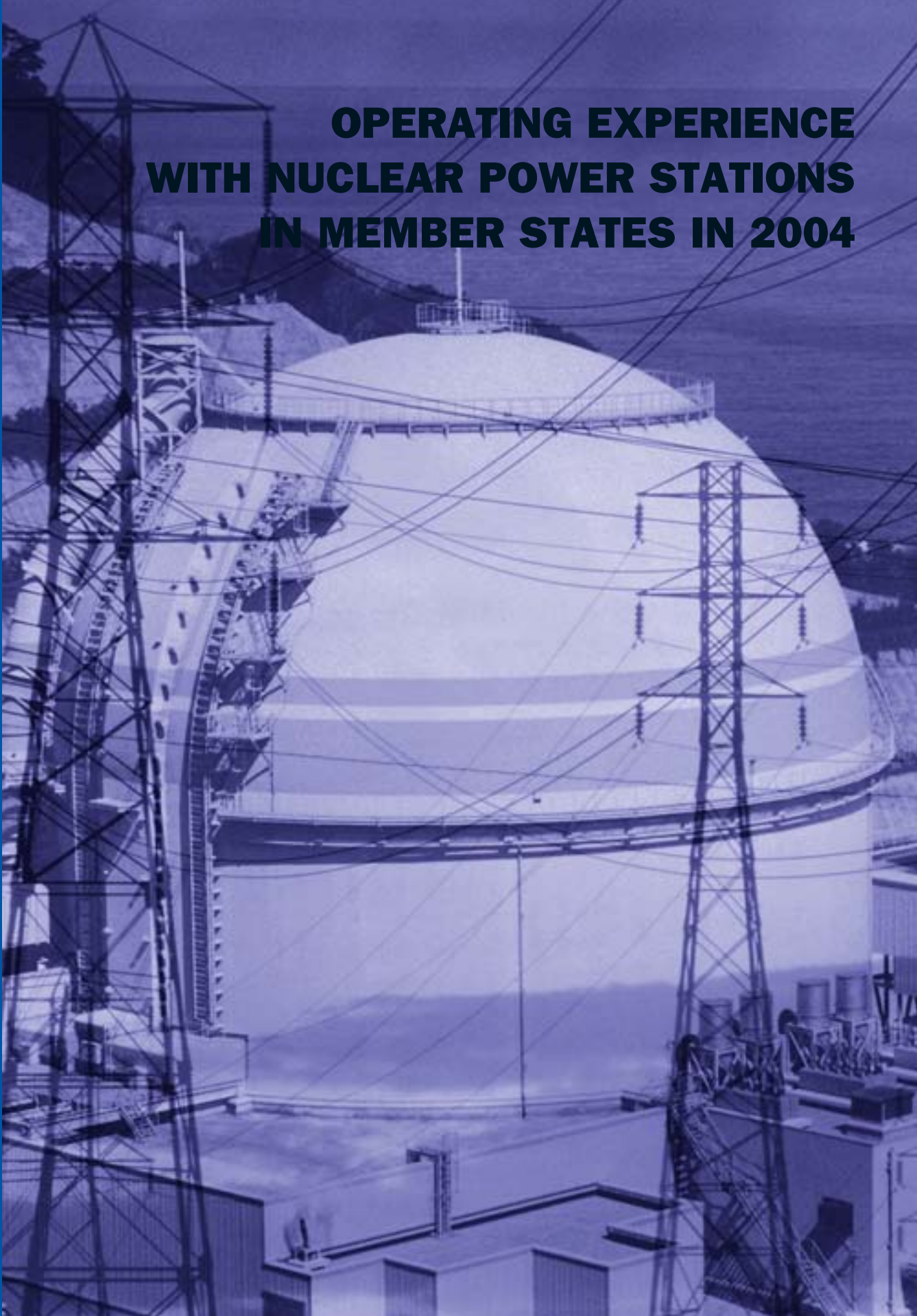




**IAEA**

International Atomic Energy Agency

**OPERATING EXPERIENCE  
WITH NUCLEAR POWER STATIONS  
IN MEMBER STATES IN 2004**



OPERATING EXPERIENCE  
WITH NUCLEAR POWER STATIONS  
IN MEMBER STATES IN 2004

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| EGYPT                               | MEXICO                    | URUGUAY  |
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| ERITREA                             | MONGOLIA                  | VENEZUELA  |
| ESTONIA                             | MOROCCO                   | VIETNAM  |
| ETHIOPIA                            | MYANMAR                   | YEMEN  |
| FINLAND                             | NAMIBIA                   | ZAMBIA   |
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|                                     | PAKISTAN                  |  |
|                                     | PANAMA                    |  |

The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

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## FOREWORD

This report is the thirty-sixth in the Agency's series of annual reports on operating experience with nuclear power stations in Member States.

As in previous years, in addition to annual performance data and outage information, the report contains a historical summary of performance and outages during the lifetime of individual plants and five figures illustrating worldwide performance and statistical data.

It is hoped that this report and related Agency publications will be useful to everyone concerned with nuclear power reactors. Suggestions and corrections from readers would be most welcome.

Director  
Division of Nuclear Power  
International Atomic Energy Agency  
Wagramer Strasse 5, P. O. Box 100  
A-1400 Vienna, Austria



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# 1. INTRODUCTION

This report is the thirty-sixth in the Agency's series of annual reports on operating experience with nuclear power stations in Member States.

The report is a direct output from the Agency's Power Reactor Information System (PRIS), whose databank contains all operating experience data published in the Agency's operating experience annual reports since 1971 and basic information on power reactors, including design data. It presents operating experience data for all worldwide nuclear power plants after starting commercial operation. The PRIS databank is available free of charge to IAEA Member States through its two services: PRIS-PC, and PRIS CD-ROM. The PRIS-PC allows direct access to the database through the Internet. The PRIS-PC on CD-ROM only includes data for reactors in operation, under construction and shutdown. It keeps the same feature as in the current front-end-tool PRIS-PC interface. This front-end-tool interface allows to search and query through pre-designed statistics. The PRIS-PC on CD-ROM contains mapping interface including a view of the world map with zooming features to country, region and site map and links to PRIS database to retrieve related (nuclear power plant) information. PRIS data and related indicators are also available on the PRIS Website: [www.iaea.org/programmes/a2](http://www.iaea.org/programmes/a2). It contains publicly available information about reactor units and nuclear industry results.

Load, operation and availability factors are used as the basic performance indicators. Energy unavailability factors, separate for planned and unplanned unavailability, due either to causes under plant management control or external causes out of plant management control, are used as a measure of energy lost through a unit not being available. However, some ambiguity remains in the operators' reports of the unavailability data, resulting in inconsistencies in these factors. It is recognized that there is an inherent difficulty in reporting unavailability in energy due to external causes with relation to energy losses due to load following operation and grid limitation. It should be noted that, for load, operation and unavailability factors, there might be differences between the data of this report and those published elsewhere. To avoid confusion, reference should be made to the definitions given in Section 3. In Section 4 this report presents figures illustrating worldwide performance indicators up to 2004.

According to the information available to the Agency at the end of 2004, there were 440 nuclear power reactors operating in the world, with a total net capacity of 366.3 GW<sub>(e)</sub>.

Five new reactor units were connected to the grid in 2004 (two in Ukraine and one each in China, Japan and the Russian Federation), and one laid-up plant was reconnected in Canada. This compares to two new grid connections and two reconnections in 2003.

There were five NPP retirements in 2004 — four 50 MW(e) units in the United Kingdom and the 1185 MW(e) Ignalina-1 reactor in Lithuania. This compares to six retirements in 2003.

At the end of 2004 there were 26 nuclear power plants under construction in the world with a total net capacity 20.8 GW<sub>(e)</sub>. Construction began on two NPPs in 2004, India's 500 MW(e) prototype fast breeder reactor and Japan's 866 MW(e) Tomari-3 PWR. In addition, active construction resumed on two NPPs in the Russian Federation, Kalinin-4 and Balakovo-5.

The information contained in the report was made available to the Agency through designated national correspondents and the US Nuclear Regulatory Commission (NRC) and Department of Energy (DOE).

The Agency appreciates the valuable assistance that it has obtained from the national authorities, official correspondents and various electrical utilities in gathering the information for this report.

This publication includes information received by the Agency up to 30 September 2004. Up to this date from 15 British units (operated by British Energy) and from 1 French unit (Phenix) had not been reported. Information received after that date, although not included in this publication, is available in the PRIS database.

The report was compiled by staff of the Agency's Division of Nuclear Power. It is hoped that it will be useful to nuclear power plant operators, nuclear system designers, nuclear power planners, interested professional engineers and scientists and others concerned with the operating experience with nuclear power reactors. Suggestions and corrections from readers would be most welcome.

## 2. NUCLEAR POWER STATION UNITS IN MEMBER STATES (as of January 2005)

| Country Name              | Reactor Code | Reactor Name  | Page        |     |
|---------------------------|--------------|---------------|-------------|-----|
| ARGENTINA                 | AR—1         | ATUCHA-1      | 37          |     |
|                           | AR—2         | EMBALSE       | 39          |     |
| ARMENIA                   | AM—19        | ARMENIA-2     | 41          |     |
| BELGIUM                   | BE—2         | DOEL-1        | 43          |     |
|                           | BE—4         | DOEL-2        | 45          |     |
|                           | BE—5         | DOEL-3        | 47          |     |
|                           | BE—7         | DOEL-4        | 49          |     |
|                           | BE—3         | TIHANGE-1     | 51          |     |
|                           | BE—6         | TIHANGE-2     | 53          |     |
|                           | BE—8         | TIHANGE-3     | 55          |     |
|                           |              |               |             |     |
| BRAZIL                    | BR—1         | ANGRA-1       | 57          |     |
|                           | BR—2         | ANGRA-2       | 59          |     |
| BULGARIA                  | BG—3         | KOZLODUY-3    | 61          |     |
|                           | BG—4         | KOZLODUY-4    | 63          |     |
|                           | BG—5         | KOZLODUY-5    | 65          |     |
|                           | BG—6         | KOZLODUY-6    | 67          |     |
| CANADA                    | CA—10        | BRUCE-3       | 69          |     |
|                           | CA—11        | BRUCE-4       | 71          |     |
|                           | CA—18        | BRUCE-5       | 73          |     |
|                           | CA—19        | BRUCE-6       | 75          |     |
|                           | CA—20        | BRUCE-7       | 77          |     |
|                           | CA—21        | BRUCE-8       | 79          |     |
|                           | CA—22        | DARLINGTON-1  | 81          |     |
|                           | CA—23        | DARLINGTON-2  | 83          |     |
|                           | CA—24        | DARLINGTON-3  | 85          |     |
|                           | CA—25        | DARLINGTON-4  | 87          |     |
|                           | CA—12        | GENTILLY-2    | 89          |     |
|                           | CA—4         | PICKERING-1   |             |     |
|                           | CA—7         | PICKERING-4   | 91          |     |
|                           | CA—13        | PICKERING-5   | 93          |     |
|                           | CA—14        | PICKERING-6   | 95          |     |
|                           | CA—15        | PICKERING-7   | 97          |     |
|                           | CA—16        | PICKERING-8   | 99          |     |
|                           | CA—17        | POINT LEPREAU | 101         |     |
|                           | CHINA        | CN—2          | GUANGDONG-1 | 103 |
| CN—3                      |              | GUANGDONG-2   | 105         |     |
| CN—6                      |              | LINGAO 1      | 107         |     |
| CN—7                      |              | LINGAO 2      | 109         |     |
| CN—1                      |              | QINSHAN 1     | 111         |     |
| CN—4                      |              | QINSHAN 2 - 1 | 113         |     |
| CN—5                      |              | QINSHAN 2 - 2 | 115         |     |
| CN—8                      |              | QINSHAN 3 - 1 | 117         |     |
| CN—9                      |              | QINSHAN 3 - 2 | 119         |     |
| (Including TAIWAN, CHINA) |              | TW—1          | CHIN SHAN-1 | 121 |
|                           |              | TW—2          | CHIN SHAN-2 | 123 |
|                           |              | TW—3          | KUOSHENG-1  | 125 |
|                           |              | TW—4          | KUOSHENG-2  | 127 |
|                           |              | TW—5          | MAANSHAN-1  | 129 |
|                           |              | TW—6          | MAANSHAN-2  | 131 |

| Country Name   | Reactor Code | Reactor Name  | Page |
|----------------|--------------|---------------|------|
| CZECH REPUBLIC | CZ—4         | DUKOVANY-1    | 133  |
|                | CZ—5         | DUKOVANY-2    | 135  |
|                | CZ—8         | DUKOVANY-3    | 137  |
|                | CZ—9         | DUKOVANY-4    | 139  |
|                | CZ—23        | TEMELIN-1     | 141  |
|                | CZ—24        | TEMELIN-2     | 143  |
| FINLAND        | FI—1         | LOVIISA-1     | 145  |
|                | FI—2         | LOVIISA-2     | 147  |
|                | FI—3         | OLKILUOTO-1   | 149  |
|                | FI—4         | OLKILUOTO-2   | 151  |
| FRANCE         | FR—54        | BELLEVILLE-1  | 153  |
|                | FR—55        | BELLEVILLE-2  | 155  |
|                | FR—32        | BLAYAIS-1     | 157  |
|                | FR—33        | BLAYAIS-2     | 159  |
|                | FR—34        | BLAYAIS-3     | 161  |
|                | FR—35        | BLAYAIS-4     | 163  |
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|                | FR—14        | BUGEY-3       | 167  |
|                | FR—15        | BUGEY-4       | 169  |
|                | FR—16        | BUGEY-5       | 171  |
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|                | FR—53        | CATTENOM-2    | 175  |
|                | FR—60        | CATTENOM-3    | 177  |
|                | FR—65        | CATTENOM-4    | 179  |
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|                | FR—41        | CHINON-B-2    | 183  |
|                | FR—56        | CHINON-B-3    | 185  |
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|                | FR—62        | CHOOZ-B-1     | 189  |
|                | FR—70        | CHOOZ-B-2     | 191  |
|                | FR—72        | CIVAUX-1      | 193  |
|                | FR—73        | CIVAUX-2      | 195  |
|                | FR—42        | CRUAS-1       | 197  |
|                | FR—43        | CRUAS-2       | 199  |
|                | FR—44        | CRUAS-3       | 201  |
|                | FR—45        | CRUAS-4       | 203  |
|                | FR—22        | DAMPIERRE-1   | 205  |
|                | FR—29        | DAMPIERRE-2   | 207  |
|                | FR—30        | DAMPIERRE-3   | 209  |
|                | FR—31        | DAMPIERRE-4   | 211  |
|                | FR—11        | FESSENHEIM-1  | 213  |
|                | FR—12        | FESSENHEIM-2  | 215  |
|                | FR—46        | FLAMANVILLE-1 | 217  |
|                | FR—47        | FLAMANVILLE-2 | 219  |
|                | FR—61        | GOLFECH-1     | 221  |
|                | FR—68        | GOLFECH-2     | 223  |
|                | FR—20        | GRAVELINES-1  | 225  |
| FR—21          | GRAVELINES-2 | 227           |      |
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|              | FR—10        | PHENIX                   |                  |
|              | FR—48        | ST. ALBAN-1              | 253              |
|              | FR—49        | ST. ALBAN-2              | 255              |
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| DE—31        |              | ISAR-2 (KKI 2)           | 289              |
| DE—20        |              | KRUEMMEL (KKK)           | 291              |
| DE—15        |              | NECKARWESTHEIM-1 (GKN 1) | 293              |
| DE—44        |              | NECKARWESTHEIM-2 (GKN 2) | 295              |
| DE—5         |              | OBRIGHEIM (KWO)          | 297              |
| DE—14        |              | PHILIPPSBURG-1 (KKP 1)   | 299              |
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| DE—17        |              | UNTERWESER (KKU)         | 303              |
| HUNGARY      |              | HU—1                     | PAKS-1           |
|              | HU—2         | PAKS-2                   | 307              |
|              | HU—3         | PAKS-3                   | 309              |
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| INDIA        | IN—13        | KAIGA-1                  | 313              |
|              | IN—14        | KAIGA-2                  | 315              |
|              | IN—9         | KAKRAPAR-1               | 317              |
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| JAPAN        | JP—5         | FUKUSHIMA-DAIICHI-1      | 341              |
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|                    | JP—35        | FUKUSHIMA-DAINI-3    | 357  |
|                    | JP—38        | FUKUSHIMA-DAINI-4    | 359  |
|                    | JP—12        | GENKAI-1             | 361  |
|                    | JP—27        | GENKAI-2             | 363  |
|                    | JP—45        | GENKAI-3             | 365  |
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|                    | JP—14        | MIHAMA-3             | 401  |
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|                    | JP—19        | OHI-2                | 405  |
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|                    | JP—51        | OHI-4                | 409  |
|                    | JP—22        | ONAGAWA-1            | 411  |
|                    | JP—54        | ONAGAWA-2            | 413  |
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|                    | JP—28        | SENDAI-1             | 417  |
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|                    | JP—7         | SHIMANE-1            | 423  |
|                    | JP—41        | SHIMANE-2            | 425  |
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| MEXICO                 | MX—1            | LAGUNA VERDE-1       | 487        |     |
|                        | MX—2            | LAGUNA VERDE-2       | 489        |     |
| NETHERLANDS            | NL—2            | BORSSELE             | 491        |     |
| PAKISTAN               | PK—2            | CHASNUPP 1           | 493        |     |
|                        | PK—1            | KANUPP               | 495        |     |
| ROMANIA                | RO—1            | CERNAVODA-1          | 497        |     |
| RUSSIAN FEDERATION     | RU—96           | BALAKOVO-1           | 499        |     |
|                        | RU—97           | BALAKOVO-2           | 501        |     |
|                        | RU—98           | BALAKOVO-3           | 503        |     |
|                        | RU—99           | BALAKOVO-4           | 505        |     |
|                        | RU—21           | BELOYARSKY-3(BN-600) | 507        |     |
|                        | RU—141          | BILIBINO-1           | 509        |     |
|                        | RU—142          | BILIBINO-2           | 511        |     |
|                        | RU—143          | BILIBINO-3           | 513        |     |
|                        | RU—144          | BILIBINO-4           | 515        |     |
|                        | RU—30           | KALININ-1            | 517        |     |
|                        | RU—31           | KALININ-2            | 519        |     |
|                        | RU—12           | KOLA-1               | 521        |     |
|                        | RU—13           | KOLA-2               | 523        |     |
|                        | RU—32           | KOLA-3               | 525        |     |
|                        | RU—33           | KOLA-4               | 527        |     |
|                        | RU—17           | KURSK-1              | 529        |     |
|                        | RU—22           | KURSK-2              | 531        |     |
|                        | RU—38           | KURSK-3              | 533        |     |
|                        | RU—39           | KURSK-4              | 535        |     |
|                        | RU—15           | LENINGRAD-1          | 537        |     |
|                        | RU—16           | LENINGRAD-2          | 539        |     |
|                        | RU—34           | LENINGRAD-3          | 541        |     |
|                        | RU—35           | LENINGRAD-4          | 543        |     |
|                        | RU—9            | NOVOVORONEZH-3       | 545        |     |
|                        | RU—11           | NOVOVORONEZH-4       | 547        |     |
|                        | RU—20           | NOVOVORONEZH-5       | 549        |     |
|                        | RU—23           | SMOLENSK-1           | 551        |     |
|                        | RU—24           | SMOLENSK-2           | 553        |     |
|                        | RU—67           | SMOLENSK-3           | 555        |     |
|                        | RU—59           | VOLGODONSK-1         | 557        |     |
|                        | SLOVAK REPUBLIC | SK—2                 | BOHUNICE-1 | 559 |
|                        |                 | SK—3                 | BOHUNICE-2 | 561 |
|                        |                 | SK—13                | BOHUNICE-3 | 563 |
| SK—14                  |                 | BOHUNICE-4           | 565        |     |
| SK—6                   |                 | MOCHOVCE-1           | 567        |     |
| SK—7                   |                 | MOCHOVCE-2           | 569        |     |
| SLOVENIA               | SI—1            | KRSKO                | 571        |     |



| Country Name   | Reactor Code | Reactor Name           | Page |
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| SOUTH AFRICA   | ZA—1         | KOEBERG-1              | 573  |
|                | ZA—2         | KOEBERG-2              | 575  |
| SPAIN          | ES—6         | ALMARAZ-1              | 577  |
|                | ES—7         | ALMARAZ-2              | 579  |
|                | ES—8         | ASCO-1                 | 581  |
|                | ES—9         | ASCO-2                 | 583  |
|                | ES—10        | COFRENTES              | 585  |
|                | ES—1         | JOSE CABRERA-1(ZORITA) | 587  |
|                | ES—2         | SANTA MARIA DE GARONA  | 589  |
|                | ES—11        | TRILLO-1               | 591  |
| SWEDEN         | ES—16        | VANDELLOS-2            | 593  |
|                | SE—8         | BARSEBACK-2            | 595  |
|                | SE—9         | FORSMARK-1             | 597  |
|                | SE—11        | FORSMARK-2             | 599  |
|                | SE—14        | FORSMARK-3             | 601  |
|                | SE—2         | OSKARSHAMN-1           | 603  |
|                | SE—3         | OSKARSHAMN-2           | 605  |
|                | SE—12        | OSKARSHAMN-3           | 607  |
|                | SE—4         | RINGHALS-1             | 609  |
|                | SE—5         | RINGHALS-2             | 611  |
|                | SE—7         | RINGHALS-3             | 613  |
|                | SE—10        | RINGHALS-4             | 615  |
| SWITZERLAND    | CH—1         | BEZNAU-1               | 617  |
|                | CH—3         | BEZNAU-2               | 619  |
|                | CH—4         | GOESGEN                | 621  |
|                | CH—5         | LEIBSTADT              | 623  |
|                | CH—2         | MUEHLEBERG             | 625  |
| UKRAINE        | UA—40        | KHMELNITSKI-1          | 627  |
|                | UA—27        | ROVNO-1                | 629  |
|                | UA—28        | ROVNO-2                | 631  |
|                | UA—29        | ROVNO-3                | 633  |
|                | UA—44        | SOUTH UKRAINE-1        | 635  |
|                | UA—45        | SOUTH UKRAINE-2        | 637  |
|                | UA—48        | SOUTH UKRAINE-3        | 639  |
|                | UA—54        | ZAPOROZHE-1            | 641  |
|                | UA—56        | ZAPOROZHE-2            | 643  |
|                | UA—78        | ZAPOROZHE-3            | 645  |
|                | UA—79        | ZAPOROZHE-4            | 647  |
|                | UA—126       | ZAPOROZHE-5            | 649  |
| UA—127         | ZAPOROZHE-6  | 651                    |      |
| UNITED KINGDOM | GB—2A        | CHAPELCROSS 1          |      |
|                | GB—2B        | CHAPELCROSS 2          |      |
|                | GB—2C        | CHAPELCROSS 3          |      |
|                | GB—2D        | CHAPELCROSS 4          |      |
|                | GB—9A        | DUNGENESS-A1           | 653  |
|                | GB—9B        | DUNGENESS-A2           | 655  |
|                | GB—18A       | DUNGENESS-B1           |      |
|                | GB—18B       | DUNGENESS-B2           |      |
|                | GB—19A       | HARTLEPOOL-A1          |      |
|                | GB—19B       | HARTLEPOOL-A2          |      |
|                | GB—20A       | HEYSHAM-A1             |      |
|                | GB—20B       | HEYSHAM-A2             |      |
|                | GB—22A       | HEYSHAM-B1             |      |
|                | GB—22B       | HEYSHAM-B2             |      |
|                | GB—16A       | HINKLEY POINT-B1       |      |

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| UNITED KINGDOM | GB—16B                   | HINKLEY POINT-B2 |                |
|                | GB—17A                   | HUNTERSTON-B1    |                |
|                | GB—17B                   | HUNTERSTON-B2    |                |
|                | GB—11A                   | OLDBURY-A1       | 657            |
|                | GB—11B                   | OLDBURY-A2       | 659            |
|                | GB—10A                   | SIZEWELL-A1      | 661            |
|                | GB—10B                   | SIZEWELL-A2      | 663            |
|                | GB—24                    | SIZEWELL-B       |                |
|                | GB—23A                   | TORNES 1         |                |
|                | GB—23B                   | TORNES 2         |                |
|                | GB—13A                   | WYLFA 1          | 665            |
|                | GB—13B                   | WYLFA 2          | 667            |
|                | UNITED STATES OF AMERICA | US—313           | ARKANSAS ONE-1 |
| US—368         |                          | ARKANSAS ONE-2   | 671            |
| US—334         |                          | BEAVER VALLEY-1  | 673            |
| US—412         |                          | BEAVER VALLEY-2  | 675            |
| US—456         |                          | BRAIDWOOD-1      | 677            |
| US—457         |                          | BRAIDWOOD-2      | 679            |
| US—259         |                          | BROWNS FERRY-1   | 681            |
| US—260         |                          | BROWNS FERRY-2   | 683            |
| US—296         |                          | BROWNS FERRY-3   | 685            |
| US—325         |                          | BRUNSWICK-1      | 687            |
| US—324         |                          | BRUNSWICK-2      | 689            |
| US—454         |                          | BYRON-1          | 691            |
| US—455         |                          | BYRON-2          | 693            |
| US—483         |                          | CALLAWAY-1       | 695            |
| US—317         |                          | CALVERT CLIFFS-1 | 697            |
| US—318         |                          | CALVERT CLIFFS-2 | 699            |
| US—413         |                          | CATAWBA-1        | 701            |
| US—414         |                          | CATAWBA-2        | 703            |
| US—461         |                          | CLINTON-1        | 705            |
| US—397         |                          | COLUMBIA         | 707            |
| US—445         |                          | COMANCHE PEAK-1  | 709            |
| US—446         |                          | COMANCHE PEAK-2  | 711            |
| US—298         |                          | COOPER           | 713            |
| US—302         |                          | CRYSTAL RIVER-3  | 715            |
| US—346         |                          | DAVIS BESSE-1    | 717            |
| US—275         |                          | DIABLO CANYON-1  | 719            |
| US—323         |                          | DIABLO CANYON-2  | 721            |
| US—315         |                          | DONALD COOK-1    | 723            |
| US—316         |                          | DONALD COOK-2    | 725            |
| US—237         |                          | DRESDEN-2        | 727            |
| US—249         |                          | DRESDEN-3        | 729            |
| US—331         |                          | DUANE ARNOLD-1   | 731            |
| US—341         |                          | ENRICO FERMI-2   | 733            |
| US—348         |                          | FARLEY-1         | 735            |
| US—364         |                          | FARLEY-2         | 737            |
| US—333         |                          | FITZPATRICK      | 739            |
| US—285         |                          | FORT CALHOUN-1   | 741            |
| US—416         |                          | GRAND GULF-1     | 743            |
| US—261         |                          | H.B. ROBINSON-2  | 745            |
| US—321         |                          | HATCH-1          | 747            |
| US—366         |                          | HATCH-2          | 749            |
| US—354         | HOPE CREEK-1             | 751              |                |
| US—247         | INDIAN POINT-2           | 753              |                |
| US—286         | INDIAN POINT-3           | 755              |                |
| US—305         | KEWAUNEE                 | 757              |                |
| US—373         | LASALLE-1                | 759              |                |
| US—374         | LASALLE-2                | 761              |                |

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| UNITED STATES OF AMERICA | US—352       | LIMERICK-1          | 763  |
|                          | US—353       | LIMERICK-2          | 765  |
|                          | US—369       | MCGUIRE-1           | 767  |
|                          | US—370       | MCGUIRE-2           | 769  |
|                          | US—336       | MILLSTONE-2         | 771  |
|                          | US—423       | MILLSTONE-3         | 773  |
|                          | US—263       | MONTICELLO          | 775  |
|                          | US—220       | NINE MILE POINT-1   | 777  |
|                          | US—410       | NINE MILE POINT-2   | 779  |
|                          | US—338       | NORTH ANNA-1        | 781  |
|                          | US—339       | NORTH ANNA-2        | 783  |
|                          | US—269       | OCONEE-1            | 785  |
|                          | US—270       | OCONEE-2            | 787  |
|                          | US—287       | OCONEE-3            | 789  |
|                          | US—219       | OYSTER CREEK        | 791  |
|                          | US—255       | PALISADES           | 793  |
|                          | US—528       | PALO VERDE-1        | 795  |
|                          | US—529       | PALO VERDE-2        | 797  |
|                          | US—530       | PALO VERDE-3        | 799  |
|                          | US—277       | PEACH BOTTOM-2      | 801  |
|                          | US—278       | PEACH BOTTOM-3      | 803  |
|                          | US—440       | PERRY-1             | 805  |
|                          | US—293       | PILGRIM-1           | 807  |
|                          | US—266       | POINT BEACH-1       | 809  |
|                          | US—301       | POINT BEACH-2       | 811  |
|                          | US—282       | PRAIRIE ISLAND-1    | 813  |
|                          | US—306       | PRAIRIE ISLAND-2    | 815  |
|                          | US—254       | QUAD CITIES-1       | 817  |
|                          | US—265       | QUAD CITIES-2       | 819  |
|                          | US—244       | R.E. GINNA          | 821  |
|                          | US—458       | RIVER BEND-1        | 823  |
|                          | US—272       | SALEM-1             | 825  |
|                          | US—311       | SALEM-2             | 827  |
|                          | US—361       | SAN ONOFRE-2        | 829  |
|                          | US—362       | SAN ONOFRE-3        | 831  |
|                          | US—443       | SEABROOK-1          | 833  |
|                          | US—327       | SEQUOYAH-1          | 835  |
|                          | US—328       | SEQUOYAH-2          | 837  |
|                          | US—400       | SHEARON HARRIS-1    | 839  |
|                          | US—498       | SOUTH TEXAS-1       | 841  |
|                          | US—499       | SOUTH TEXAS-2       | 843  |
|                          | US—335       | ST. LUCIE-1         | 845  |
|                          | US—389       | ST. LUCIE-2         | 847  |
|                          | US—280       | SURRY-1             | 849  |
|                          | US—281       | SURRY-2             | 851  |
|                          | US—387       | SUSQUEHANNA-1       | 853  |
|                          | US—388       | SUSQUEHANNA-2       | 855  |
|                          | US—289       | THREE MILE ISLAND-1 | 857  |
|                          | US—250       | TURKEY POINT-3      | 859  |
|                          | US—251       | TURKEY POINT-4      | 861  |
|                          | US—271       | VERMONT YANKEE      | 863  |
|                          | US—395       | VIRGIL C. SUMMER-1  | 865  |
|                          | US—424       | VOGTLE-1            | 867  |
|                          | US—425       | VOGTLE-2            | 869  |
|                          | US—382       | WATERFORD-3         | 871  |
|                          | US—390       | WATTS BAR-1         | 873  |
|                          | US—482       | WOLF CREEK          | 875  |

### 3. DEFINITIONS

#### 1. Reference Unit Power - maximum electrical capacity, RUP [ $MW_{(e)}$ ]

The reference unit power is the maximum (electrical) power that could be maintained continuously throughout a prolonged period of operation under reference ambient conditions.

It is specified that this value must remain constant for a given unit unless, following permanent modification, or a new permanent authorization, the management decides to amend the original value.

The reference unit power may be gross of net:

– The gross RUP ( $P_g$ ,  $MW_{(e)}$ ) is deemed to be measured at the output terminals of all generator sets in the station; it includes therefore the power taken by the station auxiliaries and losses in transformers that are considered integral parts of the station.

– The net RUP ( $P_n$ ,  $MW_{(e)}$ ), indicating the maximum power that can be supplied, is measured at the station outlet terminals, i.e. after deducting the power taken by station auxiliaries and the losses in the transformers that are considered integral parts of the station.

#### 2. Design net capacity [ $MW_{(e)}$ ]

The net reference unit power as specified in an original unit design.

#### 3. Reference period, T [hours]

For units in power ascension at the end of the period, the clock hours from the beginning of the period or the first electrical production, whichever comes last, to the end of the period.

For units in commercial operation at the end of the period, the clock hours from the beginning of the period or of commercial operation, whichever comes last, to the end of the period or permanent shutdown, whichever comes first.

#### 4. On-line hours, t [hours]

The total clock hours in the reference period during which the unit operated with breakers closed to the station bus.

#### 5. Reference Energy Generation, REG [ $MW_{(e)}h$ ]

Net electrical energy which would have been produced if the unit were operated continuously at the reference unit power during the whole reference period.

#### 6. Energy Generated (net), EG [ $GW_{(e)}h$ ]

Net electrical energy produced during the reference period as measured at the unit outlet terminals, i.e. after deducting the electrical energy taken by unit auxiliaries and the losses in transformers that are considered integral parts of the unit. If this quantity is less than zero, zero is reported.

## 7. Load Factor, LF [%]

$$LF = \frac{EG}{REG} \times 100$$

EG = energy generated (net), [MW<sub>(e)</sub>h]  
REG = reference energy generation [MW<sub>(e)</sub>h]

Load factor, for a given period, is the ratio of the energy, which the power unit has produced over that period, to the energy it would have produced at its reference power capacity over that period.

## 8. Operation factor, OF [%]

$$OF = \frac{t}{T} \times 100$$

t = number of hours on-line [h]  
T = number of hours in the reference period [h]

Operation factor is the ratio of the number of hours the unit was on-line, to the total number of hours in the reference period, expressed as a percentage. It is a measure of the unit time availability on the grid and does not depend on the operating power level.

## 9. Available capacity, P [MW<sub>(e)</sub>]

The available capacity at a given moment is the maximum net capacity at which the unit or station is able or is authorized to be operated at a continuous rating under the prevailing conditions assuming unlimited transmission facilities.

## 10. Energy loss, EL [MW<sub>(e)</sub>h]

Energy loss is the energy which could have been produced during the reference period by the unavailable capacity; it is categorized into three types:

- PEL - planned energy loss
- UEL - unplanned energy loss
- XEL - energy loss due to causes external to the plant

UEL comprise shutdowns, unplanned load reductions or outage extensions.

## 11. Unavailability

The unit unavailability is defined as a status when the plant is not able to operate at its maximum capacity (reference power). This condition, which may be under or beyond plant management control, should only reflect lack of availability of the plant itself, regardless of energy demand, transmission grid condition or political situation in the country.

Unavailability is classified as planned if it is foreseen at least 4 months in advance, generally at the time when the annual overhaul programme is established, and if the beginning of the unavailability period can be largely controlled and deferred by management. Unavailability is classified as unplanned if not scheduled at least four weeks in advance. Power plant operation at lower than maximum capacity because of lower demand from the grid but available to operate at the maximum capacity, does not constitute unavailability, either planned or unplanned.

## 12. Energy Availability Factor, EAF [%]

$$EAF = \frac{REG - PEL - UEL - XEL}{REG} \times 100$$

The energy availability factor over a specified period, is the ratio of the energy that the available capacity could have produced during this period, to the energy that the reference unit power could have produced during the same period.

## 13. Energy Unavailability Factor, EUF [%]

$$EUF = \frac{EL}{REG} \times 100$$

The unavailability factor over a specified period is the ratio of the energy losses EL that have not been produced during this period due to the unavailable capacity, to the energy that the reference unit power could have produced during the same period.

The energy unavailability factor EUF over a specified period can be divided into:

PUF = planned unavailability factor

UUF = unplanned unavailability factor due to causes in the plant

XUF = unplanned unavailability factor due to causes external to the plant.

The unavailability factor can be expressed as:  $EUF = 100 - EAF$

#### 14. Unit capability factor, UCF [%]

$$UCF = \frac{REG - PEL - UEL}{REG} \times 100$$

Unit capability factor is defined as the ratio of the energy that the unit was capable to generate over a given time period considering only limitation under the plant management control, to the reference energy generation over the same time period, expressed as a percentage. Both of these energy generation terms are determined relative to reference ambient conditions.

#### 15. Construction start

Date when first major placing of concrete, usually for the base mat of the reactor building, is done.

#### 16. First criticality

Date when the reactor is made critical for the first time.

#### 17. Grid connection

Date when the plant is first connected to the electrical grid for supply of power.

#### 18. Commercial operation

Date when the plant is handed over by the contractors to the owner and declared officially to be in commercial operation.

#### 19. Shutdown

Date when the plant is officially declared shut down by the owner and taken out of operation permanently.

#### 20. Outages

For the purpose of PRIS coding, the outage is defined as any status of a reactor unit, when its actual output power is lower than the reference unit power for a period of time. By this definition, the outage includes both power reduction and unit shutdown. The outage is considered significant, if the loss in the energy production corresponds to at least ten hours of continuous operation at the reference unit power or if it has been caused by an unplanned reactor scram (even if the unit had been shut down for less than 10 hours).

#### 21. Outage duration [h]

The total clock hours of the outage measured from the beginning of the reference period or the outage, whichever comes last, to the end of the reference period or the outage, whichever comes first.

**22. Factors** refer to the plants which were in commercial operation during the whole of the reference period.

**23. Cumulative factors** are given for the plants which were in commercial operation during full calendar years.

**24.** A blank and three periods (...), if used in tables, denote information that is not applicable or not available, respectively.

## **25. Types of outages**

The outage type is a three-character code. The third character is for unplanned outages only:

Code\_1 description:

- (P) Planned outage due to causes under the plant management control
- (U) Unplanned outage due to causes under the plant management control
- (X) Outage due to causes beyond the plant management control ("external")

Code\_2 description:

- (F) Full outage
- (P) Partial outage

Code\_3 description:

- (1) Controlled shutdown or load reduction that could be deferred but had to be performed earlier than four weeks after the cause occurred or before the next refuelling outage, whatever comes first
- (2) Controlled shutdown or load reduction that had to be performed in the next 24 hours after the cause occurred
- (3) Extension of planned outage
- (4) Reactor scram, automatic
- (5) Reactor scram, manual.

## **26. Main causes of outages**

- (A) Plant equipment failure
- (B) Refuelling without a maintenance
- (C) Inspection, maintenance or repair combined with refuelling
- (D) Inspection, maintenance or repair without refuelling
- (E) Testing of plant systems or components
- (F) Major back-fitting, refurbishment or upgrading activities with refuelling
- (G) Major back-fitting, refurbishment or upgrading activities without refuelling
- (H) Nuclear regulatory requirements
- (J) Grid failure or grid unavailability
- (K) Load-following (frequency control, reserve shutdown due to reduced energy demand)
- (L) Human factor related
- (M) Governmental requirements or Court decisions
- (N) Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.)
- (P) Fire

- (R) External restrictions on supply and services (lack of funds due to delayed payments from customers, disputes in fuel industries, fuel-rationing, labour strike outside the plant, spare part delivery problems etc.)
- (S) Fuel management limitation (including high flux tilt, stretch out or coast-down operation)
- (T) Offsite heat distribution system unavailability
- (U) Security and access control and other preventive shutdown due to external threats
- (Z) Others

## 27. Plant systems affected

### Nuclear Systems

- 11.00 Reactor and Accessories
  - 11.01 Reactor vessel and main shielding (including penetrations and nozzles)
  - 11.02 Reactor core (including fuel assemblies)
  - 11.03 Reactor internals (including steam separators/dryers - BWR, graphite, pressure tubes)
  - 11.04 Auxiliary shielding and heat insulation
  - 11.05 Moderator and auxiliaries (PHWR)
  - 11.06 Annulus gas system (PHWR/RBMK)
  - 11.99 None of the above systems
  
- 12.00 Reactor I&C Systems
  - 12.01 Control and safety rods (including drives and special power supply)
  - 12.02 Neutron monitoring (in-core and ex-core)
  - 12.03 Reactor instrumentation (except neutron)
  - 12.04 Reactor control system
  - 12.05 Reactor protection system
  - 12.06 Process computer
  - 12.07 Reactor recirculation control (BWR)
  - 12.99 None of the above systems
  
- 13.00 Reactor Auxiliary Systems
  - 13.01 Primary coolant treatment and clean-up system
  - 13.02 Chemical and volume control system
  - 13.03 Residual heat removal system (including heat exchangers)
  - 13.04 Component cooling system
  - 13.05 Gaseous, liquid and solid radwaste treatment systems
  - 13.06 Nuclear building ventilation and containment inerting system
  - 13.07 Nuclear equipment venting and drainage system (including room floor drainage)
  - 13.08 Borated or refuelling water storage system
  - 13.09 CO<sub>2</sub> injection and storage system (GCR)
  - 13.10 Sodium heating system (FBR)
  - 13.11 Primary pump oil system (including RCP or make-up pump oil)
  - 13.12 D<sub>2</sub>O leakage collection and dryer system (PHWR)
  - 13.13 Essential auxiliary systems (GCR)
  - 13.99 None of the above systems
  
- 14.00 Safety Systems



- 14.01 Emergency core cooling systems (including accumulators and core spray system)
- 14.02 High pressure safety injection and emergency poisoning system
- 14.03 Auxiliary and emergency feedwater system
- 14.04 Containment spray system (active)
- 14.05 Containment pressure suppression system (passive)
- 14.06 Containment isolation system (isolation valves, doors, locks and penetrations)
- 14.07 Containment structures
- 14.08 Fire protection system
- 14.99 None of the above systems
  
- 15.00 Reactor Cooling Systems
- 15.01 Reactor coolant pumps/blowers and drives
- 15.02 Reactor coolant piping (including associated valves)
- 15.03 Reactor coolant safety and relief valves (including relief tank)
- 15.04 Reactor coolant pressure control system
- 15.05 Main steam piping and isolation valves (BWR)
- 15.99 None of the above systems
  
- 16.00 Steam generation systems
- 16.01 Steam generator (PWR), boiler (PHWR, AGR), steam drum vessel (RBMK, BWR)
- 16.02 Steam generator blowdown system
- 16.03 Steam drum level control system (RBMK, BWR)
- 16.99 None of the above systems
  
- 17.00 Safety I&C Systems (excluding reactor I&C)
- 17.01 Engineered safeguard feature actuation system
- 17.02 Fire detection system
- 17.03 Containment isolation function
- 17.04 Main steam/feedwater isolation function
- 17.05 Main steam pressure emergency control system (turbine bypass and steam dump valve control)
- 17.06 Failed fuel detection system (DN monitoring system for PHWR)
- 17.07 RCS integrity monitoring system (RBMK)
- 17.99 None of the above systems

#### Fuel and Refuelling Systems

- 21.00 Fuel Handling and Storage Facilities
- 21.01 On-power refuelling machine
- 21.02 Fuel transfer system
- 21.03 Storage facilities, including treatment plant and final loading and cask handling facilities
- 21.99 None of the above systems

#### Secondary plant systems

- 31.00 Turbine and auxiliaries
- 31.01 Turbine
- 31.02 Moisture separator and reheater
- 31.03 Turbine control valves and stop valves

- 31.04 Main condenser (including vacuum system)
- 31.05 Turbine by-pass valves
- 31.06 Turbine auxiliaries (lubricating oil, gland steam, steam extraction)
- 31.07 Turbine control and protection system
- 31.99 None of the above systems
  
- 32.00 Feedwater and Main Steam System
- 32.01 Main steam piping and valves
- 32.02 Main steam safety and relief valves
- 32.03 Feedwater system (including feedwater tank, piping, pumps and heaters)
- 32.04 Condensate system (including condensate pumps, piping and heaters)
- 32.05 Condensate treatment system
- 32.99 None of the above systems
  
- 33.00 Circulating Water System
- 33.01 Circulating water system (pumps and piping/ducts excluding heat sink system)
- 33.02 Cooling towers / heat sink system
- 33.03 Emergency ultimate heat sink system
- 33.99 None of the above systems
  
- 34.00 Miscellaneous Systems
- 34.01 Compressed air (essential and non-essential / high-pressure and low-pressure)
- 34.02 Gas storage, supply and cleanup systems (nitrogen, hydrogen, carbon dioxide etc.)
- 34.03 Service water / process water supply system (including water treatment)
- 34.04 Demineralized water supply system (including water treatment)
- 34.05 Auxiliary steam supply system (including boilers and pressure control equipment)
- 34.06 Non-nuclear area ventilation (including main control room)
- 34.07 Chilled water supply system
- 34.08 Chemical additive injection and makeup systems
- 34.09 Non-nuclear equipment venting and drainage system
- 34.10 Communication system
- 34.99 None of the above systems
  
- 35.00 All other I&C Systems
- 35.01 Plant process monitoring systems (excluding process computer)
- 35.02 Leak monitoring systems
- 35.03 Alarm annunciation system
- 35.04 Plant radiation monitoring system
- 35.05 Plant process control systems
- 35.99 None of the above systems

#### Electrical Systems

- 41.00 Main Generator Systems
- 41.01 Generator and exciter (including generator output breaker)
- 41.02 Sealing oil system

- 41.03 Rotor cooling gas system
- 41.04 Stator cooling water system
- 41.05 Main generator control and protection system
- 41.99 None of the above systems
  
- 42.00 Electrical Power Supply Systems
- 42.01 Main transformers
- 42.02 Unit self-consumption transformers (station, auxiliary, house reserve etc.)
- 42.03 Vital AC and DC plant power supply systems (medium and low voltage)
- 42.04 Non-vital AC plant power supply system (medium and low voltage)
- 42.05 Emergency power generation system (e.g. emergency diesel generator and auxiliaries)
- 42.06 Power supply system logics (including load shed logic, emergency bus transfer logic, load sequencer logic, breaker trip logic etc.)
- 42.07 Plant switchyard equipment
- 42.99 None of the above systems

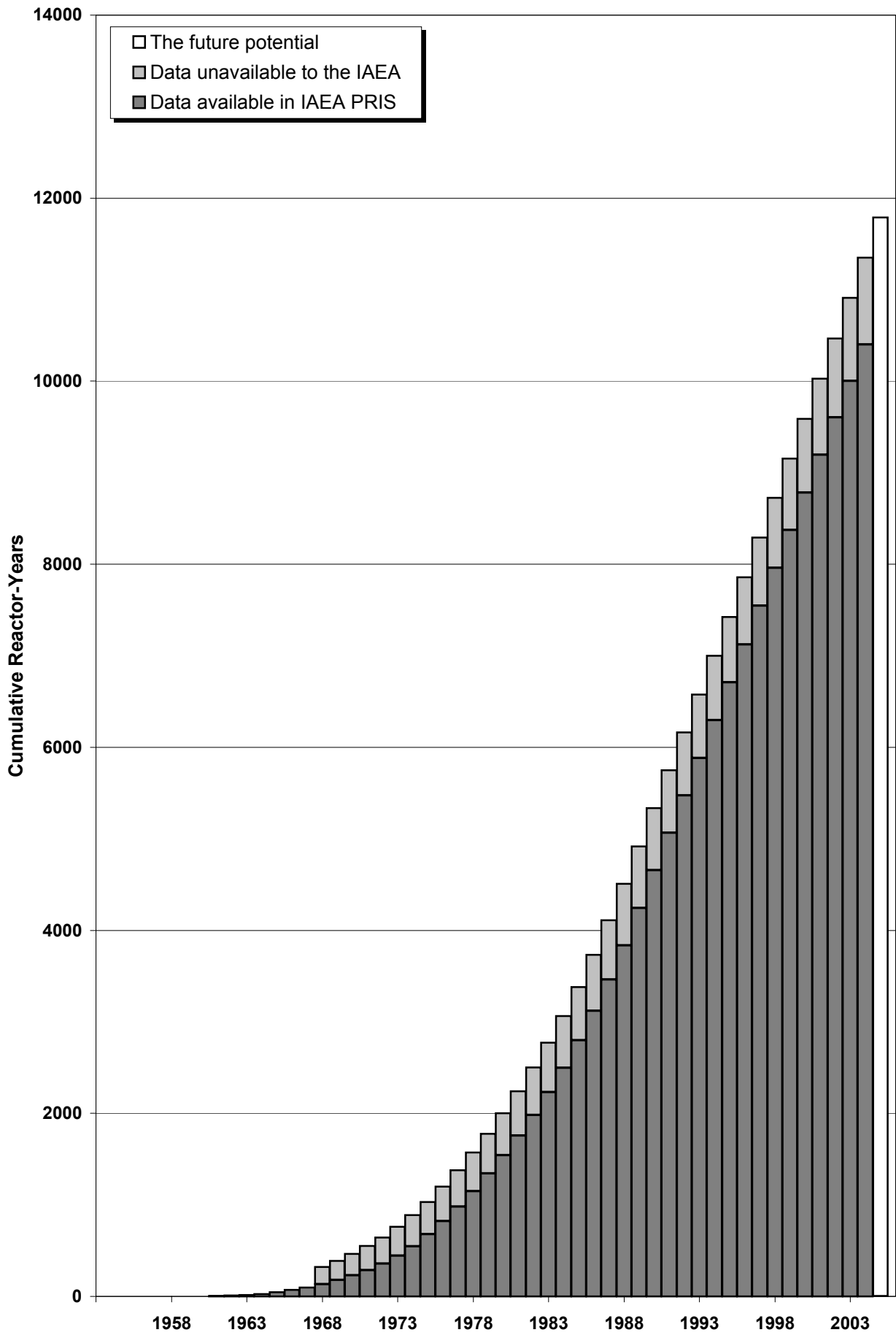
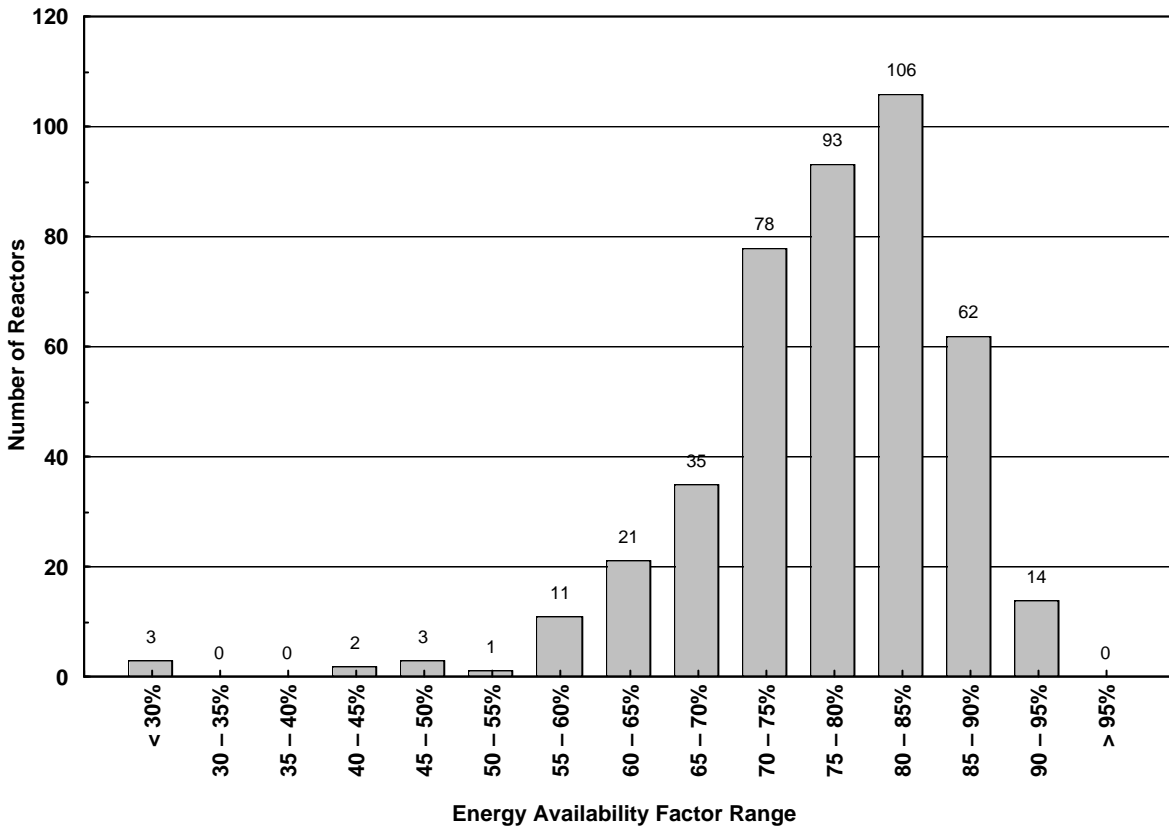
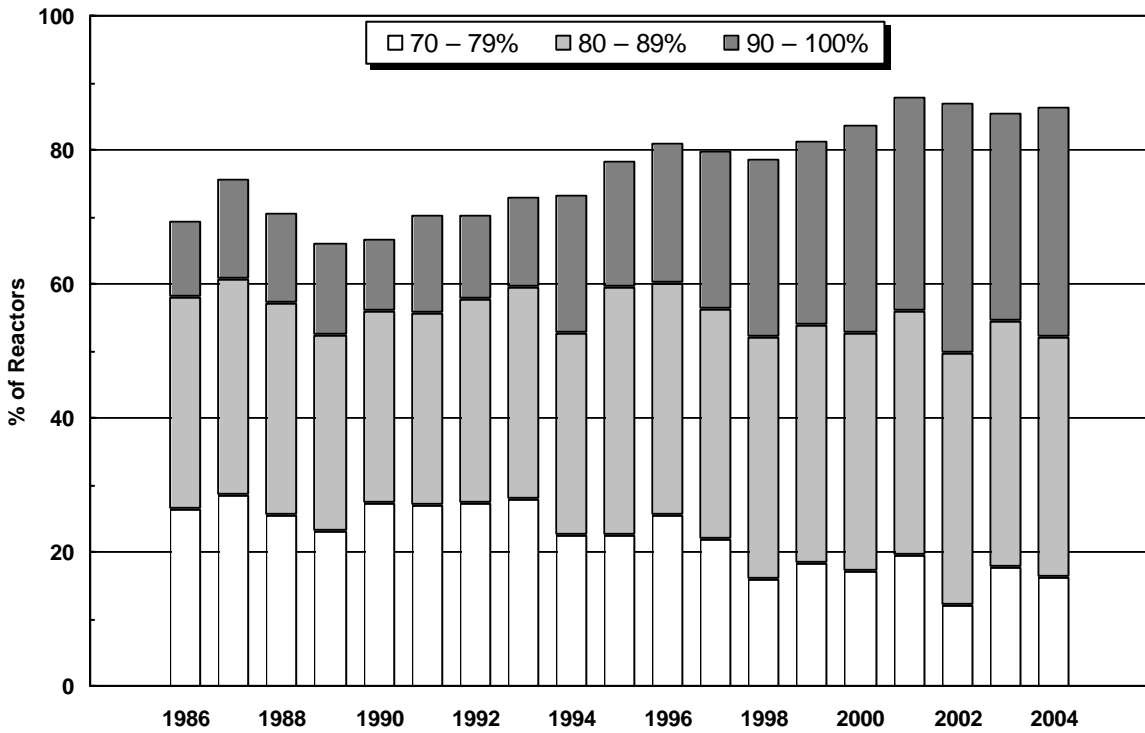


Figure 1 — Nuclear Power Reactors Operating Experience



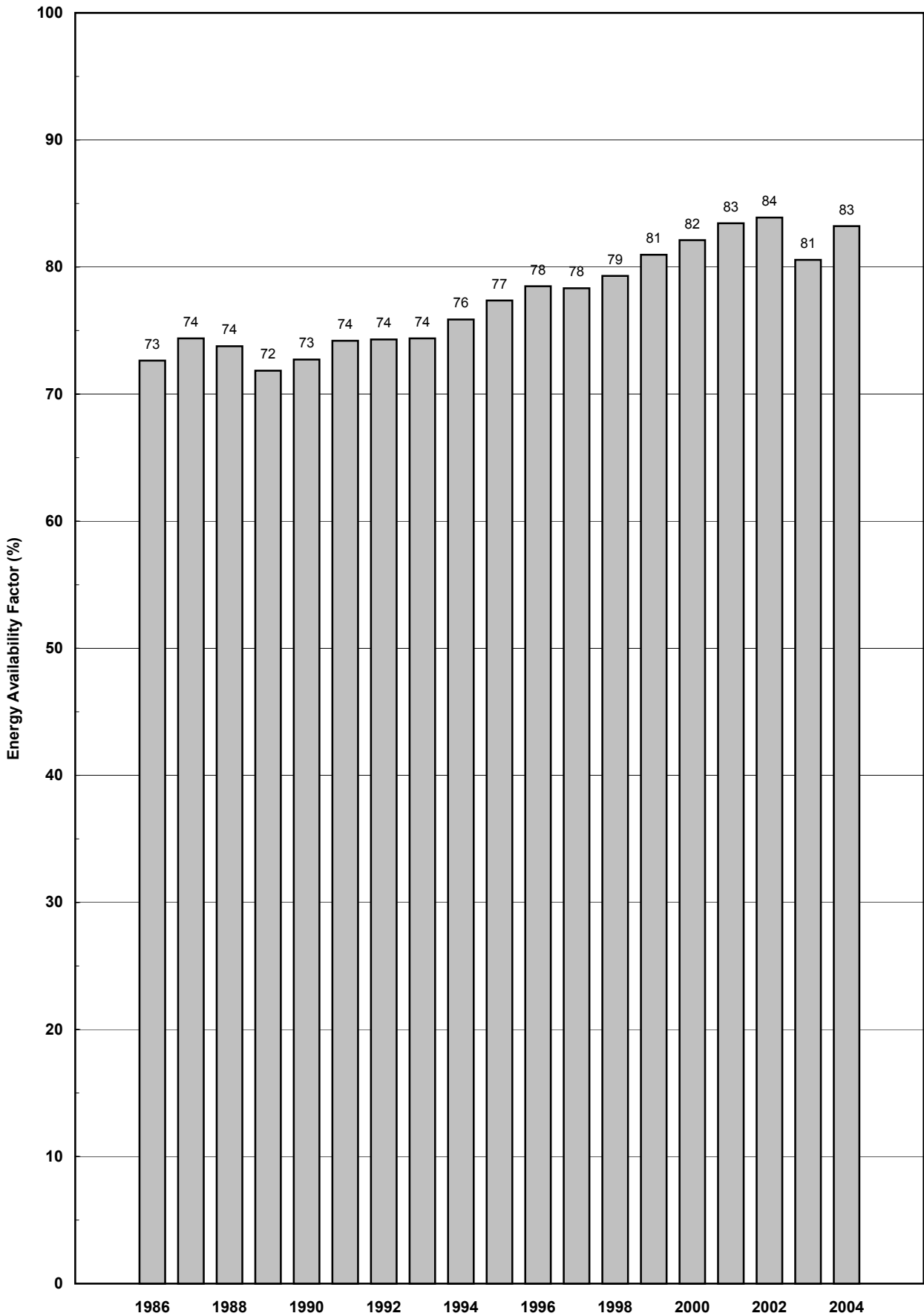
**Figure 2 — Lifetime Energy Availability Factors up to 2004**

(only reactors with capacity greater than 100 MW(e) and with more than one year of commercial operation)



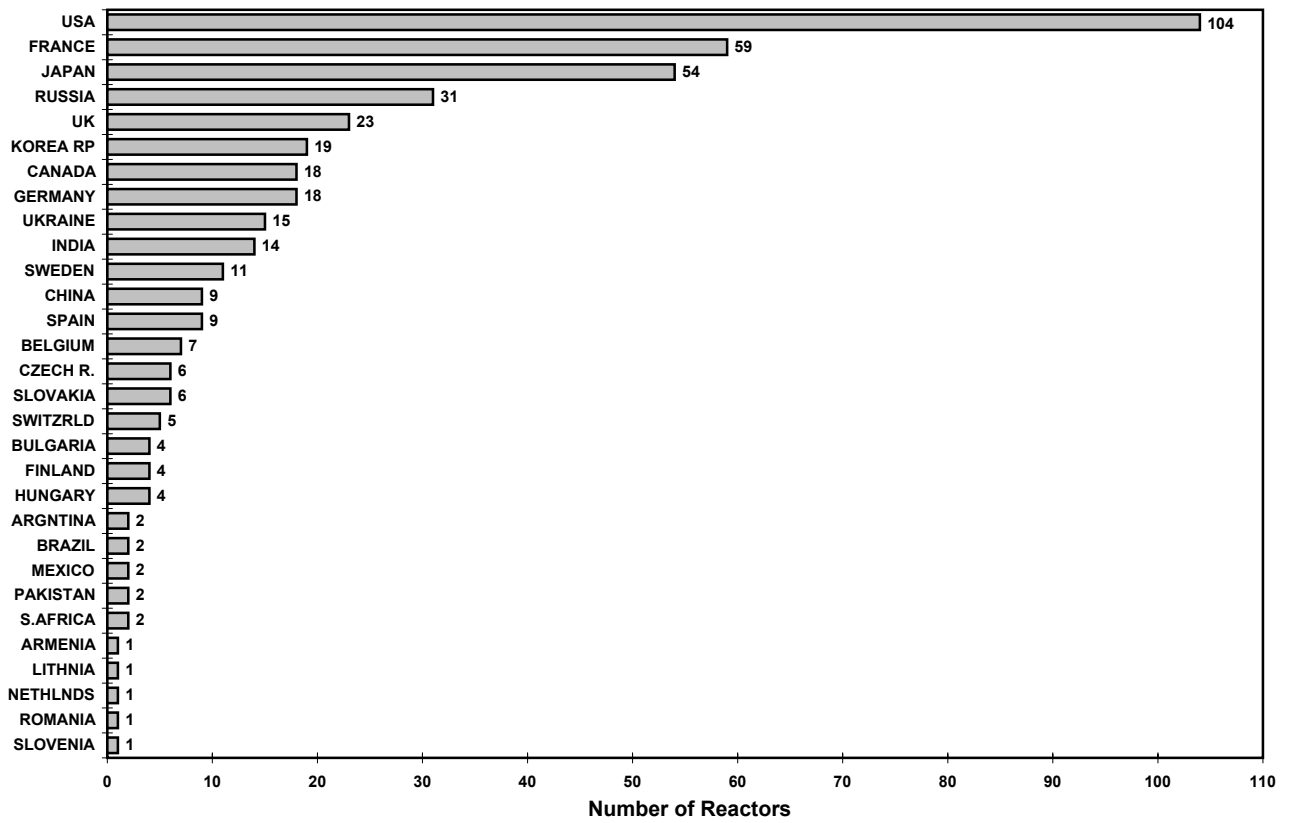
**Figure 3 — Reactors with High Availability Factors**

(only reactors with capacity greater than 100 MW(e) and with more than one year of commercial operation)



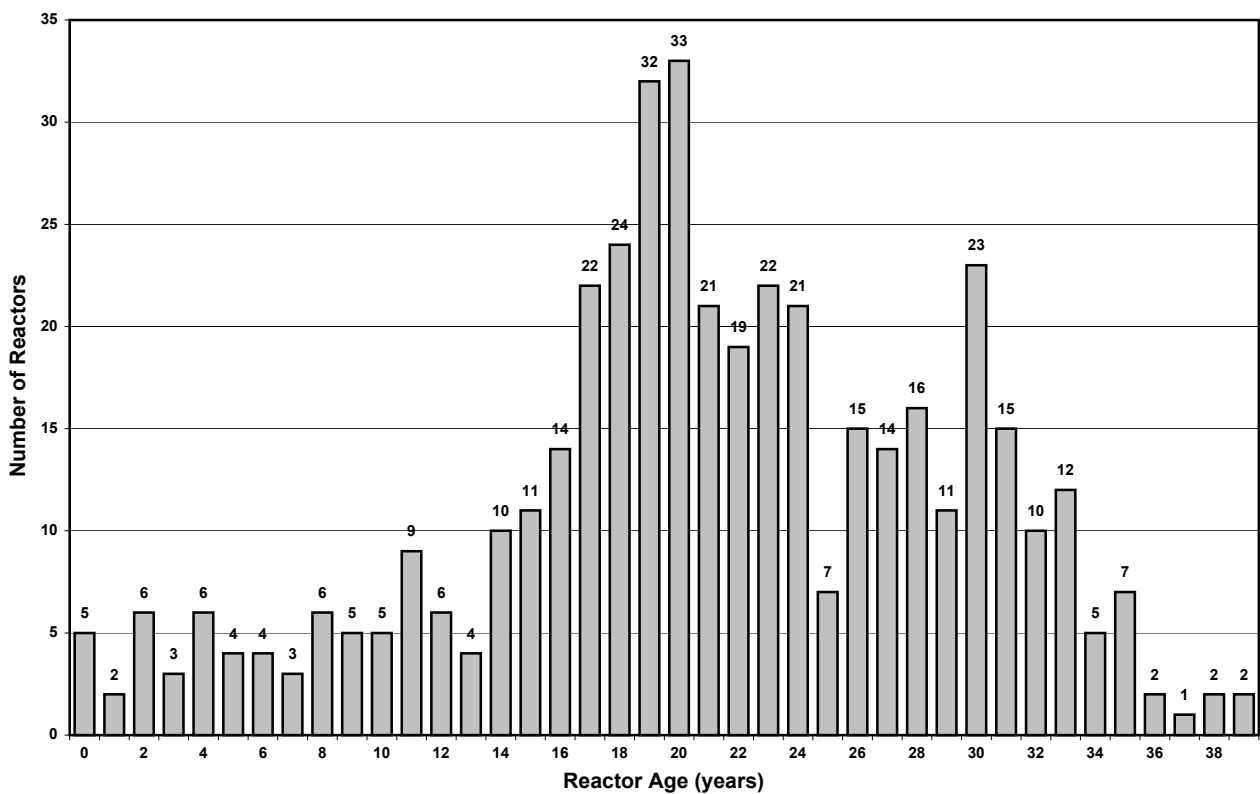
**Figure 4 — Average Energy Availability Factors**

(only reactors with capacity greater than 100 MW(e) and with more than one year of commercial operation)



**Figure 5 — Number of Reactors in Operation (as of 1 January 2005)**

Note: There were 6 reactors in operation in Taiwan, China.



**Figure 6 — Number of Reactors by Age (as of 1 January 2005)**

## 5. ABBREVIATIONS

### COUNTRY CODES

|    |                          |
|----|--------------------------|
| AM | ARMENIA                  |
| AR | ARGENTINA                |
| BE | BELGIUM                  |
| BG | BULGARIA                 |
| BR | BRAZIL                   |
| CA | CANADA                   |
| CH | SWITZERLAND              |
| CN | CHINA                    |
| CZ | CZECH REPUBLIC           |
| DE | GERMANY                  |
| ES | SPAIN                    |
| FI | FINLAND                  |
| FR | FRANCE                   |
| GB | UNITED KINGDOM           |
| HU | HUNGARY                  |
| IN | INDIA                    |
| JP | JAPAN                    |
| KR | KOREA, REPUBLIC OF       |
| KZ | KAZAKHSTAN               |
| LT | LITHUANIA, REPUBLIC OF   |
| MX | MEXICO                   |
| NL | NETHERLANDS              |
| PK | PAKISTAN                 |
| RO | ROMANIA                  |
| RU | RUSSIAN FEDERATION       |
| SE | SWEDEN                   |
| SI | SLOVENIA                 |
| SK | SLOVAK REPUBLIC          |
| TW | TAIWAN, CHINA            |
| UA | UKRAINE                  |
| US | UNITED STATES OF AMERICA |
| ZA | SOUTH AFRICA             |

### REACTOR TYPES

|       |   |
|-------|---|
| ABWR  | Advanced Boiling Light-Water-Cooled and Moderated Reactor |
| AGR   | Advanced Gas-Cooled, Graphite-Moderated Reactor           |
| BWR   | Boiling Light-Water-Cooled and Moderated Reactor          |
| FBR   | Fast Breeder Reactor                                      |
| GCR   | Gas-Cooled, Graphite-Moderated Reactor                    |
| HTGR  | High-Temperature Gas-Cooled, Graphite-Moderated Reactor   |
| HWGCR | Heavy-Water-Moderated, Gas-Cooled Reactor                 |
| HWLWR | Heavy-Water-Moderated, Boiling Light-Water-Cooled Reactor |
| LWGR  | Light-Water-Cooled, Graphite-Moderated Reactor            |
| PHWR  | Pressurized Heavy-Water-Moderated and Cooled Reactor      |
| PWR   | Pressurized Light-Water-Moderated and Cooled Reactor      |
| SGHWR | Steam-Generating Heavy-Water Reactor                      |
| WWER  | Water Cooled Water Moderated Power Reactor                |

### OPERATORS

|          |   |
|----------|---|
| AMEREN   | AMEREN  |
| AMERGEN  | AMERGEN ENERGY CO.  |
| ANAV     | ASOCIACION NUCLEAR ASCO-VANDELLOS A.I.E. (ENDESA/ID)      |
| ANPP     | ARIZONA NUCLEAR POWER PROJECT                             |
| BE       | BRITISH ENERGY  |
| BKAB     | BARSEBECK KRAFT AB  |
| BKW      | BKW ENERGIE AG  |
| BNFL     | BRITISH NUCLEAR FUELS PLC                                 |
| BRUCEPOW | BRUCE POWER   |
| CEA/EDF  | COMMISSARIAT A L'ENERGIE ATOMIQUE / ELECTRICITE DE FRANCE |
| CEZ      | CZECH POWER COMPANY , CEZ A.S.                            |
| CFE      | COMISION FEDERAL DE ELECTRICIDAD                          |
| CHUBU    | CHUBU ELECTRIC POWER CO.                                  |
| CHUGOKU  | CHUGOKU ELECTRIC POWER CO.                                |



|          |  |
|----------|--|
| CNAT     | CENTRALES NUCLEARES ALMARAZ-TRILLO(ID/UFG/ENDESA/HC/NUCLENOR ) |
| CONST    | CONSTELLATION NUCLEAR GROUP                                    |
| DETED    | DETROIT EDISON CO.   |
| DOMIN    | DOMINION VIRGINIA POWER  |
| DUKE     | DUKE POWER CO.   |
| EBO      | ELECTROSTATION BOHUNICE  |
| EDF      | ELECTRICITE DE FRANCE  |
| ELECTRAB | ELECTRABEL M. V. NUCLEAIRE PRODUKTIE                           |
| ELETRONU | ELETRONUCLEAR SA – ELETRONUCLEAR                               |
| EMO      | ELECTROSTATION MOCHOVCE  |
| EnBW     | ENBW KRAFTWERK AG  |
| ENERGYNW | ENERGY NORTHWEST   |
| ENTERGY  | ENTERGY NUCLEAR  |
| EON      | EON KERNKRAFT GES.M.B.H  |
| EPZ      | N.V. ELEKTRICITEITS-PRODUKTIEMAATSCHAPPIJ ZUID-NEDERLAND       |
| ESKOM    | ESKOM  |
| EXELON   | EXELON NUCLEAR CO.   |
| FENOC    | FIRST ENERGY NUCLEAR OPERATING CO.                             |
| FKA      | FORSMARK KRAFTGRUPP AB   |
| FORTUMPH | FORTUM POWER AND HEAT OY (FORMER IVO)                          |
| FPL      | FLORIDA POWER & LIGHT CO.                                      |
| GNPJVC   | GUANDONG NUCLEAR POWER JOINT VENTURE COMPANY LIMITED(GNPJVC)   |
| HEPCO    | HOKKAIDO ELECTRIC POWER CO.                                    |
| HEW      | HAMBURGISCHE ELEKTRIZITAETSWERKE                               |
| HOKURIKU | HOKURIKU ELECTRIC POWER CO.                                    |
| HQ       | HYDRO QUEBEC   |
| ID       | IBERDROLA, S.A.  |
| IMPCO    | INDIANA MICHIGAN POWER CO.                                     |
| INPP     | IGNALINA NUCLEAR POWER PLANT                                   |
| JAPCO    | JAPAN ATOMIC POWER CO.   |
| JNC      | JAPAN NUCLEAR CYCLE DEVELOPEMENT INSTITUTE                     |
| JSC      | JOINT STOCK COMPANY ARMENIA NPP                                |
| KEPCO    | KANSAI ELECTRIC POWER CO.                                      |
| KHNP     | KOREA HYDRO AND NUCLEAR POWER CO.                              |
| KKG      | KERNKRAFTWERK GOESGEN-DAENIKEN AG                              |
| KKL      | KERNKRAFTWERK LEIBSTADT  |
| KYUSHU   | KYUSHU ELECTRIC POWER CO.                                      |
| LANPC    | LINGAO NUCLEAR POWER COMPANY LTD.                              |
| NASA     | NUCLEOELECTRICA ARGENTINA S.A.                                 |
| NBEPCC   | NEW BRUNSWICK ELECTRIC POWER COMMISSION                        |
| NEC      | NATIONAL ELECTRICITY COMPANY, BRANCH NPP-KOZLODUY              |
| NEK      | NUKLEARNA ELEKTRARNA KRSKO                                     |
| NNEGC    | NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>        |
| NOK      | NORDOSTSCHWEIZERISCHE KRAFTWERKE                               |
| NPCL     | NUCLEAR POWER CORPORATION OF INDIA LTD.                        |
| NPPD     | NEBRASKA PUBLIC POWER DISTRICT                                 |
| NPQJVC   | NUCLEAR POWER PLANT QINSHAN JOINT VENTURE COMPANY LTD.         |
| NUCLENOR | NUCLENOR, S.A.   |
| NUCMAN   | NUCLEAR MANAGEMENT CO.   |
| OKG      | OKG AKTIEBOLAG   |
| OPG      | ONTARIO POWER GENERATION                                       |
| OPPD     | OMAHA PUBLIC POWER DISTRICT                                    |
| PAEC     | PAKISTAN ATOMIC ENERGY COMMISSION                              |
| PAKS RT. | PAKS NUCLEAR POWER PLANT LTD                                   |
| PGE      | PACIFIC GAS & ELECTRIC CO.                                     |
| PP&L     | PENNSYLVANIA POWER & LIGHT CO.                                 |
| PROGRESS | PROGRESS ENERGY CORPORATION                                    |
| PSEG     | PUBLIC SERVICE ELECTRIC & GAS CO.                              |
| QNPC     | QINSHAN NUCLEAR POWER COMPANY                                  |
| RAB      | RINGHALS AB  |
| REA      | ROSENERGOATOM, CONSORTIUM                                      |
| RGE      | ROCHESTER GAS & ELECTRIC CORP.                                 |
| RWE      | RWE ENERGIE AG   |
| SCE      | SOUTHERN CALIFORNIA EDISON                                     |
| SCEG     | SOUTH CAROLINA ELECTRIC & GAS CO.                              |
| SHIKOKU  | SHIKOKU ELECTRIC POWER CO.                                     |
| SNN      | SOCIETATEA NATIONALA NUCLEARELECTRICA S.A.                     |
| SOUTH    | SOUTHERN NUCLEAR OPERATING CO.                                 |
| STP      | STP NUCLEAR OPERATING CO.                                      |
| TEPCO    | TOKYO ELECTRIC POWER CO.                                       |
| TOHOKU   | TOHOKU ELECTRIC POWER CO.                                      |
| TPC      | TAI POWER CO.  |
| TQNPC    | THE THIRD QINSHAN JOINTED VENTURE COMPANY LTD.                 |
| TVA      | TENNESSEE VALLEY AUTHORITY                                     |
| TVO      | TEOLLISUUDEN VOIMA OY  |
| TXU      | TXU ELECTRIC CO.   |
| UFG      | UNION FENOSA GENERATION S.A.                                   |

**CONTRACTORS**

|          |   |
|----------|---|
| AA       | ALSTHOM ATLANTIQUE  |
| ABBATOM  | ABBATOM (formerly ASEA-ATOM)  |
| ACECOWEN | ACECOWEN ( ACEC-COCKERILL-WESTINGHOUSE )  |
| ACLF     | (ACECOWEN - CREUSOT LOIRE - FRAMATOME)  |
| AECL     | ATOMIC ENERGY OF CANADA LTD.  |
| AECL/DAE | ATOMIC ENERGY OF CANADA Ltda AND DEPARTMENT OF ATOMIC ENERGY(INDIA)   |
| AECL/DHI | ATOMIC ENERGY OF CANADA LTD./DOOSAN HEAVY INDUSTRY & CONSTRUCTION   |
| AEE      | ATOMENERGOEXPORT  |
| APC      | ATOMIC POWER CONSTRUCTION LTD.  |
| ASEASTAL | ASEA-ATOM / STAL-LAVAL  |
| B&W      | BABCOCK & WILCOX CO.  |
| BBC      | BROWN BOVERI ET CIE   |
| CE       | COMBUSTION ENGINEERING CO.  |
| CGE      | CANADIAN GENERAL ELECTRIC   |
| CNCLNEY  | CNIM-CONSTRUCTIONS NAVALES ET INDUSTRIELLES DE MEDITERRANEE CL -<br>CREUSOT LOIRE , NEY - NEYRPIIC            |
| CNNC     | CHINA NATIONAL NUCLEAR CORPORATION  |
| DHICKAEC | DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA<br>ATOMICENERGY RESEARCH INSTITUTE/COMBUSTIONENGINEERING |
| DHICKOPC | DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA<br>POWER ENGINEERING COMPANY/COMBUSTIONENGINEERING       |
| EE/B&W/T | THE ENGLISH ELECTRIC CO. LTD / BABCOCK & WILCOX CO. /<br>TAYLOR WOODROW CONSTRUCTION LTD.                     |
| FRAM     | FRAMATOME   |
| FRAMACEC | FRAMACECO ( FRAMATOME-ACEC-COCKERILL )  |
| GE       | GENERAL ELECTRIC COMPANY (US)   |
| GEC      | GENERAL ELECTRIC COMPANY (UK)   |
| GETSCO   | GENERAL ELECTRIC TECHNICAL SERVICES CO.   |
| HITA/GE  | HITACHI LTD./GENERAL ELECTRIC CO.   |
| HITACHI  | HITACHI LTD.  |
| KWU      | SIEMENS KRAFTWERK UNION AG  |
| KWU/STOR | KRAFTWERK UNION AG / STORK  |
| M        | mitsubishi heavy industry ltd   |
| MAEP     | MINATOMENERGOPROM, MINISTRY OF NUCLEAR POWER AND INDUSTRY   |
| MNE      | MINISTRY OF NUCLEAR ENERGY OF RUSSIAN FEDERATION  |
| NEI.P    | NEI PARSONS   |
| NNC      | NATIONAL NUCLEAR CORPORATION  |
| NPC      | NUCLEAR POWER CO. LTD.  |
| NPCIL    | NUCLEAR POWER CORPORATION OF INDIA LTD.   |
| OH/AECL  | ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.  |
| PAA      | PRODUCTION AMALGAMATION 'ATOMMASH', VOLGODONSK  |
| PAIP     | PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH, VOLGODONSK,<br>RUSSIA  |
| PPC      | PWR POWER PROJECTS  |
| SIEM,KWU | SIEMENS AG, KRAFTWERK UNION AG  |
| SIEMENS  | SIEMENS AG  |
| SKODA    | SKODA CONCERN NUCLEAR POWER PLANT WORKS   |
| TNPG     | THE NUCLEAR POWER GROUP LTD.  |
| TOSHI/GE | TOSHIBA CORPORATION/GENERAL ELECTRIC CO.  |
| TOSHIBA  | TOSHIBA CORPORATION   |
| UKAEA    | UNITED KINGDOM ATOMIC ENERGY AUTHORITY  |
| WEST     | WESTINGHOUSE ELECTRIC CORPORATION   |



**6. DATA SHEETS ON  
INDIVIDUAL NUCLEAR POWER STATIONS UNITS**



# AR-1 ATUCHA-1

**Operator:** NASA (NUCLEOELECTRICA ARGENTINA S.A.)  
**Contractor:** SIEMENS (SIEMENS AG)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 335.0 MW(e)  
**Design Net RUP:** 319.0 MW(e)  
**Design Discharge Burnup:** 5600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2725.0 GW(e).h  
**Energy Availability Factor:** 92.2%  
**Load Factor:** 92.6%  
**Operating Factor:** 93.9%  
**Energy Unavailability Factor:** 7.8%  
**Total Off-line Time:** 534 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 246.0 | 188.3 | 190.4 | 242.9 | 253.4 | 245.1 | 252.4 | 182.8 | 224.4 | 250.9 | 226.2 | 222.1 | 2725.0 |
| <b>EAF (%)</b>  | 100.0 | 81.8  | 76.7  | 100.0 | 100.0 | 100.0 | 100.0 | 72.1  | 91.4  | 99.9  | 93.6  | 90.3  | 92.2   |
| <b>UCF (%)</b>  | 100.0 | 81.8  | 76.7  | 100.0 | 100.0 | 100.0 | 100.0 | 72.1  | 91.5  | 99.9  | 93.6  | 90.3  | 92.2   |
| <b>LF (%)</b>   | 98.7  | 80.8  | 76.4  | 100.7 | 101.7 | 101.6 | 101.3 | 73.3  | 93.0  | 100.7 | 93.8  | 89.1  | 92.6   |
| <b>OF (%)</b>   | 100.0 | 81.6  | 78.0  | 100.0 | 100.0 | 100.0 | 100.0 | 73.9  | 93.3  | 100.0 | 100.0 | 100.0 | 93.9   |
| <b>EUF (%)</b>  | 0.0   | 18.2  | 23.3  | 0.0   | 0.0   | 0.0   | 0.0   | 27.9  | 8.6   | 0.1   | 6.4   | 9.7   | 7.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 18.2  | 23.3  | 0.0   | 0.0   | 0.0   | 0.0   | 27.9  | 8.6   | 0.1   | 6.4   | 9.7   | 7.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1968  
**Date of First Criticality:** 13 Jan 1974  
**Date of Grid Connection:** 19 Mar 1974  
**Date of Commercial Operation:** 24 Jun 1974

**Lifetime Generation:** 60791.2 GW(e).h  
**Cumulative Energy Availability Factor:** 71.0%  
**Cumulative Load Factor:** 68.1%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 29.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2356.0         | 335.0          | 78.4   | 77.9   | 78.4                              | 77.9   | 80.3               | 78.0   | 8101               | 92.5   |
| 1984 | 1706.1         | 335.0          | 98.7   | 80.0   | 98.7                              | 80.0   | 58.0               | 75.9   | 8678               | 98.8   |
| 1985 | 1470.5         | 335.0          | 91.6   | 81.0   | 91.6                              | 81.0   | 50.1               | 73.6   | 7159               | 81.7   |
| 1986 | 2205.0         | 335.0          | 75.8   | 80.6   | 75.8                              | 80.6   | 75.1               | 73.7   | 7532               | 86.0   |
| 1987 | 1405.8         | 335.0          | 49.2   | 78.2   | 49.2                              | 78.2   | 47.9               | 71.7   | 4391               | 50.1   |
| 1988 | 808.1          | 335.0          | 27.1   | 74.5   | 27.1                              | 74.5   | 27.5               | 68.5   | 2515               | 28.6   |
| 1989 | 0.0            | 335.0          | 0.0  | 69.5   | 0.0                               | 69.5   | 0.0                | 63.9   | 0                  | 0.0    |
| 1990 | 1722.6         | 335.0          | 84.9   | 70.5   | 58.7                              | 68.8   | 58.7               | 63.6   | 7201               | 82.2   |
| 1991 | 2721.9         | 335.0          | 92.6   | 71.8   | 92.6                              | 70.2   | 92.8               | 65.3   | 8390               | 95.8   |
| 1992 | 2230.2         | 335.0          | 76.3   | 72.0   | 76.3                              | 70.6   | 75.8               | 65.9   | 7089               | 80.7   |
| 1993 | 2403.7         | 335.0          | 82.2   | 72.6   | 82.2                              | 71.2   | 81.9               | 66.8   | 7287               | 83.2   |
| 1994 | 2651.9         | 335.0          | 90.4   | 73.5   | 90.4                              | 72.1   | 90.4               | 67.9   | 7916               | 90.4   |
| 1995 | 2671.7         | 335.0          | 92.3   | 74.4   | 92.3                              | 73.1   | 91.0               | 69.1   | 8376               | 95.6   |
| 1996 | 2038.8         | 335.0          | 70.6   | 74.2   | 70.6                              | 73.0   | 69.3               | 69.1   | 6990               | 79.6   |
| 1997 | 2720.1         | 335.0          | 93.4   | 75.0   | 93.4                              | 73.9   | 92.7               | 70.1   | 8329               | 95.1   |
| 1998 | 2374.4         | 335.0          | 81.4   | 75.3   | 81.3                              | 74.2   | 80.9               | 70.5   | 7242               | 82.7   |
| 1999 | 1395.5         | 335.0          | 47.8   | 74.2   | 47.8                              | 73.1   | 47.6               | 69.6   | 4364               | 49.8   |
| 2000 | 1677.9         | 335.0          | 72.8   | 74.1   | 56.8                              | 72.5   | 57.0               | 69.1   | 5038               | 57.4   |
| 2001 | 1426.0         | 335.0          | 64.6   | 73.8   | 48.4                              | 71.6   | 48.6               | 68.4   | 4405               | 50.3   |
| 2002 | 1011.5         | 335.0          | 34.6   | 72.4   | 34.6                              | 70.3   | 34.5               | 67.2   | 3030               | 34.6   |
| 2003 | 2020.6         | 335.0          | 68.8   | 72.3   | 68.8                              | 70.2   | 68.9               | 67.2   | 6094               | 69.6   |
| 2004 | 2725.0         | 335.0          | 92.2   | 72.9   | 92.2                              | 71.0   | 92.6               | 68.1   | 8250               | 93.9   |

# AR-1 ATUCHA-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 24 Feb | 291.0  | 100.5   | UF4  | A42  | REACTOR SCRAM AT FULL POWER OPERATION DUE TO LOSS OF OFF-SITE POWER.A REACTOR COOLANT PUMP SEAL WAS DAMAGED AND IT HAD TO BE REPLACED                              |
| 22 Aug | 170.0  | 63.0    | UF4  | A42  | REACTOR SCRAM AT FULL POWER OPERATION.THE EMERGENCY GENERATION SIGNAL TRIGGERED DUE TO A HYDRAULIC TURBINE DISCONNECTION AND A SYNCHRONIZATION FAILURE OF A DIESEL |
| 30 Aug | 72.0   | 27.0    | UF2  | A11  | CONTROLLED SHUTDOWN DUE TO A LEAKAGE FROM A FUEL CHANNEL PLUG HOLDER WELD  |
| 09 Nov | 1260.0 | 39.5    | UP1  | S11  | LOAD REDUCTION TO 92% OF FULL POWER DUE TO RADIOCHEMICAL PARAMETER INCREASE.THERE WERE FOUND MANY FAULT FUEL ELEMENTS  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 533       |          |  | 802       | 2        |
| B. Refuelling without a maintenance  |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 7  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 1251                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          | 6  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         | 90       |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 16        | 55       |
| Subtotal   | 0               | 533       | 0        | 1264                                     | 833       | 149      |
| Total  |                 | 533       |          |  | 2246      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    | 72              | 123                                      |
| 12. Reactor I&C Systems                        |                 | 55                                       |
| 13. Reactor Auxiliary Systems                  |                 | 161                                      |
| 14. Safety Systems                             |                 | 41                                       |
| 15. Reactor Cooling Systems                    |                 | 212                                      |
| 16. Steam generation systems                   |                 | 61                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 12                                       |
| 31. Turbine and auxiliaries                    |                 | 11                                       |
| 32. Feedwater and Main Steam System            |                 | 27                                       |
| 33. Circulating Water System                   |                 | 9  |
| 41. Main Generator Systems                     |                 | 6  |
| 42. Electrical Power Supply Systems            | 461             | 56                                       |
| Total  | 533             | 774                                      |

# AR-2 EMBALSE

**Operator:** NASA (NUCLEOELECTRICA ARGENTINA S.A.)  
**Contractor:** AECL (ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 600.0 MW(e)  
**Design Net RUP:** 600.0 MW(e)  
**Design Discharge Burnup:** 7200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4589.6 GW(e).h  
**Energy Availability Factor:** 87.5%  
**Load Factor:** 87.1%  
**Operating Factor:** 87.7%  
**Energy Unavailability Factor:** 12.5%  
**Total Off-line Time:** 1080 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 441.7 | 412.4 | 441.8 | 400.5 | 0.0   | 312.6 | 416.7 | 419.4 | 431.3 | 440.7 | 429.3 | 443.1 | 4589.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.9  | 92.7  | 0.0   | 72.4  | 93.4  | 94.0  | 99.8  | 99.6  | 99.8  | 99.9  | 87.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 99.9  | 92.7  | 0.0   | 72.4  | 93.7  | 94.0  | 99.8  | 99.6  | 99.8  | 99.9  | 87.5   |
| <b>LF (%)</b>   | 99.0  | 98.7  | 99.0  | 92.7  | 0.0   | 72.4  | 93.4  | 94.0  | 99.8  | 98.7  | 99.4  | 99.3  | 87.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 93.5  | 0.0   | 72.9  | 93.5  | 94.1  | 100.0 | 99.7  | 100.0 | 100.0 | 87.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.1   | 7.3   | 100.0 | 27.6  | 6.6   | 6.0   | 0.2   | 0.4   | 0.2   | 0.1   | 12.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 7.3   | 100.0 | 27.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.3   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 6.3   | 6.0   | 0.2   | 0.4   | 0.2   | 0.1   | 1.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

ON THE 04/08/04, 100.000.000 MW(E)H OF GENERATION WERE REACHED FROM THE FIRST SYNCHRONIZATION TO THE NATIONAL GRID. IN 2004 THERE WERE EXTRACTED FOR SALE 4.537.837,8 CI OF COBALT 60.

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1974      **Lifetime Generation:** 94220.0 GW(e).h  
**Date of First Criticality:** 13 Mar 1983      **Cumulative Energy Availability Factor:** 87.1%  
**Date of Grid Connection:** 25 Apr 1983      **Cumulative Load Factor:** 84.3%  
**Date of Commercial Operation:** 20 Jan 1984      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 12.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 3778.6         | 600.0          | 93.4   | 81.9   | 93.4                              | 81.6   | 71.9               | 59.9   | 8170               | 93.3   |
| 1986 | 3061.7         | 600.0          | 67.1   | 77.0   | 66.3                              | 76.5   | 58.3               | 59.4   | 5847               | 66.7   |
| 1987 | 4577.0         | 600.0          | 87.9   | 79.7   | 87.9                              | 79.4   | 87.1               | 66.3   | 7951               | 90.8   |
| 1988 | 4560.6         | 600.0          | 88.8   | 81.5   | 88.8                              | 81.3   | 86.5               | 70.3   | 7798               | 88.8   |
| 1989 | 4659.0         | 600.0          | 90.1   | 83.0   | 89.1                              | 82.6   | 88.6               | 73.4   | 7804               | 89.1   |
| 1990 | 5000.7         | 600.0          | 96.5   | 84.9   | 95.1                              | 84.4   | 95.1               | 76.5   | 8404               | 95.9   |
| 1991 | 4498.8         | 600.0          | 89.7   | 85.5   | 85.8                              | 84.5   | 85.6               | 77.6   | 7855               | 89.7   |
| 1992 | 4354.0         | 600.0          | 83.4   | 85.3   | 81.6                              | 84.2   | 82.6               | 78.2   | 7440               | 84.7   |
| 1993 | 4773.3         | 600.0          | 90.7   | 85.8   | 90.6                              | 84.8   | 90.8               | 79.4   | 7956               | 90.8   |
| 1994 | 5157.9         | 600.0          | 98.3   | 86.9   | 97.8                              | 86.0   | 98.1               | 81.1   | 8575               | 97.9   |
| 1995 | 3897.9         | 600.0          | 74.3   | 85.9   | 74.3                              | 85.1   | 74.2               | 80.6   | 6541               | 74.7   |
| 1996 | 4892.0         | 600.0          | 92.8   | 86.4   | 92.8                              | 85.6   | 92.8               | 81.5   | 8176               | 93.1   |
| 1997 | 4737.0         | 600.0          | 89.3   | 86.6   | 89.3                              | 85.9   | 90.1               | 82.1   | 7821               | 89.3   |
| 1998 | 4555.4         | 600.0          | 86.9   | 86.6   | 86.9                              | 86.0   | 86.7               | 82.4   | 7629               | 87.1   |
| 1999 | 5201.8         | 598.0          | 99.1   | 87.4   | 99.1                              | 86.8   | 99.3               | 83.5   | 8700               | 99.3   |
| 2000 | 4064.5         | 643.0          | 78.2   | 86.8   | 78.1                              | 86.2   | 72.0               | 82.8   | 6837               | 77.8   |
| 2001 | 5128.1         | 600.0          | 97.5   | 87.4   | 97.4                              | 86.9   | 97.6               | 83.6   | 8564               | 97.8   |
| 2002 | 4385.5         | 600.0          | 84.0   | 87.2   | 83.4                              | 86.7   | 83.4               | 83.6   | 7401               | 84.5   |
| 2003 | 5004.1         | 600.0          | 95.1   | 87.6   | 95.1                              | 87.1   | 95.2               | 84.1   | 8367               | 95.5   |
| 2004 | 4589.6         | 600.0          | 87.5   | 87.6   | 87.5                              | 87.1   | 87.1               | 84.3   | 7704               | 87.7   |



## AR-2 EMBALSE

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                 |
|--------|-------|---------|------|------|-----------------------------|
| 29 Apr | 986.0 | 597.3   | PF   | D    | PLANNED MAINTENANCE         |
| 22 Jul | 48.0  | 28.2    | UF1  | A15  | LIQUID RELIEF VALVE FAILURE |
| 16 Aug | 43.0  | 26.0    | UF2  | A15  | LIQUID RELIEF VALVE REPAIR  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 91        |          | 7   | 276       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 109   |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 986             |           |          | 626   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 65  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 10  | 2         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 2         | 21       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 3         |          |
| Subtotal   | 986             | 91        | 0        | 817   | 284       | 21       |
| Total  |                 | 1077      |          |   | 1122      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1983 to 2004<br>Average Hours Lost Per Year |
|--|-----------------|---|
| 11. Reactor and Accessories                    |                 | 10  |
| 12. Reactor I&C Systems                        |                 | 6   |
| 13. Reactor Auxiliary Systems                  |                 | 50  |
| 15. Reactor Cooling Systems                    | 91              | 14  |
| 16. Steam generation systems                   |                 | 78  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1   |
| 31. Turbine and auxiliaries                    |                 | 41  |
| 32. Feedwater and Main Steam System            |                 | 27  |
| 41. Main Generator Systems                     |                 | 41  |
| 42. Electrical Power Supply Systems            |                 | 8   |
| Total  | 91              | 276   |

## AM-19 ARMENIA-2

**Operator:** JSC (JOINT STOCK COMPANY ARMENIA NPP)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 376.0 MW(e)  
**Design Net RUP:** 376.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 2196.6 GW(e).h  
**Energy Availability Factor:** 64.2%  
**Load Factor:** 66.5%  
**Operating Factor:** 81.2%  
**Energy Unavailability Factor:** 35.8%  
**Total Off-line Time:** 1649 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 256.7 | 231.3 | 229.8 | 151.8 | 197.9 | 231.0 | 220.6 | 0.0   | 0.0   | 165.3 | 250.4 | 261.9 | 2196.6 |
| <b>EAF (%)</b>  | 89.6  | 88.7  | 74.4  | 56.3  | 70.9  | 77.2  | 71.1  | 0.0   | 0.0   | 58.4  | 92.0  | 92.0  | 64.2   |
| <b>UCF (%)</b>  | 89.6  | 90.5  | 92.0  | 56.3  | 92.0  | 91.7  | 88.8  | 0.0   | 0.0   | 58.4  | 92.0  | 92.0  | 70.3   |
| <b>LF (%)</b>   | 91.8  | 88.4  | 82.1  | 56.1  | 70.7  | 85.3  | 78.9  | 0.0   | 0.0   | 59.1  | 92.5  | 93.6  | 66.5   |
| <b>OF (%)</b>   | 97.8  | 98.9  | 99.9  | 96.1  | 100.0 | 100.0 | 96.9  | 0.0   | 0.0   | 85.3  | 100.0 | 100.0 | 81.2   |
| <b>EUF (%)</b>  | 10.4  | 11.3  | 25.6  | 43.7  | 29.1  | 22.8  | 28.9  | 100.0 | 100.0 | 41.6  | 8.0   | 8.0   | 35.8   |
| <b>PUF (%)</b>  | 8.0   | 8.0   | 8.0   | 41.5  | 8.0   | 8.0   | 8.0   | 100.0 | 100.0 | 40.6  | 8.0   | 8.0   | 28.8   |
| <b>UCLF (%)</b> | 2.4   | 1.5   | 0.0   | 2.2   | 0.0   | 0.3   | 3.2   | 0.0   | 0.0   | 1.0   | 0.0   | 0.0   | 0.9    |
| <b>XUF (%)</b>  | 0.0   | 1.9   | 17.6  | 0.0   | 21.1  | 14.5  | 17.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.1    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Jul 1975  
**Date of First Criticality:** 05 Jan 1980  
**Date of Grid Connection:** 05 Jan 1980  
**Date of Commercial Operation:** 03 May 1980

**Lifetime Generation:** 39271.5 GW(e).h  
**Cumulative Energy Availability Factor:** 63.5%  
**Cumulative Load Factor:** 56.0%  
**Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 36.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 2629.1         | 408.0          | 79.3   | 79.3   | 79.3                              | 79.3   | 73.6               | 73.6   | 7040               | 80.4   |
| 1988 | 2254.5         | 376.0          | 73.4   | 76.5   | 73.4                              | 76.5   | 68.3               | 71.0   | 6741               | 76.7   |
| 1989 | 671.3          | 376.0          | 99.9   | 84.1   | 99.9                              | 84.1   | 20.4               | 54.6   | 1838               | 21.0   |
| 1996 | 2098.0         | 376.0          | 86.3   | 84.6   | 63.6                              | 79.1   | 63.5               | 56.8   | 7561               | 86.1   |
| 1997 | 1430.0         | 376.0          | 43.4   | 76.5   | 43.4                              | 72.1   | 43.4               | 54.2   | 5700               | 65.1   |
| 1998 | 1416.5         | 376.0          | 44.6   | 71.3   | 44.6                              | 67.5   | 43.0               | 52.3   | 6408               | 73.2   |
| 1999 | 1890.4         | 376.0          | 57.4   | 69.3   | 57.4                              | 66.1   | 57.4               | 53.0   | 6193               | 70.7   |
| 2000 | 1841.5         | 376.0          | 55.8   | 67.6   | 55.8                              | 64.8   | 55.8               | 53.4   | 5699               | 64.9   |
| 2001 | 1815.4         | 376.0          | 55.1   | 66.3   | 55.1                              | 63.8   | 55.1               | 53.6   | 5660               | 64.6   |
| 2002 | 2078.9         | 376.0          | 63.3   | 66.0   | 63.2                              | 63.7   | 63.1               | 54.5   | 6961               | 79.5   |
| 2003 | 1997.6         | 376.0          | 63.4   | 65.7   | 60.6                              | 63.4   | 60.6               | 55.1   | 6120               | 69.9   |
| 2004 | 2196.6         | 376.0          | 70.3   | 66.1   | 64.2                              | 63.5   | 66.5               | 56.0   | 7135               | 81.2   |

**AM-19 ARMENIA-2****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 7135.0 | 219.6   | PP   | H    | OPERATION AT LOWER POWER 92% NNOM DUE TO NUCLEAR REGULATORY REQUIREMENTS.   |
| 31 Jan | 16.0   | 6.8     | UF5  | A42  | DISCONNECTION OF AT-1 THROUGH TRANSFORMER DIFFERENTIAL PROTECTION ACTUATION. THE AZ-III WAS ACTIVATED. THE REACTOR SCRAM WAS ACTIVATED BY OPERATOR, MANUALLY.   |
| 08 Mar | 25.0   | 2.5     | XP1  | K    | OPERATION AT LOWER POWER DUE TO GRID RESTRICTION.   |
| 18 Mar | 40.0   | 6.3     | XP1  | K    | OPERATION AT LOWER POWER DUE TO GRID RESTRICTION.   |
| 08 Apr | 240.0  | 45.0    | PP   | D    | DISCONNECTION OF TG-4 FOR CLEANING THE CONDENSER AND OPERATOR LIMITATION.   |
| 20 Apr | 216.0  | 40.5    | PP   | D    | DISCONNECTION OF TG-4 FOR CLEANING THE CONDENSER AND OPERATOR LIMITATION.   |
| 27 Apr | 28.0   | 5.9     | UF5  | A41  | DUE TO UNSTABLE GRID, DISCONNECTION OF G-4 BY "SPURIOUS" ACTUATING THE ROTOR'S PROTECTION DUE TO OVERLOADING DROP AZ-IV GROUP'S CONTROL RODS TO LOWER LEVEL. THE REACTOR SCRAM WAS ACTIVATED BY OPERATOR, MANUALLY. |
| 07 Jun | 7.0    | 0.8     | UP2  | A42  | THE DISCONNECTION OF TG-3 FROM NETWORK DUE TO DIFFERENTIAL PROTECTION ACTUATION 23T, RESULTED IN OCCURRING SHORT CIRCUIT AT BUSES 6.3 KV, LEG "A".  |
| 31 Jul | 1574.0 | 585.0   | PP   | F    | PLANNED UNIT OUTAGE WITH REFUELING AND MODERNIZATION.   |
| 01 Oct | 432.0  | 81.0    | PP   | D    | CONTINUATION OF PLANNED UNIT OUTAGE WITHOUT REFUELING.  |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 44        |          |   | 63        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                |                 |           |          | 1014  |           |          |
| D. Inspection, maintenance or repair without refuelling                      |                 |           |          | 93  |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling | 1574            |           |          |   |           |          |
| J. Grid failure or grid unavailability                                       |                 |           |          |   |           | 14       |
| Subtotal   | 1574            | 44        | 0        | 1107  | 65        | 14       |
| Total  |                 | 1618      |          |   | 1186      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1987 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 0   |
| 15. Reactor Cooling Systems                    |                    | 8   |
| 16. Steam generation systems                   |                    | 11  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 1   |
| 41. Main Generator Systems                     | 28                 |   |
| 42. Electrical Power Supply Systems            | 16                 | 1   |
| Total  | 44                 | 23  |

## BE-2 DOEL-1

**Operator:** ELECTRAB (ELECTRABEL M. V. NUCLEAIRE PRODUKTIE)  
**Contractor:** ACECOWEN (ACECOWEN ( ACEC-COCKERILL-WESTINGHOUSE ))

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 392.0 MW(e)  
**Design Net RUP:** 392.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 2989.1 GW(e).h  
**Energy Availability Factor:** 85.5%  
**Load Factor:** 86.8%  
**Operating Factor:** 88.1%  
**Energy Unavailability Factor:** 14.5%  
**Total Off-line Time:** 1042 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 299.7 | 279.6 | 299.3 | 288.3 | 292.4 | 206.2 | 239.3 | 238.4 | 282.6 | 270.0 | 1.5  | 291.8 | 2989.1 |
| <b>EAF (%)</b>  | 99.8  | 99.7  | 100.0 | 99.9  | 98.7  | 72.5  | 81.8  | 83.2  | 99.3  | 91.8  | 0.4  | 98.1  | 85.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 74.8  | 82.6  | 100.0 | 100.0 | 92.6  | 0.4  | 98.7  | 87.6   |
| <b>LF (%)</b>   | 102.8 | 102.5 | 102.6 | 102.1 | 100.2 | 73.0  | 82.1  | 81.8  | 100.1 | 92.6  | 0.5  | 100.0 | 86.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 75.1  | 85.3  | 100.0 | 100.0 | 93.0  | 2.6  | 100.0 | 88.1   |
| <b>EUF (%)</b>  | 0.2   | 0.3   | 0.0   | 0.1   | 1.3   | 27.5  | 18.2  | 16.8  | 0.7   | 8.2   | 99.6 | 1.9   | 14.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 25.2  | 0.0   | 0.0   | 0.0   | 7.4   | 96.6 | 1.3   | 10.7   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 17.4  | 0.0   | 0.0   | 0.0   | 3.0  | 0.0   | 1.7    |
| <b>XUF (%)</b>  | 0.2   | 0.3   | 0.0   | 0.1   | 1.3   | 2.4   | 0.7   | 16.8  | 0.7   | 0.8   | 0.0  | 0.6   | 2.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE REFERENCE UNIT POWER IS 392.5 MWE

### 5. Historical Summary

**Date of Construction Start:** 01 Jul 1969  
**Date of First Criticality:** 18 Jul 1974  
**Date of Grid Connection:** 28 Aug 1974  
**Date of Commercial Operation:** 15 Feb 1975

**Lifetime Generation:** 88641.8 GW(e).h  
**Cumulative Energy Availability Factor:** 85.4%  
**Cumulative Load Factor:** 85.6%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 14.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2823.0         | 393.0          | 82.1   | 96.7   | 82.1                              | 83.2   | 82.0               | 83.5   | 7316               | 83.5   |
| 1984 | 3129.0         | 393.0          | 90.2   | 96.0   | 90.2                              | 84.0   | 90.6               | 84.3   | 7988               | 90.9   |
| 1985 | 2896.3         | 392.0          | 82.4   | 94.7   | 82.4                              | 83.8   | 84.3               | 84.3   | 7330               | 83.7   |
| 1986 | 2685.9         | 392.0          | 79.2   | 93.3   | 78.8                              | 83.4   | 78.2               | 83.8   | 7040               | 80.4   |
| 1987 | 2928.4         | 400.0          | 85.5   | 92.6   | 85.4                              | 83.6   | 83.6               | 83.7   | 7306               | 83.4   |
| 1988 | 2694.1         | 400.0          | 86.6   | 92.1   | 81.3                              | 83.4   | 76.7               | 83.2   | 7686               | 87.5   |
| 1989 | 2513.1         | 400.0          | 73.6   | 90.8   | 71.9                              | 82.6   | 71.7               | 82.4   | 6475               | 73.9   |
| 1990 | 2859.9         | 400.0          | 85.6   | 90.5   | 83.5                              | 82.6   | 81.6               | 82.3   | 7380               | 84.2   |
| 1991 | 3061.4         | 400.0          | 89.5   | 90.4   | 89.2                              | 83.0   | 87.4               | 82.6   | 7860               | 89.7   |
| 1992 | 2990.5         | 400.0          | 87.7   | 90.2   | 86.5                              | 83.2   | 85.1               | 82.8   | 7741               | 88.1   |
| 1993 | 2908.9         | 400.0          | 86.0   | 90.0   | 84.4                              | 83.3   | 83.0               | 82.8   | 7580               | 86.5   |
| 1994 | 2921.8         | 400.0          | 88.7   | 89.9   | 84.8                              | 83.4   | 83.4               | 82.8   | 7635               | 87.2   |
| 1995 | 2791.5         | 392.0          | 82.7   | 89.6   | 81.0                              | 83.3   | 81.3               | 82.7   | 7342               | 83.8   |
| 1996 | 3169.4         | 392.0          | 91.5   | 89.7   | 91.3                              | 83.6   | 92.0               | 83.2   | 8141               | 92.7   |
| 1997 | 3113.8         | 392.0          | 89.0   | 89.6   | 88.9                              | 83.9   | 90.7               | 83.5   | 7899               | 90.2   |
| 1998 | 3292.5         | 392.0          | 94.0   | 89.8   | 93.7                              | 84.3   | 95.9               | 84.1   | 8277               | 94.5   |
| 1999 | 3196.8         | 392.0          | 92.6   | 89.9   | 91.1                              | 84.6   | 93.1               | 84.4   | 8123               | 92.7   |
| 2000 | 3264.8         | 392.0          | 94.3   | 90.1   | 92.3                              | 84.9   | 94.8               | 84.8   | 8317               | 94.7   |
| 2001 | 3157.6         | 392.0          | 91.4   | 90.2   | 90.5                              | 85.1   | 91.9               | 85.1   | 8098               | 92.4   |
| 2002 | 3260.7         | 392.0          | 93.4   | 90.3   | 93.3                              | 85.4   | 95.0               | 85.5   | 8308               | 94.8   |
| 2003 | 3024.6         | 392.0          | 90.3   | 90.3   | 86.4                              | 85.4   | 88.1               | 85.6   | 7953               | 90.8   |
| 2004 | 2989.1         | 392.0          | 87.5   | 90.2   | 85.5                              | 85.4   | 86.8               | 85.6   | 7742               | 88.1   |

## BE-2 DOEL-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 02 May | 17.0  | 1.4     | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)   |
| 18 Jun | 179.0 | 71.1    | PF   | E14  | COLD SHUTDOWN FOR THE PERFORMANCE OF PERIODIC TESTS ON THE SAFETY INJECTION SYSTEMS. |
| 06 Jul | 123.0 | 48.4    | UF2  | A16  | SHUTDOWN FOR REPAIR A LEAKAGE PIPE STEAMGENERATOR B.                                 |
| 06 Jul | 6.0   | 2.4     | UF4  | L    | SCRAM AND SI DUE TO HIGH STEAM PRESSURE  |
| 17 Jul | 58.0  | 2.4     | UP2  | A32  | POWER REDUCTION FOR EW-PUMP DUE TO HIGH BEARING TEMPERATURE.                         |
| 09 Aug |       | 49.0    | XP   | N33  | MODULATION DUE TO COOLING WATER TEMPERATURE LIMITS.                                  |
| 01 Sep | 190.0 | 1.9     | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)   |
| 15 Oct | 348.0 | 1.7     | XP   | S    | STRETCH-OUT  |
| 29 Oct | 52.0  | 20.6    | PF   | C    | REFUELING  |
| 01 Nov | 678.0 | 266.1   | PF   | C    | REFUELING OUTAGE   |
| 29 Nov | 21.0  | 8.4     | UF3  | L    | REFUELING OUTAGE EXTENSION   |
| 30 Nov | 19.0  | 5.8     | PP   | C    | STARTUP AFTER REFUELING OUTAGE - PARTIAL   |
| 30 Nov | 2.0   | 0.7     | PF   | C    | STARTUP AFTER REFUELING OUTAGE - FULL  |
| 01 Dec | 44.0  | 3.5     | PP   | C    | STARTUP AFTER REFUELING OUTAGE   |
| 21 Dec | 3.0   | 0.3     | PP   | D31  | MAINTENANCE ON THE MODULE TURBINE REGULATION   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 123       |          |  | 206       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 732             |           |          | 782                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 8  |           |          |
| E. Testing of plant systems or components  | 179             |           |          | 30                                       | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 5         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 7        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 27                                       | 50        |          |
| L. Human factor related  |                 | 27        |          |  |           |          |
| Z. Others  |                 |           |          |  | 1         |          |
| Subtotal   | 911             | 150       | 0        | 847                                      | 266       | 7        |
| Total  |                 | 1061      |          |  | 1120      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 11                                       |
| 12. Reactor I&C Systems             |                 | 13                                       |
| 14. Safety Systems                  |                 | 10                                       |
| 15. Reactor Cooling Systems         |                 | 16                                       |
| 16. Steam generation systems        | 123             | 43                                       |
| 31. Turbine and auxiliaries         |                 | 77                                       |
| 32. Feedwater and Main Steam System |                 | 22                                       |
| 33. Circulating Water System        |                 | 0  |
| 41. Main Generator Systems          |                 | 7  |
| 42. Electrical Power Supply Systems |                 | 0  |
| Total                               | 123             | 199                                      |

## BE-4 DOEL-2

**Operator:** ELECTRAB (ELECTRABEL M. V. NUCLEAIRE PRODUKTIE)  
**Contractor:** ACECOWEN (ACECOWEN ( ACEC-COCKERILL-WESTINGHOUSE ))

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 393.0 MW(e)  
**Design Net RUP:** 392.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 2951.9 GW(e).h  
**Energy Availability Factor:** 80.5%  
**Load Factor:** 81.4%  
**Operating Factor:** 81.7%  
**Energy Unavailability Factor:** 19.5%  
**Total Off-line Time:** 1610 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 300.8 | 281.1 | 300.7 | 277.9 | 55.2 | 0.0   | 182.7 | 283.3 | 307.4 | 323.8 | 317.3 | 321.8 | 2951.9 |
| <b>EAF (%)</b>  | 100.0 | 99.9  | 100.0 | 97.1  | 19.0 | 0.0   | 60.2  | 88.7  | 99.0  | 99.8  | 99.5  | 97.0  | 80.5   |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 100.0 | 100.0 | 22.1 | 0.0   | 60.3  | 97.8  | 100.0 | 100.0 | 99.9  | 97.0  | 81.9   |
| <b>LF (%)</b>   | 102.9 | 102.8 | 102.8 | 98.4  | 18.9 | 0.0   | 56.7  | 87.9  | 98.6  | 100.4 | 101.8 | 99.9  | 81.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 22.3 | 0.0   | 62.1  | 98.4  | 100.0 | 100.0 | 100.0 | 97.6  | 81.7   |
| <b>EUF (%)</b>  | 0.0   | 0.1   | 0.0   | 2.9   | 81.0 | 100.0 | 39.8  | 11.3  | 1.0   | 0.2   | 0.5   | 3.0   | 19.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 77.9 | 100.0 | 39.6  | 0.0   | 0.0   | 0.0   | 0.0   | 2.0   | 17.8   |
| <b>UCLF (%)</b> | 0.0   | 0.1   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 2.2   | 0.0   | 0.0   | 0.0   | 1.1   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 2.9   | 3.1  | 0.0   | 0.1   | 9.1   | 1.0   | 0.2   | 0.4   | 0.0   | 1.4    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

STARTING AT 12-07-2004 THE OUTPUT CAPACITY IS CHANGED INTO 433 MW (NEW STEAMGENERATORS). THE CAPACITY WAS 392.5 MWH

### 5. Historical Summary

**Date of Construction Start:** 01 Sep 1971      **Lifetime Generation:** 81507.4 GW(e).h  
**Date of First Criticality:** 04 Aug 1975      **Cumulative Energy Availability Factor:** 80.2%  
**Date of Grid Connection:** 21 Aug 1975      **Cumulative Load Factor:** 80.4%  
**Date of Commercial Operation:** 01 Dec 1975      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 19.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 2916.0         | 393.0          | 84.2   | 90.8   | 84.1                              | 75.5   | 84.5               | 75.5   | 7508               | 85.5   |
| 1985 | 2908.7         | 392.0          | 83.0   | 90.0   | 83.0                              | 76.2   | 84.7               | 76.5   | 7341               | 83.8   |
| 1986 | 2282.6         | 392.0          | 69.8   | 88.2   | 69.8                              | 75.6   | 66.5               | 75.6   | 5891               | 67.2   |
| 1987 | 2616.4         | 400.0          | 77.8   | 87.3   | 76.8                              | 75.7   | 74.7               | 75.5   | 6612               | 75.5   |
| 1988 | 2906.7         | 400.0          | 83.2   | 87.0   | 82.6                              | 76.3   | 82.7               | 76.0   | 7408               | 84.3   |
| 1989 | 2479.8         | 400.0          | 71.8   | 85.9   | 70.8                              | 75.9   | 70.8               | 75.7   | 6436               | 73.5   |
| 1990 | 1982.6         | 400.0          | 66.5   | 84.6   | 56.6                              | 74.6   | 56.6               | 74.4   | 5170               | 59.0   |
| 1991 | 2779.8         | 400.0          | 81.2   | 84.4   | 81.0                              | 75.0   | 79.3               | 74.7   | 7136               | 81.5   |
| 1992 | 2971.9         | 400.0          | 86.3   | 84.5   | 86.1                              | 75.6   | 84.6               | 75.3   | 7617               | 86.7   |
| 1993 | 2949.5         | 400.0          | 85.9   | 84.6   | 85.7                              | 76.2   | 84.2               | 75.8   | 7551               | 86.2   |
| 1994 | 2982.4         | 392.0          | 87.3   | 84.7   | 86.2                              | 76.7   | 86.9               | 76.4   | 7810               | 89.2   |
| 1995 | 2867.5         | 392.0          | 82.9   | 84.6   | 82.7                              | 77.0   | 83.5               | 76.7   | 7342               | 83.8   |
| 1996 | 2888.8         | 392.0          | 83.4   | 84.6   | 83.1                              | 77.3   | 83.9               | 77.0   | 7390               | 84.1   |
| 1997 | 2935.0         | 392.0          | 87.7   | 84.7   | 84.5                              | 77.6   | 85.5               | 77.4   | 7749               | 88.5   |
| 1998 | 3145.0         | 392.0          | 90.2   | 84.9   | 90.1                              | 78.2   | 91.6               | 78.0   | 7987               | 91.2   |
| 1999 | 3091.7         | 392.0          | 89.6   | 85.1   | 88.9                              | 78.6   | 90.0               | 78.5   | 7875               | 89.9   |
| 2000 | 3135.6         | 392.0          | 90.4   | 85.3   | 89.8                              | 79.1   | 91.1               | 79.0   | 8022               | 91.3   |
| 2001 | 3150.5         | 392.0          | 90.9   | 85.5   | 90.3                              | 79.5   | 91.7               | 79.5   | 8060               | 92.0   |
| 2002 | 3104.5         | 392.0          | 91.4   | 85.8   | 89.5                              | 79.9   | 90.4               | 79.9   | 8076               | 92.2   |
| 2003 | 3142.6         | 392.0          | 93.1   | 86.0   | 90.1                              | 80.2   | 91.5               | 80.3   | 8184               | 93.4   |
| 2004 | 2951.9         | 413.0          | 81.9   | 85.9   | 80.5                              | 80.2   | 81.4               | 80.4   | 7174               | 81.7   |

## BE-4 DOEL-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 13 Apr | 410.0 | 8.2     | XP   | S    | STRETCH-OUT   |
| 01 May | 163.0 | 8.9     | XP   | S    | STRETCH-OUT   |
| 07 May | 578.0 | 226.9   | PF   | C    | REFUELING OUTAGE  |
| 01 Jun | 720.0 | 282.6   | PF   | C    | REFUELING OUTAGE  |
| 01 Jul | 282.0 | 111.3   | PF   | C    | REFUELING OUTAGE  |
| 12 Jul | 89.0  | 16.1    | PP   | C    | STARTUP AFTER REFUELING OUTAGE                          |
| 05 Aug |       | 26.6    | XP   | N33  | MODULATION DUE TO COOLING WATER TEMPERATURE LIMITS      |
| 06 Aug | 12.0  | 6.9     | UF5  | A31  | SCRAM DUE TO A FAILURE IN THE MODULE TURBINE REGULATION |
| 03 Sep | 269.0 | 3.1     | XP   | K    | MODULATION FOR GENCO (= GRID OWNER)                     |
| 12 Dec | 12.0  | 5.1     | PF   | E31  | TURBINE RUNBACK : TESTING                               |
| 13 Dec | 6.0   | 2.7     | UF4  | L41  | SCRAM DUE TO UNSUFFICIENT EXITATION                     |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 12        |          |  | 342       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1580            |           |          | 821                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 181                                      |           |          |
| E. Testing of plant systems or components  | 12              |           |          | 73                                       | 15        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 14       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 9  | 12        |          |
| L. Human factor related  |                 | 6         |          |  |           |          |
| Z. Others  |                 |           |          |  | 0         |          |
| Subtotal   | 1592            | 18        | 0        | 1084                                     | 385       | 14       |
| Total  |                 | 1610      |          |  | 1483      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 11                                       |
| 13. Reactor Auxiliary Systems       |                 | 6  |
| 14. Safety Systems                  |                 | 10                                       |
| 15. Reactor Cooling Systems         |                 | 28                                       |
| 16. Steam generation systems        |                 | 100                                      |
| 31. Turbine and auxiliaries         | 12              | 97                                       |
| 32. Feedwater and Main Steam System |                 | 19                                       |
| 41. Main Generator Systems          |                 | 12                                       |
| 42. Electrical Power Supply Systems |                 | 9  |
| Total                               | 12              | 292                                      |

## BE-5 DOEL-3

**Operator:** ELECTRAB (ELECTRABEL M. V. NUCLEAIRE PRODUKTIE)  
**Contractor:** FRAMACEC (FRAMACECO ( FRAMATOME-ACEC-COCKERILL ))

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1006.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7984.8 GW(e).h  
**Energy Availability Factor:** 90.8%  
**Load Factor:** 90.4%  
**Operating Factor:** 92.3%  
**Energy Unavailability Factor:** 9.2%  
**Total Off-line Time:** 680 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 754.5 | 706.4 | 748.7 | 73.5 | 743.9 | 702.4 | 728.4 | 685.4 | 704.0 | 737.4 | 710.1 | 690.2 | 7984.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.6  | 10.0 | 99.4  | 96.9  | 98.8  | 95.4  | 99.1  | 98.9  | 98.2  | 92.2  | 90.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 10.2 | 99.4  | 100.0 | 100.0 | 95.8  | 99.9  | 99.8  | 100.0 | 93.2  | 91.6   |
| <b>LF (%)</b>   | 100.8 | 100.9 | 100.0 | 10.2 | 99.4  | 97.0  | 97.3  | 91.6  | 97.2  | 98.4  | 98.0  | 92.2  | 90.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 14.2 | 100.0 | 100.0 | 100.0 | 96.6  | 100.0 | 100.0 | 100.0 | 95.0  | 92.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.4   | 90.0 | 0.6   | 3.1   | 1.2   | 4.6   | 0.9   | 1.1   | 1.8   | 7.8   | 9.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 89.3 | 0.3   | 0.0   | 0.0   | 0.0   | 0.1   | 0.2   | 0.0   | 0.0   | 7.4    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.5  | 0.3   | 0.0   | 0.0   | 4.3   | 0.0   | 0.0   | 0.0   | 6.8   | 1.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.3   | 0.2  | 0.0   | 3.1   | 1.2   | 0.4   | 0.8   | 0.9   | 1.8   | 1.0   | 0.8    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Jan 1975      **Lifetime Generation:** 159260.0 GW(e).h  
**Date of First Criticality:** 14 Jun 1982      **Cumulative Energy Availability Factor:** 85.8%  
**Date of Grid Connection:** 23 Jun 1982      **Cumulative Load Factor:** 85.6%  
**Date of Commercial Operation:** 01 Oct 1982      **Cumulative Unit Capability Factor:** 77.9%  
**Cumulative Energy Unavailability Factor:** 14.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6705.0         | 900.0          | 100.0  | 100.0  | 85.0                              | 85.0   | 85.0               | 85.0   | 7807               | 89.1   |
| 1984 | 7074.0         | 900.0          | 89.5   | 94.8   | 89.5                              | 87.3   | 89.5               | 87.3   | 8084               | 92.0   |
| 1985 | 6496.3         | 900.0          | 82.4   | 90.6   | 82.4                              | 85.7   | 82.4               | 85.6   | 7515               | 85.8   |
| 1986 | 6860.0         | 897.0          | 100.0  | 93.0   | 88.5                              | 86.4   | 87.3               | 86.1   | 8007               | 91.4   |
| 1987 | 5713.2         | 897.0          | 75.7   | 89.5   | 73.5                              | 83.8   | 72.7               | 83.4   | 6905               | 78.8   |
| 1988 | 6777.5         | 890.0          | 88.7   | 89.4   | 85.9                              | 84.1   | 86.7               | 83.9   | 7875               | 89.7   |
| 1989 | 5774.9         | 900.0          | 82.1   | 88.3   | 73.4                              | 82.6   | 73.2               | 82.4   | 7470               | 85.3   |
| 1990 | 6811.8         | 900.0          | 89.9   | 88.5   | 86.4                              | 83.1   | 86.4               | 82.9   | 8021               | 91.6   |
| 1991 | 6742.9         | 900.0          | 90.0   | 88.7   | 85.8                              | 83.4   | 85.5               | 83.2   | 7913               | 90.3   |
| 1992 | 6732.2         | 900.0          | 92.3   | 89.1   | 90.1                              | 84.1   | 85.2               | 83.4   | 7778               | 88.5   |
| 1993 | 5377.2         | 900.0          | 69.6   | 87.3   | 65.8                              | 82.4   | 68.2               | 82.0   | 6198               | 70.8   |
| 1994 | 7482.3         | 970.0          | 88.4   | 87.4   | 87.7                              | 82.9   | 88.1               | 82.6   | 7888               | 90.0   |
| 1995 | 7025.1         | 970.0          | 83.4   | 87.1   | 82.6                              | 82.9   | 82.7               | 82.6   | 7396               | 84.4   |
| 1996 | 7334.2         | 993.0          | 84.4   | 86.8   | 83.8                              | 82.9   | 84.1               | 82.7   | 7447               | 84.8   |
| 1997 | 8108.2         | 1006.0         | 93.5   | 87.3   | 91.9                              | 83.6   | 92.0               | 83.4   | 8250               | 94.2   |
| 1998 | 8012.6         | 1006.0         | 92.0   | 87.7   | 90.9                              | 84.1   | 90.9               | 83.9   | 8171               | 93.3   |
| 1999 | 8231.2         | 1006.0         | 94.8   | 88.1   | 93.4                              | 84.7   | 93.4               | 84.5   | 8330               | 95.1   |
| 2000 | 7884.9         | 1006.0         | 89.3   | 88.2   | 89.0                              | 84.9   | 89.2               | 84.8   | 7892               | 89.8   |
| 2001 | 7993.3         | 1006.0         | 90.9   | 88.3   | 90.2                              | 85.2   | 90.7               | 85.1   | 7989               | 91.2   |
| 2002 | 7636.6         | 1006.0         | 86.7   | 88.2   | 86.2                              | 85.3   | 86.7               | 85.2   | 7647               | 87.3   |
| 2003 | 7870.8         | 1006.0         | 89.8   | 88.3   | 89.7                              | 85.5   | 89.3               | 85.4   | 7928               | 90.5   |
| 2004 | 7984.8         | 1006.0         | 91.6   | 88.5   | 90.8                              | 85.8   | 90.4               | 85.6   | 8104               | 92.3   |



## BE-5 DOEL-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 22 Mar | 226.0 | 2.5     | XP   | S    | STRETCH-OUT   |
| 01 Apr | 40.0  | 1.5     | XP   | S    | STRETCH-OUT   |
| 02 Apr | 614.0 | 617.9   | PF   | C    | REFUELING OUTAGE  |
| 28 Apr | 4.0   | 3.5     | UF   | A31  | TURBINE TRIP DUE TO HIGH LEVEL GESTRA (HIGH LEVEL CONDENSATE MAIN STEAM LINE)             |
| 28 Apr | 60.0  | 25.9    | PP   | C    | STARTUP AFTER REFUELING OUTAGE  |
| 02 Jun |       | 19.3    | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)  |
| 10 Aug | 23.0  | 19.3    | UF4  | L32  | SCRAM DUE TO A WRONG CONSIGNATION FEED WATER SYSTEM (LOW LEVEL REGULATION STEAMGENERATOR) |
| 11 Aug | 1.0   | 1.2     | UF   | A31  | TRIP TURBINE DUE TO HIGH LEVEL DRAIN MAIN STEAM LINES.                                    |
| 12 Aug | 17.0  | 10.0    | UP   | A35  | HIGH CONDUCTIVITY IN THE STEAMGENERATOR (CHEMISTRY PARAMETERS)                            |
| 04 Sep | 217.0 | 5.7     | XP   | K    | MODULATION FOR GENCO (= GRID OWNER)   |
| 01 Oct | 278.0 | 6.9     | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)  |
| 01 Nov | 31.0  | 6.6     | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)  |
| 05 Nov | 274.0 | 6.2     | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)  |
| 07 Dec | 26.0  | 25.7    | UF4  | A32  | SCRAM DUE TO FAILURE FEEDWATER ISOLATION VALVES   |
| 08 Dec | 12.0  | 12.1    | UF4  | A14  | SCRAM DUE TO STOP AUXILIARY FEEDWATER PUMP  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 43        |          |  | 179       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 614             |           |          | 707                                      | 2         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 9  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 12        |          |
| L. Human factor related  |                 | 23        |          |  |           |          |
| Subtotal   | 614             | 66        | 0        | 717                                      | 195       | 0        |
| Total  |                 | 680       |          |  | 912       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 13                                       |
| 12. Reactor I&C Systems                        |                 | 1  |
| 13. Reactor Auxiliary Systems                  |                 | 1  |
| 14. Safety Systems                             | 12              |  |
| 15. Reactor Cooling Systems                    |                 | 34                                       |
| 16. Steam generation systems                   |                 | 61                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 20                                       |
| 31. Turbine and auxiliaries                    | 5               | 21                                       |
| 32. Feedwater and Main Steam System            | 26              | 9  |
| 41. Main Generator Systems                     |                 | 8  |
| 42. Electrical Power Supply Systems            |                 | 6  |
| Total  | 43              | 174                                      |

## BE-7 DOEL-4

**Operator:** ELECTRAB (ELECTRABEL M. V. NUCLEAIRE PRODUKTIE)  
**Contractor:** ACECOWEN (ACECOWEN ( ACEC-COCKERILL-WESTINGHOUSE ))

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 985.0 MW(e)  
**Design Net RUP:** 1000.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7519.8 GW(e).h  
**Energy Availability Factor:** 87.0%  
**Load Factor:** 86.9%  
**Operating Factor:** 89.3%  
**Energy Unavailability Factor:** 13.0%  
**Total Off-line Time:** 942 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 714.0 | 681.5 | 730.0 | 701.9 | 708.3 | 697.4 | 696.0 | 267.5 | 156.3 | 729.5 | 706.4 | 731.1 | 7519.8 |
| <b>EAF (%)</b>  | 97.2  | 99.2  | 99.6  | 99.2  | 97.3  | 99.4  | 95.0  | 36.6  | 22.1  | 99.6  | 99.2  | 99.4  | 87.0   |
| <b>UCF (%)</b>  | 99.9  | 99.9  | 99.9  | 100.0 | 98.6  | 100.0 | 98.6  | 42.3  | 22.1  | 100.0 | 99.4  | 99.4  | 88.4   |
| <b>LF (%)</b>   | 97.4  | 99.4  | 99.6  | 99.0  | 96.6  | 98.3  | 95.0  | 36.5  | 22.0  | 99.4  | 99.6  | 99.8  | 86.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 42.7  | 28.5  | 100.0 | 100.0 | 100.0 | 89.3   |
| <b>EUF (%)</b>  | 2.8   | 0.8   | 0.4   | 0.8   | 2.7   | 0.6   | 5.0   | 63.4  | 77.9  | 0.4   | 0.8   | 0.6   | 13.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 57.7  | 53.8  | 0.0   | 0.6   | 0.6   | 9.4    |
| <b>UCLF (%)</b> | 0.1   | 0.1   | 0.1   | 0.0   | 1.4   | 0.0   | 1.4   | 0.0   | 24.1  | 0.0   | 0.0   | 0.0   | 2.2    |
| <b>XUF (%)</b>  | 2.7   | 0.8   | 0.3   | 0.7   | 1.3   | 0.6   | 3.6   | 5.7   | 0.0   | 0.4   | 0.2   | 0.0   | 1.4    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Dec 1978      **Lifetime Generation:** 142218.0 GW(e).h  
**Date of First Criticality:** 31 Mar 1985      **Cumulative Energy Availability Factor:** 83.1%  
**Date of Grid Connection:** 08 Apr 1985      **Cumulative Load Factor:** 83.0%  
**Date of Commercial Operation:** 01 Jul 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 16.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 4282.1         | 981.0          | 0.0  | 0.0    | 76.0                              | 100.0  | 50.8               | 0.0    | 5263               | 61.3   |
| 1986 | 7722.9         | 1006.0         | 90.6   | 90.6   | 90.6                              | 90.6   | 87.6               | 87.6   | 7973               | 91.0   |
| 1987 | 6809.3         | 1006.0         | 81.4   | 86.0   | 77.0                              | 83.8   | 77.3               | 82.5   | 7448               | 85.0   |
| 1988 | 7552.0         | 1000.0         | 87.6   | 86.5   | 85.9                              | 84.5   | 86.0               | 83.6   | 7784               | 88.6   |
| 1989 | 7445.9         | 1010.0         | 87.4   | 86.8   | 84.4                              | 84.5   | 84.2               | 83.8   | 7737               | 88.3   |
| 1990 | 7535.8         | 1010.0         | 88.2   | 87.0   | 85.3                              | 84.7   | 85.2               | 84.0   | 7790               | 88.9   |
| 1991 | 7425.4         | 1010.0         | 84.8   | 86.7   | 84.1                              | 84.6   | 83.9               | 84.0   | 7673               | 87.6   |
| 1992 | 7418.6         | 1010.0         | 86.7   | 86.7   | 85.9                              | 84.8   | 83.6               | 84.0   | 7481               | 85.2   |
| 1993 | 6980.9         | 1010.0         | 79.6   | 85.8   | 78.9                              | 84.0   | 78.9               | 83.3   | 7112               | 81.2   |
| 1994 | 3462.7         | 1001.0         | 39.2   | 80.7   | 39.2                              | 79.1   | 39.5               | 78.5   | 3637               | 41.5   |
| 1995 | 6769.7         | 1001.0         | 76.9   | 80.3   | 76.8                              | 78.8   | 77.2               | 78.4   | 7381               | 84.3   |
| 1996 | 6186.8         | 1001.0         | 70.6   | 79.4   | 69.9                              | 78.0   | 70.4               | 77.6   | 6565               | 74.7   |
| 1997 | 7548.7         | 1001.0         | 87.1   | 80.0   | 87.0                              | 78.8   | 86.1               | 78.3   | 7653               | 87.4   |
| 1998 | 7844.0         | 985.0          | 90.0   | 80.8   | 90.0                              | 79.6   | 90.9               | 79.3   | 7998               | 91.3   |
| 1999 | 8008.4         | 985.0          | 92.5   | 81.6   | 92.4                              | 80.5   | 92.8               | 80.2   | 8150               | 93.0   |
| 2000 | 7992.9         | 985.0          | 92.0   | 82.3   | 92.0                              | 81.3   | 92.4               | 81.0   | 8323               | 94.8   |
| 2001 | 8098.9         | 985.0          | 93.3   | 83.0   | 93.2                              | 82.0   | 93.9               | 81.8   | 8264               | 94.3   |
| 2002 | 7831.9         | 985.0          | 90.6   | 83.4   | 90.4                              | 82.5   | 90.8               | 82.3   | 8017               | 91.5   |
| 2003 | 7781.2         | 985.0          | 91.1   | 83.8   | 90.5                              | 82.9   | 90.2               | 82.8   | 8015               | 91.5   |
| 2004 | 7519.8         | 985.0          | 88.3   | 84.1   | 87.0                              | 83.1   | 86.9               | 83.0   | 7843               | 89.3   |

## BE-7 DOEL-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                          |
|--------|-------|---------|------|------|--------------------------------------|
| 01 Jan | 33.0  | 12.1    | XP   | K    | MODULATION FOR GENCO (= GRID OWNER)  |
| 01 Jan | 6.0   | 0.9     | UP   | S12  | MODULATION DUE TO NUCLEAR PARAMETERS |
| 01 Feb | 8.0   | 2.4     | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)   |
| 30 May | 35.0  | 10.4    | UP   | Z31  | CLEANING CONDENSER PART A-B-C-D      |
| 01 Jul | 744.0 | 26.4    | XP   | S    | STRETCH-OUT                          |
| 03 Jul | 46.0  | 10.1    | UP2  | Z32  | CLEANING CONDENSER                   |
| 01 Aug | 314.0 | 41.9    | XP   | S    | STRETCH-OUT                          |
| 14 Aug | 426.0 | 423.1   | PF   | C    | REFUELING OUTAGE                     |
| 01 Sep | 264.0 | 260.0   | PF   | C    | REFUELING OUTAGE                     |
| 12 Sep | 134.0 | 132.0   | UF3  | L    | REFUELING OUTAGE EXTENSION           |
| 17 Sep | 87.7  | 86.4    | PF   | C    | STARTUP AFTER REFUELING OUTAGE       |
| 21 Sep | 149.0 | 35.1    | PP   | C    | STARTUP AFTER REFUELING OUTAGE       |
| 21 Sep | 30.0  | 29.7    | UF2  | A14  | SHUTDOWN FOR REPAIR A LEAKAGE VALVE  |
| 09 Oct | 110.0 | 2.9     | XP   | K    | MODULATION FOR GENCO (=GRID OWNER)   |
| 04 Nov | 27.0  | 4.3     | PP   | Z32  | CLEANING CONDENSER                   |
| 22 Dec | 21.0  | 4.7     | PP   | Z32  | CLEANING CONDENSER                   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 30        |          |   | 314       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 777             |           |          | 827   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 34  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2   | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 61        |          |
| L. Human factor related  |                 | 134       |          |   |           |          |
| Subtotal   | 777             | 164       | 0        | 863   | 377       | 0        |
| Total  |                 | 941       |          |   | 1240      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1987 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 0   |
| 14. Safety Systems                  | 30                 | 1   |
| 15. Reactor Cooling Systems         |                    | 22  |
| 16. Steam generation systems        |                    | 258   |
| 31. Turbine and auxiliaries         |                    | 8   |
| 32. Feedwater and Main Steam System |                    | 15  |
| 33. Circulating Water System        |                    | 0   |
| 41. Main Generator Systems          |                    | 4   |
| 42. Electrical Power Supply Systems |                    | 2   |
| Total                               | 30                 | 310   |

# BE-3 TIHANGE-1

**Operator:** ELECTRAB (ELECTRABEL M. V. NUCLEAIRE PRODUKTIE)  
**Contractor:** ACLF ((ACECOWEN - CREUSOT LOIRE - FRAMATOME))

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 962.0 MW(e)  
**Design Net RUP:** 870.0 MW(e)  
**Design Discharge Burnup:** 37000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7106.5 GW(e).h  
**Energy Availability Factor:** 84.5%  
**Load Factor:** 84.1%  
**Operating Factor:** 84.9%  
**Energy Unavailability Factor:** 15.5%  
**Total Off-line Time:** 1328 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 744.5 | 173.3 | 56.8 | 689.2 | 713.0 | 675.6 | 694.6 | 673.7 | 678.5 | 588.7 | 695.3 | 723.1 | 7106.5 |
| <b>EAF (%)</b>  | 100.0 | 24.9  | 8.1  | 99.7  | 100.0 | 100.0 | 100.0 | 97.5  | 100.0 | 82.0  | 100.0 | 100.0 | 84.5   |
| <b>UCF (%)</b>  | 100.0 | 24.9  | 8.1  | 99.7  | 100.0 | 100.0 | 100.0 | 97.6  | 100.0 | 82.0  | 100.0 | 100.0 | 84.5   |
| <b>LF (%)</b>   | 104.0 | 25.9  | 7.9  | 99.6  | 99.6  | 97.5  | 97.1  | 94.1  | 98.0  | 82.1  | 100.4 | 101.0 | 84.1   |
| <b>OF (%)</b>   | 100.0 | 25.0  | 11.4 | 100.1 | 100.0 | 100.0 | 100.0 | 98.5  | 100.0 | 81.6  | 100.0 | 100.0 | 84.9   |
| <b>EUF (%)</b>  | 0.0   | 75.1  | 91.9 | 0.3   | 0.0   | 0.0   | 0.0   | 2.5   | 0.0   | 18.0  | 0.0   | 0.0   | 15.5   |
| <b>PUF (%)</b>  | 0.0   | 75.1  | 84.2 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 7.7  | 0.4   | 0.0   | 0.0   | 0.0   | 2.5   | 0.0   | 18.0  | 0.0   | 0.0   | 2.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

FULL POWER DURING 2004.

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1970      **Lifetime Generation:** 191646.4 GW(e).h  
**Date of First Criticality:** 21 Feb 1975      **Cumulative Energy Availability Factor:** 83.0%  
**Date of Grid Connection:** 07 Mar 1975      **Cumulative Load Factor:** 82.6%  
**Date of Commercial Operation:** 01 Oct 1975      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 17.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5843.0         | 870.0          | 76.6   | 92.3   | 76.6                              | 76.1   | 76.7               | 76.0   | 7135               | 81.4   |
| 1984 | 6374.0         | 870.0          | 83.4   | 91.3   | 83.4                              | 76.9   | 83.4               | 76.8   | 7774               | 88.5   |
| 1985 | 5979.0         | 870.0          | 90.8   | 91.3   | 81.1                              | 77.3   | 78.5               | 77.0   | 8077               | 92.2   |
| 1986 | 4005.0         | 870.0          | 59.1   | 88.3   | 54.8                              | 75.3   | 52.6               | 74.8   | 5429               | 62.0   |
| 1987 | 7337.0         | 870.0          | 98.5   | 89.2   | 97.6                              | 77.1   | 96.3               | 76.6   | 8733               | 99.7   |
| 1988 | 6310.0         | 870.0          | 84.9   | 88.8   | 83.9                              | 77.6   | 82.6               | 77.0   | 7520               | 85.6   |
| 1989 | 6508.0         | 870.0          | 88.4   | 88.8   | 87.9                              | 78.4   | 85.4               | 77.6   | 7854               | 89.7   |
| 1990 | 6683.0         | 870.0          | 90.8   | 89.0   | 88.4                              | 79.0   | 87.7               | 78.3   | 8082               | 92.3   |
| 1991 | 6163.0         | 870.0          | 86.7   | 88.8   | 81.0                              | 79.2   | 80.9               | 78.5   | 7714               | 88.1   |
| 1992 | 6059.0         | 870.0          | 80.5   | 88.3   | 79.1                              | 79.2   | 79.3               | 78.5   | 7807               | 88.9   |
| 1993 | 7317.0         | 870.0          | 99.8   | 89.0   | 96.4                              | 80.1   | 96.0               | 79.5   | 8459               | 96.6   |
| 1994 | 6737.0         | 863.0          | 90.7   | 89.0   | 90.0                              | 80.6   | 89.1               | 80.0   | 8018               | 91.5   |
| 1995 | 5442.0         | 882.0          | 72.9   | 88.2   | 69.9                              | 80.1   | 70.4               | 79.5   | 6488               | 74.1   |
| 1996 | 7210.7         | 931.0          | 88.4   | 88.2   | 88.2                              | 80.5   | 88.2               | 79.9   | 7823               | 89.1   |
| 1997 | 7942.6         | 962.0          | 95.5   | 88.6   | 94.3                              | 81.2   | 94.3               | 80.7   | 8385               | 95.7   |
| 1998 | 7264.0         | 962.0          | 87.4   | 88.5   | 86.3                              | 81.4   | 86.2               | 80.9   | 7777               | 88.8   |
| 1999 | 7272.0         | 962.0          | 86.9   | 88.5   | 85.5                              | 81.6   | 86.3               | 81.2   | 7905               | 90.2   |
| 2000 | 8457.0         | 962.0          | 99.3   | 88.9   | 99.3                              | 82.4   | 100.1              | 82.0   | 8782               | 100.0  |
| 2001 | 6969.0         | 962.0          | 91.2   | 89.0   | 82.5                              | 82.4   | 82.7               | 82.0   | 7481               | 85.4   |
| 2002 | 7047.2         | 962.0          | 86.0   | 88.9   | 83.9                              | 82.4   | 83.6               | 82.1   | 7631               | 87.1   |
| 2003 | 7990.4         | 962.0          | 95.5   | 89.2   | 95.1                              | 82.9   | 94.8               | 82.6   | 8552               | 97.6   |
| 2004 | 7106.5         | 962.0          | 84.5   | 89.0   | 84.5                              | 83.0   | 84.1               | 82.6   | 7456               | 84.9   |

## BE-3 TIHANGE-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 08 Feb | 521.0 | 503.2   | PF   | C    | REFUELLING   |
| 01 Mar | 600.0 | 577.2   | PF   | C    | REFUELLING   |
| 26 Mar | 57.0  | 54.4    | UF3  | Z    | EXTENSION OF THE REFUELLING OUTAGE   |
| 28 Mar | 62.0  | 25.8    | PP   | C    | POWER RISE AFTER PLANNED OUTAGE FOR INSPECTION, MAINTENANCE AND REPAIR COMBINED WITH REFUELLING. |
| 14 Aug | 16.0  | 15.2    | UF4  | A35  | REACTOR SCRAM BY LOW LEVEL OF STEAM GENERATOR 2.   |
| 12 Oct | 134.0 | 128.8   | UF4  | A32  | REACTOR SCRAM BY LOW LEVEL OF SG 3 (DUE TO FEEDWATERPUMP COMMAND SYSTEM FAILURE).                |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 150       |          |  | 96        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1121            |           |          | 834                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 13                                       |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 10       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 5         | 95       |
| L. Human factor related  |                 |           |          |  | 1         |          |
| Z. Others  |                 | 57        |          |  |           |          |
| Subtotal   | 1121            | 207       | 0        | 847                                      | 102       | 105      |
| Total  |                 | 1328      |          |  | 1054      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 10                                       |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 30                                       |
| 16. Steam generation systems        |                 | 16                                       |
| 31. Turbine and auxiliaries         |                 | 14                                       |
| 32. Feedwater and Main Steam System | 134             | 7  |
| 33. Circulating Water System        |                 | 1  |
| 35. All other I&C Systems           | 16              |  |
| 42. Electrical Power Supply Systems |                 | 12                                       |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 150             | 93                                       |

**BE-6 TIHANGE-2**

**Operator:** ELECTRAB (ELECTRABEL M. V. NUCLEAIRE PRODUKTIE)  
**Contractor:** FRAMACEC (FRAMACECO ( FRAMATOME-ACEC-COCKERILL ))

**1. Station Details**

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1008.0 MW(e)  
**Design Net RUP:** 902.0 MW(e)  
**Design Discharge Burnup:** 33700 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 8517.3 GW(e).h  
**Energy Availability Factor:** 96.0%  
**Load Factor:** 96.2%  
**Operating Factor:** 96.5%  
**Energy Unavailability Factor:** 4.0%  
**Total Off-line Time:** 306 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 766.4 | 716.5 | 761.8 | 727.6 | 433.0 | 708.9 | 733.8 | 723.3 | 714.1 | 747.6 | 726.5 | 757.8 | 8517.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 99.9  | 57.8  | 99.5  | 99.4  | 98.1  | 99.3  | 99.7  | 99.4  | 99.9  | 96.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 58.1  | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 99.9  | 96.4   |
| <b>LF (%)</b>   | 102.2 | 102.1 | 101.6 | 100.4 | 57.7  | 97.7  | 97.8  | 96.4  | 98.4  | 99.5  | 100.1 | 101.0 | 96.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 58.9  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 96.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 42.2  | 0.5   | 0.6   | 1.9   | 0.7   | 0.3   | 0.6   | 0.1   | 4.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 42.0  | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 3.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 0.2   | 0.5   | 0.6   | 1.9   | 0.6   | 0.3   | 0.6   | 0.0   | 0.4    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

FULL POWER DURING 2004

**5. Historical Summary**

**Date of Construction Start:** 01 Apr 1976      **Lifetime Generation:** 155413.7 GW(e).h  
**Date of First Criticality:** 05 Oct 1982      **Cumulative Energy Availability Factor:** 87.4%  
**Date of Grid Connection:** 13 Oct 1982      **Cumulative Load Factor:** 87.2%  
**Date of Commercial Operation:** 01 Jul 1983      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 12.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5507.0         | 901.0          | 0.0  | 0.0    | 69.8                              | 100.0  | 69.8               | 0.0    | 6373               | 72.8   |
| 1984 | 6856.0         | 901.0          | 86.4   | 86.4   | 86.4                              | 86.4   | 86.6               | 86.6   | 7693               | 87.6   |
| 1985 | 6636.0         | 900.0          | 89.4   | 87.9   | 87.8                              | 87.1   | 84.2               | 85.4   | 7890               | 90.1   |
| 1986 | 6189.0         | 900.0          | 85.0   | 86.9   | 83.1                              | 85.7   | 78.5               | 83.1   | 7509               | 85.7   |
| 1987 | 6584.0         | 900.0          | 84.3   | 86.3   | 83.4                              | 85.2   | 83.5               | 83.2   | 7477               | 85.4   |
| 1988 | 6966.0         | 900.0          | 89.9   | 87.0   | 87.9                              | 85.7   | 88.1               | 84.2   | 7992               | 91.0   |
| 1989 | 6663.0         | 901.0          | 86.0   | 86.8   | 84.7                              | 85.6   | 84.4               | 84.2   | 7728               | 88.2   |
| 1990 | 6919.0         | 901.0          | 88.5   | 87.1   | 88.0                              | 85.9   | 87.7               | 84.7   | 7827               | 89.3   |
| 1991 | 6850.0         | 901.0          | 88.4   | 87.2   | 87.7                              | 86.1   | 86.8               | 85.0   | 7790               | 88.9   |
| 1992 | 6746.0         | 901.0          | 89.7   | 87.5   | 86.9                              | 86.2   | 85.2               | 85.0   | 7912               | 90.1   |
| 1993 | 6555.0         | 901.0          | 86.4   | 87.4   | 83.6                              | 86.0   | 83.1               | 84.8   | 7507               | 85.7   |
| 1994 | 7585.0         | 894.0          | 98.3   | 88.4   | 96.7                              | 86.9   | 96.9               | 85.9   | 8501               | 97.0   |
| 1995 | 6849.0         | 921.0          | 90.2   | 88.5   | 85.0                              | 86.8   | 84.9               | 85.8   | 7697               | 87.9   |
| 1996 | 7253.0         | 943.0          | 88.6   | 88.5   | 87.0                              | 86.8   | 87.6               | 86.0   | 7810               | 88.9   |
| 1997 | 6854.0         | 960.0          | 82.3   | 88.1   | 81.3                              | 86.4   | 81.5               | 85.6   | 7241               | 82.7   |
| 1998 | 7664.0         | 960.0          | 91.0   | 88.3   | 90.6                              | 86.7   | 91.1               | 86.0   | 8015               | 91.5   |
| 1999 | 8111.0         | 960.0          | 95.5   | 88.8   | 95.5                              | 87.2   | 96.4               | 86.7   | 8380               | 95.7   |
| 2000 | 7481.0         | 960.0          | 89.4   | 88.8   | 88.0                              | 87.3   | 88.7               | 86.8   | 7901               | 89.9   |
| 2001 | 6976.0         | 960.0          | 80.8   | 88.3   | 80.7                              | 86.9   | 83.0               | 86.6   | 7137               | 81.5   |
| 2002 | 7833.4         | 1008.0         | 89.0   | 88.4   | 87.9                              | 87.0   | 88.7               | 86.7   | 7821               | 89.3   |
| 2003 | 7601.0         | 1008.0         | 86.3   | 88.3   | 85.6                              | 86.9   | 86.1               | 86.7   | 7589               | 86.6   |
| 2004 | 8517.3         | 1008.0         | 96.4   | 88.7   | 96.0                              | 87.4   | 96.2               | 87.2   | 8478               | 96.5   |

## BE-6 TIHANGE-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                              |
|--------|-------|---------|------|------|--|
| 12 May | 306.0 | 309.1   | UF   | A42  | LOST OF MAIN TRANSFORMER DURING 12 DAYS. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 306       |          |   | 113       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 732   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 100   |           |          |
| E. Testing of plant systems or components  |                 |           |          |   | 3         |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |   |           | 18       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 17  | 32        |          |
| Subtotal   | 0               | 306       | 0        | 849   | 164       | 18       |
| Total  |                 | 306       |          |   | 1031      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1983 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 6   |
| 12. Reactor I&C Systems             |                    | 7   |
| 14. Safety Systems                  |                    | 2   |
| 15. Reactor Cooling Systems         |                    | 18  |
| 16. Steam generation systems        |                    | 33  |
| 31. Turbine and auxiliaries         |                    | 11  |
| 32. Feedwater and Main Steam System |                    | 9   |
| 41. Main Generator Systems          |                    | 2   |
| 42. Electrical Power Supply Systems | 306                | 0   |
| Total                               | 306                | 88  |

# BE-8 TIHANGE-3

**Operator:** ELECTRAB (ELECTRABEL M. V. NUCLEAIRE PRODUKTIE)  
**Contractor:** ACECOWEN (ACECOWEN ( ACEC-COCKERILL-WESTINGHOUSE ))

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1015.0 MW(e)  
**Design Net RUP:** 1006.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7936.4 GW(e).h  
**Energy Availability Factor:** 89.2%  
**Load Factor:** 89.0%  
**Operating Factor:** 90.7%  
**Energy Unavailability Factor:** 10.8%  
**Total Off-line Time:** 815 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 755.1 | 713.7 | 760.4 | 734.5 | 749.5 | 718.1 | 729.5 | 723.0 | 536.7 | 55.0 | 720.6 | 740.3 | 7936.4 |
| <b>EAF (%)</b>  | 98.9  | 99.7  | 99.6  | 99.9  | 99.1  | 99.8  | 98.6  | 98.4  | 73.4  | 7.3  | 98.7  | 97.8  | 89.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.1  | 7.3  | 99.7  | 99.0  | 90.4   |
| <b>LF (%)</b>   | 100.0 | 101.0 | 100.7 | 100.6 | 99.2  | 98.3  | 96.6  | 95.7  | 73.4  | 7.3  | 98.6  | 98.0  | 89.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 80.6  | 9.9  | 100.0 | 99.3  | 90.7   |
| <b>EUF (%)</b>  | 1.1   | 0.3   | 0.4   | 0.1   | 0.9   | 0.2   | 1.4   | 1.6   | 26.6  | 92.7 | 1.3   | 2.2   | 10.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 19.9  | 92.7 | 0.0   | 0.0   | 9.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.3   | 1.0   | 0.1    |
| <b>XUF (%)</b>  | 1.1   | 0.3   | 0.4   | 0.1   | 0.9   | 0.2   | 1.4   | 1.6   | 6.6   | 0.0  | 0.9   | 1.2   | 1.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

FULL POWER DURING 2004

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1978      **Lifetime Generation:** 147671.4 GW(e).h  
**Date of First Criticality:** 05 Jun 1985      **Cumulative Energy Availability Factor:** 87.4%  
**Date of Grid Connection:** 15 Jun 1985      **Cumulative Load Factor:** 87.2%  
**Date of Commercial Operation:** 01 Sep 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 12.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 7558.0         | 1020.0         | 86.5   | 86.5   | 85.6                              | 85.6   | 84.6               | 84.6   | 7733               | 88.3   |
| 1987 | 7829.0         | 1020.0         | 89.0   | 87.8   | 87.3                              | 86.4   | 87.6               | 86.1   | 7872               | 89.9   |
| 1988 | 7623.0         | 1020.0         | 87.4   | 87.6   | 85.0                              | 86.0   | 85.1               | 85.8   | 7773               | 88.5   |
| 1989 | 7749.0         | 1020.0         | 87.5   | 87.6   | 87.0                              | 86.2   | 86.7               | 86.0   | 7790               | 88.9   |
| 1990 | 7794.0         | 1020.0         | 90.0   | 88.1   | 87.1                              | 86.4   | 87.2               | 86.2   | 7924               | 90.5   |
| 1991 | 7649.0         | 1020.0         | 88.3   | 88.1   | 86.2                              | 86.4   | 85.6               | 86.1   | 7903               | 90.2   |
| 1992 | 8335.0         | 1020.0         | 93.4   | 88.9   | 93.3                              | 87.4   | 93.0               | 87.1   | 8246               | 93.9   |
| 1993 | 7748.0         | 1020.0         | 89.5   | 89.0   | 88.1                              | 87.4   | 86.7               | 87.1   | 7874               | 89.9   |
| 1994 | 7480.0         | 1015.0         | 86.8   | 88.7   | 84.7                              | 87.1   | 84.1               | 86.7   | 7666               | 87.5   |
| 1995 | 7559.0         | 1015.0         | 86.7   | 88.5   | 84.7                              | 86.9   | 85.0               | 86.6   | 7632               | 87.1   |
| 1996 | 7189.0         | 1015.0         | 81.1   | 87.8   | 81.1                              | 86.4   | 80.6               | 86.0   | 7142               | 81.3   |
| 1997 | 8357.0         | 1015.0         | 99.2   | 88.8   | 94.4                              | 87.0   | 94.0               | 86.7   | 8342               | 95.2   |
| 1998 | 6738.0         | 1015.0         | 77.9   | 87.9   | 75.9                              | 86.2   | 75.8               | 85.9   | 6903               | 78.8   |
| 1999 | 8799.0         | 1015.0         | 99.1   | 88.7   | 98.9                              | 87.1   | 99.0               | 86.8   | 8686               | 99.2   |
| 2000 | 7597.0         | 1015.0         | 86.4   | 88.6   | 84.9                              | 86.9   | 85.2               | 86.7   | 7656               | 87.2   |
| 2001 | 7729.0         | 1015.0         | 89.9   | 88.7   | 86.5                              | 86.9   | 86.9               | 86.7   | 7929               | 90.5   |
| 2002 | 8340.5         | 1015.0         | 95.7   | 89.1   | 93.7                              | 87.3   | 93.8               | 87.1   | 8368               | 95.5   |
| 2003 | 7661.5         | 1015.0         | 89.4   | 89.1   | 86.5                              | 87.3   | 86.2               | 87.1   | 7846               | 89.6   |
| 2004 | 7936.4         | 1015.0         | 90.4   | 89.2   | 89.2                              | 87.4   | 89.0               | 87.2   | 7969               | 90.7   |



## BE-8 TIHANGE-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Sep | 576.0 | 48.5    | XP   | S    | STRETCH-OUT BEFORE SHUT DOWN FOR MAINTENANCE AND REFUELLING. |
| 25 Sep | 144.0 | 145.6   | PF   | C    | SHUT DOWN FOR INSPECTION, MAINTENANCE AND REFUELLING.        |
| 01 Oct | 670.0 | 701.0   | PF   | C    | SHUT DOWN FOR INSPECTION, MAINTENANCE AND REFUELLING.        |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 143       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 814             |           |          | 652   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 6   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1   |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          | 28  |           | 20       |
| H. Nuclear regulatory requirements   |                 |           |          |   | 2         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 7   |           |          |
| Subtotal   | 814             | 0         | 0        | 694   | 150       | 20       |
| Total  |                 | 814       |          |   | 864       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 7   |
| 15. Reactor Cooling Systems         |                    | 22  |
| 16. Steam generation systems        |                    | 55  |
| 31. Turbine and auxiliaries         |                    | 36  |
| 32. Feedwater and Main Steam System |                    | 2   |
| 33. Circulating Water System        |                    | 11  |
| 41. Main Generator Systems          |                    | 2   |
| 42. Electrical Power Supply Systems |                    | 3   |
| Total                               | 0                  | 138   |

**BR-1 ANGRA-1**

Operator: ELETRONU (ELETROBRAS TERMONUCLEAR SA - ELETRONUCLEAR)

Contractor: WEST (WESTINGHOUSE ELECTRIC CORPORATION)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 626.0 MW(e)  
 Design Net RUP: 626.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 3890.2 GW(e).h  
 Energy Availability Factor: 70.7%  
 Load Factor: 70.7%  
 Operating Factor: 90.7%  
 Energy Unavailability Factor: 29.3%  
 Total Off-line Time: 816 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 364.3 | 333.5 | 363.9 | 343.6 | 364.3 | 352.4 | 105.0 | 230.5 | 352.3 | 364.4 | 352.0 | 364.0 | 3890.2 |
| EAF (%)  | 78.2  | 76.5  | 78.1  | 76.2  | 78.2  | 78.2  | 22.5  | 49.5  | 78.2  | 78.2  | 78.1  | 78.2  | 70.7   |
| UCF (%)  | 78.2  | 76.5  | 78.1  | 76.2  | 78.2  | 78.2  | 22.5  | 49.5  | 78.2  | 78.2  | 78.1  | 78.2  | 70.8   |
| LF (%)   | 78.2  | 76.5  | 78.1  | 76.2  | 78.2  | 78.2  | 22.5  | 49.5  | 78.2  | 78.2  | 78.1  | 78.2  | 70.7   |
| OF (%)   | 100.0 | 98.6  | 100.0 | 98.3  | 100.0 | 100.0 | 29.0  | 64.2  | 100.0 | 100.0 | 100.0 | 100.0 | 90.7   |
| EUF (%)  | 21.8  | 23.5  | 21.9  | 23.8  | 21.8  | 21.8  | 77.5  | 50.5  | 21.8  | 21.8  | 21.9  | 21.8  | 29.3   |
| PUF (%)  | 21.8  | 22.0  | 21.9  | 22.1  | 21.8  | 21.8  | 77.5  | 50.5  | 21.8  | 21.8  | 21.9  | 21.8  | 29.0   |
| UCLF (%) | 0.0   | 1.4   | 0.0   | 1.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 May 1971      Lifetime Generation: 45465.7 GW(e).h  
 Date of First Criticality: 13 Mar 1982      Cumulative Energy Availability Factor: 49.8%  
 Date of Grid Connection: 01 Apr 1982      Cumulative Load Factor: 39.8%  
 Date of Commercial Operation: 01 Jan 1985      Cumulative Unit Capability Factor: 78.1%  
    Cumulative Energy Unavailability Factor: 50.2%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 162.5             | 626.0             | 0.0  | 0.0    | 3.0                                  | 100.0  | 3.0                | 0.0    | 1127                  | 12.9   |
| 1984 | 1545.5            | 626.0             | 0.0  | 0.0    | 28.1                                 | 100.0  | 28.1               | 0.0    | 3771                  | 42.9   |
| 1985 | 3169.4            | 626.0             | 57.8   | 57.8   | 57.8                                 | 57.8   | 57.8               | 57.8   | 6847                  | 78.2   |
| 1986 | 132.4             | 626.0             | 3.7  | 30.8   | 3.7                                  | 30.7   | 2.4                | 30.1   | 512                   | 5.8    |
| 1987 | 910.6             | 626.0             | 19.7   | 27.1   | 19.7                                 | 27.1   | 16.6               | 25.6   | 1958                  | 22.4   |
| 1988 | 566.6             | 626.0             | 18.5   | 24.9   | 18.5                                 | 24.9   | 10.3               | 21.8   | 1488                  | 16.9   |
| 1989 | 1695.1            | 626.0             | 61.8   | 32.3   | 61.3                                 | 32.2   | 30.9               | 23.6   | 5362                  | 61.2   |
| 1990 | 2055.3            | 626.0             | 86.1   | 41.3   | 82.5                                 | 40.6   | 37.5               | 25.9   | 7400                  | 84.5   |
| 1991 | 1306.4            | 626.0             | 57.2   | 43.5   | 57.2                                 | 43.0   | 23.8               | 25.6   | 5046                  | 57.6   |
| 1992 | 1506.4            | 626.0             | 47.9   | 44.1   | 47.9                                 | 43.6   | 27.4               | 25.8   | 4275                  | 48.7   |
| 1993 | 402.7             | 626.0             | 17.2   | 41.1   | 17.2                                 | 40.6   | 7.3                | 23.8   | 1524                  | 17.4   |
| 1994 | 41.5              | 626.0             | 83.8   | 45.4   | 3.5                                  | 36.9   | 0.8                | 21.5   | 305                   | 3.5    |
| 1995 | 2333.6            | 626.0             | 92.8   | 49.7   | 42.6                                 | 37.4   | 42.6               | 23.4   | 8127                  | 92.8   |
| 1996 | 2288.8            | 626.0             | 67.0   | 51.1   | 55.2                                 | 38.9   | 41.6               | 24.9   | 5063                  | 57.6   |
| 1997 | 2990.0            | 626.0             | 60.6   | 51.9   | 53.2                                 | 40.0   | 54.5               | 27.2   | 6219                  | 71.0   |
| 1998 | 3093.8            | 626.0             | 56.4   | 52.2   | 56.4                                 | 41.2   | 56.4               | 29.3   | 6976                  | 79.6   |
| 1999 | 3631.7            | 626.0             | 65.2   | 53.0   | 64.8                                 | 42.8   | 66.2               | 31.7   | 8429                  | 96.2   |
| 2000 | 3164.9            | 626.0             | 58.7   | 53.4   | 58.7                                 | 43.8   | 57.6               | 33.4   | 6514                  | 74.2   |
| 2001 | 3614.4            | 626.0             | 82.9   | 55.1   | 82.9                                 | 46.1   | 65.9               | 35.3   | 7295                  | 83.3   |
| 2002 | 3775.2            | 626.0             | 87.7   | 56.9   | 85.9                                 | 48.3   | 68.8               | 37.1   | 7595                  | 86.7   |
| 2003 | 3137.1            | 626.0             | 74.5   | 57.9   | 57.2                                 | 48.7   | 57.2               | 38.2   | 6551                  | 74.8   |
| 2004 | 3890.2            | 626.0             | 70.8   | 58.5   | 70.7                                 | 49.8   | 70.7               | 39.8   | 7968                  | 90.7   |

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## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 744.0 | 101.5   | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 01 Feb | 686.0 | 96.0    | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 19 Feb | 10.0  | 6.3     | UF4  | L14  | DURING THE SURVEILLANCE OF THE CONTAINMENT PRESSURE CHANNEL (PI-I 022), OCCURED THE ACTUATION OF THE SAFETY INJECTION DUE THE HIGH-PRESSURE SIGNAL (HI-1) CAUSED BY THE INTERFERENCE OF RADIOTRANSMITTER, IMPROPERLY USED NEXT TO THE PRESSURE TRANSMITTERS OF THE CONTAINMENT. |
| 01 Mar | 744.0 | 101.8   | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 01 Apr | 708.0 | 99.6    | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 30 Apr | 12.0  | 7.5     | UF4  | A32  | DURING THE NORMALIZATION OF THE AIR OF THE HV-1301 (FEEDWATER VALVE CONTROL) AFTER MAINTENANCE, OCCURRED THE CLOSING OF THE VALVE AND REATOR TRIP BY STEAM GENERATOR NUMBER 2 LOW LEVEL SIGNAL.   |
| 01 May | 744.0 | 101.5   | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 01 Jun | 720.0 | 98.3    | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 01 Jul | 216.0 | 30.3    | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 10 Jul | 528.0 | 330.5   | PF   | D16  | THE PLANT INITIATED THE ANNUAL PLANNED OUTAGE ON JUL, 10 AT 00:07. (OUTAGE 1P-12A).   |
| 01 Aug | 266.2 | 166.6   | PF   | D16  | THE PLANT INITIATED THE ANNUAL PLANNED OUTAGE ON JUL, 10 AT 00:07. (OUTAGE 1P-12A).   |
| 12 Aug | 477.8 | 68.6    | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 01 Sep | 720.0 | 98.4    | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 01 Oct | 744.0 | 101.4   | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 01 Nov | 710.0 | 97.4    | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |
| 20 Nov | 10.0  | 1.4     | PP   | E31  | TEST OF THE GOVERNING VALVES OF THE TURBINE   |
| 01 Dec | 744.0 | 101.7   | PP   | Z16  | TO EXTEND THE STEAM GENERATOR LIFE. MANAGEMENT DECISION.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 12        |          |  | 1654      | 0        |
| B. Refuelling without a maintenance  |                 |           |          | 44                                       | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1027                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 794             |           |          | 184                                      | 13        |          |
| E. Testing of plant systems or components  |                 |           |          | 81                                       | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 64                                       | 0         | 12       |
| J. Grid failure or grid unavailability   |                 |           |          |  | 6         | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 29        | 14       |
| L. Human factor related  |                 | 10        |          |  |           | 358      |
| Subtotal   | 794             | 22        | 0        | 1400                                     | 1708      | 387      |
| Total  |                 | 816       |          |  | 3495      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 33                                       |
| 13. Reactor Auxiliary Systems            |                 | 106                                      |
| 15. Reactor Cooling Systems              |                 | 6  |
| 16. Steam generation systems             |                 | 37                                       |
| 21. Fuel Handling and Storage Facilities |                 | 375                                      |
| 31. Turbine and auxiliaries              |                 | 130                                      |
| 32. Feedwater and Main Steam System      | 12              | 63                                       |
| 33. Circulating Water System             |                 | 9  |
| 41. Main Generator Systems               |                 | 532                                      |
| 42. Electrical Power Supply Systems      |                 | 297                                      |
| Total                                    | 12              | 1588                                     |

## BR-2 ANGRA-2

**Operator:** ELETRONU (ELETROBRAS TERMONUCLEAR SA - ELETRONUCLEAR)

**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1275.0 MW(e)  
**Design Net RUP:** 1245.0 MW(e)  
**Design Discharge Burnup:** 34000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6919.8 GW(e).h  
**Energy Availability Factor:** 72.8%  
**Load Factor:** 61.8%  
**Operating Factor:** 74.0%  
**Energy Unavailability Factor:** 27.2%  
**Total Off-line Time:** 2287 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 914.9 | 733.5 | 296.9 | 492.9 | 288.0 | 478.7 | 720.5 | 751.4 | 892.2 | 669.2 | 681.6 | 0.0   | 6919.8 |
| <b>EAF (%)</b>  | 96.5  | 94.2  | 39.9  | 70.0  | 35.5  | 60.0  | 93.5  | 93.5  | 100.0 | 95.9  | 96.7  | 0.0   | 72.8   |
| <b>UCF (%)</b>  | 96.5  | 94.2  | 39.9  | 70.0  | 35.5  | 60.0  | 93.6  | 93.6  | 100.0 | 95.9  | 96.7  | 0.0   | 72.8   |
| <b>LF (%)</b>   | 96.4  | 82.7  | 31.3  | 53.7  | 30.4  | 52.1  | 75.9  | 79.2  | 97.2  | 70.5  | 74.2  | 0.0   | 61.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 45.2  | 70.0  | 35.5  | 60.0  | 93.5  | 93.5  | 100.0 | 95.8  | 96.7  | 0.0   | 74.0   |
| <b>EUF (%)</b>  | 3.5   | 5.8   | 60.1  | 30.0  | 64.5  | 40.0  | 6.5   | 6.5   | 0.0   | 4.1   | 3.3   | 100.0 | 27.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 64.5  | 40.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.7    |
| <b>UCLF (%)</b> | 3.5   | 5.8   | 60.1  | 30.0  | 0.0   | 0.0   | 6.5   | 6.5   | 0.0   | 4.1   | 3.3   | 100.0 | 18.5   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Jan 1976  
**Date of First Criticality:** 14 Jul 2000  
**Date of Grid Connection:** 21 Jul 2000  
**Date of Commercial Operation:** 01 Feb 2001

**Lifetime Generation:** 37903.2 GW(e).h  
**Cumulative Energy Availability Factor:** 80.1%  
**Cumulative Load Factor:** 76.3%  
**Cumulative Unit Capability Factor:** 83.5%  
**Cumulative Energy Unavailability Factor:** 19.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2000 | 2421.2         | 1350.0         | 0.0  | 0.0    | 79.6                              | 100.0  | 45.8               | 0.0    | 2914               | 74.5   |
| 2001 | 9905.0         | 1350.0         | 0.0  | 0.0    | 92.1                              | 100.0  | 83.8               | 0.0    | 8315               | 94.9   |
| 2002 | 9238.2         | 1275.0         | 91.3   | 91.3   | 83.3                              | 83.3   | 82.7               | 82.7   | 8060               | 92.0   |
| 2003 | 9419.0         | 1275.0         | 91.0   | 91.1   | 84.3                              | 83.8   | 84.3               | 83.5   | 8019               | 91.5   |
| 2004 | 6919.8         | 1275.0         | 72.8   | 85.0   | 72.8                              | 80.1   | 61.8               | 76.3   | 6497               | 74.0   |

## BR-2 ANGRA-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 13.6  | 17.3    | UP1  | Z42  | EXTRA INTERNAL CONSUMPTION   |
| 12 Jan | 10.1  | 12.8    | UP1  | A31  | LOSS OF THE CONDENSER N. 6   |
| 26 Jan | 68.5  | 0.0     | XP2  | K42  | PLANT OPERATION AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 29 Jan | 2.7   | 3.4     | UP1  | A33  | LOSS OF THE CIRCULATING WATER PUMP   |
| 02 Feb | 27.3  | 34.8    | UP2  | A33  | LOSS OF THE CIRCULATING WATER PUMP PAC40AP001                                  |
| 08 Feb | 12.9  | 16.5    | UP2  | A33  | LOSS OF THE CIRCULATING WATER PUMP PAC20AP001                                  |
| 14 Feb | 85.6  | 109.2   | XP2  | K42  | PLANT OPERATING AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 01 Mar | 64.1  | 81.7    | XP2  | K42  | PLANT OPERATION AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 13 Mar | 39.1  | 49.8    | UP2  | A13  | FAILURE CHECK VALVE OF THE RESIDUAL HEAT REMOVAL JNA42AA002                    |
| 15 Mar | 408.0 | 520.2   | UF5  | A13  | FAILURE CHECK VALVE OF THE RESIDUAL HEAT REMOVAL JNA42AA002                    |
| 01 Apr | 216.0 | 275.4   | UF5  | A13  | FAILURE CHECK VALVE OF THE RESIDUAL HEAT REMOVAL JNA42AA002                    |
| 11 Apr | 480.0 | 122.4   | XP2  | K42  | PLANT RETURNED AT GRID IN APRIL, 10. PLANT OPERATED AT 11 TO 30, APRIL AT 80%. |
| 01 May | 264.0 | 81.1    | XP2  | K42  | PLANT OPERATION AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 12 May | 480.0 | 612.0   | PF   | C    | PLANNED OUTAGE   |
| 01 Jun | 288.0 | 368.5   | PF   | C    | PLANNED OUTAGE   |
| 15 Jun | 384.0 | 97.9    | XP2  | K42  | PLANT OPERATION AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 01 Jul | 672.0 | 186.1   | XP2  | K42  | PLANT OPERATION AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 29 Jul | 48.0  | 61.2    | UF2  | A42  | MAIN TRANSFORMER FAILED  |
| 01 Aug | 48.0  | 61.2    | UF2  | A42  | MAIN TRANSFORMER FAILED  |
| 02 Aug | 696.0 | 163.3   | XP2  | K42  | PLANT OPERATION AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 27 Sep | 96.0  | 24.0    | XP2  | K42  | PLANT OPERATING AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 01 Oct | 713.0 | 160.7   | XP2  | K42  | PLANT OPERATING AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 05 Oct | 31.0  | 39.3    | UF4  | A15  | TRIP OF THE REACTOR COOLING PUMP   |
| 01 Nov | 696.0 | 134.8   | XP2  | K42  | PLANT OPERATING AT LOAD REDUCTION LOAD DISPATCH REQUIRED                       |
| 30 Nov | 24.0  | 30.6    | UF1  | A41  | MOISTURE IN GENERATOR  |
| 01 Dec | 744.0 | 948.6   | UF1  | A41  | MOISTURE IN GENERATOR  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2000 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 1519      |          |  | 44        |          |
| C. Inspection, maintenance or repair combined with refuelling | 768             |           |          | 257                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 225                                      |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 11                                       |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |  |           | 6        |
| Subtotal  | 768             | 1519      | 0        | 493                                      | 44        | 6        |
| Total   |                 | 2287      |          |  | 543       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2000 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 13. Reactor Auxiliary Systems       | 624             |  |
| 15. Reactor Cooling Systems         | 31              | 0  |
| 16. Steam generation systems        |                 | 1  |
| 31. Turbine and auxiliaries         |                 | 2  |
| 41. Main Generator Systems          | 768             | 1  |
| 42. Electrical Power Supply Systems | 96              | 38                                       |
| Total                               | 1519            | 42                                       |

# BG-3 KOZLODUY-3

**Operator:** KOZNPP (KOZLODUY NPP-plc)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 408.0 MW(e)  
**Design Net RUP:** 408.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2531.0 GW(e).h  
**Energy Availability Factor:** 81.2%  
**Load Factor:** 70.6%  
**Operating Factor:** 81.5%  
**Energy Unavailability Factor:** 18.8%  
**Total Off-line Time:** 1624 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 311.1 | 172.1 | 243.9 | 299.3 | 304.2 | 208.6 | 1.1  | 14.3 | 105.6 | 295.7 | 289.3 | 285.8 | 2531.0 |
| <b>EAF (%)</b>  | 99.8  | 100.0 | 98.0  | 100.0 | 100.0 | 100.0 | 1.6  | 10.7 | 70.7  | 99.8  | 99.2  | 97.7  | 81.2   |
| <b>UCF (%)</b>  | 99.8  | 100.0 | 98.0  | 100.0 | 100.0 | 100.0 | 1.6  | 10.7 | 70.7  | 99.8  | 99.2  | 97.7  | 81.2   |
| <b>LF (%)</b>   | 102.5 | 60.6  | 80.4  | 102.0 | 100.2 | 71.0  | 0.4  | 4.7  | 36.0  | 97.3  | 98.5  | 94.2  | 70.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 98.0  | 100.1 | 100.0 | 100.0 | 3.6  | 10.1 | 70.6  | 100.0 | 100.0 | 98.4  | 81.5   |
| <b>EUF (%)</b>  | 0.2   | 0.0   | 2.0   | 0.0   | 0.0   | 0.0   | 98.4 | 89.3 | 29.3  | 0.2   | 0.8   | 2.3   | 18.8   |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 98.4 | 89.3 | 29.3  | 0.2   | 0.8   | 0.5   | 18.4   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 2.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 1.8   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

- OPERATION IN BASE-LOAD MODE, N=100% NOM IN ACCORDANCE WITH THE SHEDULE- PLANNED POWER REDUCTION FROM N=100% DOWN TO N=85%N NOM FOR REPAIR OF LEAKAGES IN MOISTURE SEPARATOR/REHEATED-II

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1973      **Lifetime Generation:** GW(e).h  
**Date of First Criticality:** 04 Dec 1980      **Cumulative Energy Availability Factor:** 74.4%  
**Date of Grid Connection:** 17 Dec 1980      **Cumulative Load Factor:** 66.0%  
**Date of Commercial Operation:** 20 Jan 1981      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 25.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 3204.8         | 408.0          | 94.2   | 89.2   | 94.2                              | 89.2   | 89.7               | 81.9   | 8253               | 94.2   |
| 1986 | 2688.1         | 408.0          | 77.4   | 87.3   | 77.4                              | 87.3   | 75.2               | 80.8   | 8173               | 93.3   |
| 1987 | 2752.6         | 408.0          | 82.6   | 86.6   | 82.4                              | 86.6   | 77.0               | 80.2   | 7239               | 82.6   |
| 1988 | 3119.0         | 408.0          | 92.7   | 87.4   | 92.3                              | 87.3   | 87.0               | 81.1   | 8181               | 93.1   |
| 1989 | 2429.0         | 408.0          | 72.8   | 85.8   | 72.6                              | 85.7   | 68.0               | 79.6   | 6520               | 74.4   |
| 1990 | 2606.9         | 408.0          | 78.2   | 85.0   | 78.2                              | 84.9   | 72.9               | 79.0   | 7715               | 88.1   |
| 1991 | 2171.9         | 408.0          | 61.7   | 82.9   | 61.7                              | 82.8   | 60.8               | 77.3   | 5607               | 64.0   |
| 1992 | 2336.5         | 408.0          | 73.0   | 82.0   | 73.0                              | 82.0   | 65.2               | 76.3   | 7727               | 88.0   |
| 1993 | 1933.0         | 408.0          | 78.6   | 81.8   | 52.2                              | 79.7   | 54.1               | 74.6   | 7416               | 84.7   |
| 1994 | 1082.7         | 408.0          | 40.3   | 78.8   | 40.3                              | 76.9   | 30.3               | 71.4   | 4255               | 48.6   |
| 1995 | 2747.2         | 408.0          | 97.3   | 80.0   | 86.9                              | 77.5   | 76.9               | 71.8   | 8682               | 99.1   |
| 1996 | 1021.0         | 408.0          | 82.2   | 80.2   | 82.2                              | 77.8   | 28.5               | 69.1   | 3193               | 36.4   |
| 1997 | 2225.4         | 408.0          | 80.1   | 80.2   | 80.1                              | 78.0   | 62.3               | 68.7   | 7020               | 80.1   |
| 1998 | 2150.0         | 408.0          | 80.8   | 80.2   | 59.3                              | 76.9   | 60.2               | 68.2   | 8584               | 98.0   |
| 1999 | 1684.7         | 408.0          | 49.2   | 78.6   | 48.8                              | 75.5   | 47.1               | 67.1   | 4656               | 53.2   |
| 2000 | 2166.9         | 440.0          | 75.5   | 78.4   | 62.9                              | 74.8   | 56.2               | 66.5   | 6736               | 76.9   |
| 2001 | 2249.8         | 408.0          | 98.8   | 79.4   | 62.5                              | 74.2   | 62.9               | 66.3   | 8712               | 99.5   |
| 2002 | 1779.7         | 408.0          | 63.4   | 78.7   | 63.4                              | 73.7   | 49.8               | 65.6   | 5574               | 63.6   |
| 2003 | 2477.9         | 408.0          | 82.9   | 78.8   | 82.9                              | 74.1   | 69.3               | 65.8   | 7392               | 84.4   |
| 2004 | 2531.0         | 408.0          | 81.2   | 78.9   | 81.2                              | 74.4   | 70.6               | 66.0   | 7160               | 81.5   |

## BG-3 KOZLODUY-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 20 Jan | 13.2  | 0.7     | PP   | D31  | PLANNED POWER REDUCTION FROM N=100% DOWN TO N=85% NNOM FOR REPAIR LEKAGES IN MOISTURE SEPARATOR/REHEATER-II STAGE |
| 29 Mar | 13.9  | 6.2     | UF4  | A31  | UNPLANNED UNIT TRIP BY AUTOMATICALLY ACTUATION OF THE REACTOR SCRAM DURING TG STOP VALVES PERIODIC CHECKS         |
| 02 Jul | 731.0 | 298.6   | PF   | C    | PLANNED UNIT OUTAGE WITH REFUELING  |
| 01 Aug | 659.2 | 271.1   | PF   | C    | PLANNED UNIT OUTAGE WITH REFUELING  |
| 04 Sep | 207.1 | 86.0    | PF   | D16  | UNIT SHUT DOWN FOR REPAIR OF LEAKAGE OF SG5 PIPE LINE   |
| 16 Oct | 11.3  | 0.6     | PP   | D41  | PLANNED UNIT POWER REDUCTION FROM 100% DOWN TO 86% FOR REPAIR OF HYDROGEN LEAKAGE OF GENERATOR #6 HYDROGEN COOLER |
| 12 Nov | 12.8  | 2.3     | PP   | D31  | UNIT POWER REDUCTION TO 55% NNOM DUE TO LEAKAGE FROM CHECK VALVE ON TURBINE STEAM EXTRACT LINE \$2                |
| 18 Dec | 58.8  | 1.6     | PP   | E15  | PLANNED UNIT POWER REDUCTION FOR PERFORMING OF HEAT-BALANCE TESTS (FIRST AND SECONDARY CIRCUIT HEAT BALANCE)      |
| 29 Dec | 13.8  | 5.5     | UF4  | A41  | UNPLANNED UNIT TRIP BY AUTOMATICALLY ACTIVATION OF THE REACTOR SCRAM AFTER TRIP OF TG#5 BY ELECTRICAL PROTECTION  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 27        |          |  | 28        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1390            |           |          | 972                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 207             |           |          | 85                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 17                                       | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 0         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         |          |
| Subtotal   | 1597            | 27        | 0        | 1074                                     | 28        | 0        |
| Total  |                 | 1624      |          |  | 1102      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 2  |
| 13. Reactor Auxiliary Systems                  |                 | 5  |
| 15. Reactor Cooling Systems                    |                 | 4  |
| 16. Steam generation systems                   |                 | 8  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    | 13              | 1  |
| 32. Feedwater and Main Steam System            |                 | 4  |
| 41. Main Generator Systems                     | 13              | 0  |
| 42. Electrical Power Supply Systems            |                 | 0  |
| Total  | 26              | 24                                       |

# BG-4 KOZLODUY-4

**Operator:** KOZNPP (KOZLODUY NPP-plc)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 408.0 MW(e)  
**Design Net RUP:** 408.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2943.4 GW(e).h  
**Energy Availability Factor:** 89.6%  
**Load Factor:** 82.1%  
**Operating Factor:** 90.2%  
**Energy Unavailability Factor:** 10.4%  
**Total Off-line Time:** 864 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 282.0 | 282.8 | 302.1 | 295.2 | 239.5 | 0.0   | 160.5 | 201.5 | 279.4 | 300.3 | 294.9 | 305.2 | 2943.4 |
| <b>EAF (%)</b>  | 98.3  | 99.8  | 100.0 | 100.0 | 88.0  | 0.0   | 97.8  | 89.7  | 100.0 | 100.0 | 100.0 | 100.0 | 89.6   |
| <b>UCF (%)</b>  | 98.5  | 99.8  | 100.0 | 100.0 | 88.0  | 0.0   | 97.9  | 89.7  | 100.0 | 100.0 | 100.0 | 100.0 | 89.6   |
| <b>LF (%)</b>   | 92.9  | 99.6  | 99.5  | 100.5 | 78.9  | 0.0   | 52.9  | 66.4  | 95.1  | 98.8  | 100.4 | 100.5 | 82.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 90.6  | 0.0   | 98.5  | 91.7  | 100.0 | 100.0 | 100.0 | 100.0 | 90.2   |
| <b>EUF (%)</b>  | 1.7   | 0.2   | 0.0   | 0.0   | 12.0  | 100.0 | 2.2   | 10.3  | 0.0   | 0.0   | 0.0   | 0.0   | 10.4   |
| <b>PUF (%)</b>  | 1.5   | 0.2   | 0.0   | 0.0   | 12.0  | 100.0 | 2.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.9    |
| <b>XUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1973      **Lifetime Generation:** 55126.1 GW(e).h  
**Date of First Criticality:** 25 Apr 1982      **Cumulative Energy Availability Factor:** 73.5%  
**Date of Grid Connection:** 17 May 1982      **Cumulative Load Factor:** 67.5%  
**Date of Commercial Operation:** 20 Jun 1982      **Cumulative Unit Capability Factor:** 77.9%  
**Cumulative Energy Unavailability Factor:** 26.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2867.2         | 408.0          | 92.7   | 92.7   | 92.7                              | 92.7   | 80.2               | 80.2   | 8116               | 92.6   |
| 1984 | 3252.6         | 408.0          | 93.8   | 93.2   | 93.8                              | 93.2   | 90.8               | 85.5   | 8238               | 93.8   |
| 1985 | 3031.0         | 408.0          | 86.3   | 90.9   | 86.3                              | 90.9   | 84.8               | 85.3   | 7812               | 89.2   |
| 1986 | 3168.0         | 408.0          | 92.5   | 91.3   | 92.3                              | 91.3   | 88.6               | 86.1   | 8154               | 93.1   |
| 1987 | 3026.3         | 408.0          | 91.2   | 91.3   | 91.2                              | 91.2   | 84.7               | 85.8   | 8080               | 92.2   |
| 1988 | 2902.0         | 408.0          | 87.8   | 90.7   | 87.8                              | 90.7   | 81.0               | 85.0   | 8139               | 92.7   |
| 1989 | 2842.1         | 408.0          | 86.5   | 90.1   | 86.4                              | 90.1   | 79.5               | 84.2   | 8129               | 92.8   |
| 1990 | 2569.1         | 408.0          | 78.7   | 88.7   | 78.7                              | 88.6   | 71.9               | 82.7   | 7223               | 82.5   |
| 1991 | 2170.6         | 408.0          | 64.4   | 86.0   | 64.4                              | 85.9   | 60.7               | 80.2   | 5661               | 64.6   |
| 1992 | 2316.9         | 408.0          | 70.2   | 84.4   | 70.2                              | 84.4   | 64.6               | 78.7   | 6997               | 79.7   |
| 1993 | 2081.3         | 408.0          | 71.6   | 83.2   | 65.9                              | 82.7   | 58.2               | 76.8   | 6277               | 71.7   |
| 1994 | 1094.4         | 408.0          | 31.4   | 78.9   | 31.4                              | 78.4   | 30.6               | 73.0   | 4112               | 46.9   |
| 1995 | 2516.4         | 408.0          | 84.8   | 79.4   | 81.5                              | 78.7   | 70.4               | 72.8   | 7424               | 84.7   |
| 1996 | 2401.1         | 408.0          | 71.3   | 78.8   | 71.2                              | 78.1   | 67.0               | 72.4   | 8743               | 99.5   |
| 1997 | 1524.4         | 408.0          | 49.5   | 76.8   | 49.5                              | 76.2   | 42.7               | 70.4   | 4338               | 49.5   |
| 1998 | 1929.2         | 408.0          | 57.9   | 75.7   | 57.4                              | 75.0   | 54.0               | 69.4   | 6633               | 75.7   |
| 1999 | 1938.5         | 408.0          | 92.9   | 76.7   | 55.7                              | 73.9   | 54.2               | 68.5   | 8736               | 99.7   |
| 2000 | 2418.4         | 440.0          | 78.0   | 76.8   | 69.7                              | 73.7   | 62.7               | 68.1   | 6922               | 79.0   |
| 2001 | 1777.9         | 408.0          | 64.9   | 76.1   | 49.7                              | 72.4   | 49.7               | 67.2   | 5777               | 65.9   |
| 2002 | 2025.6         | 408.0          | 82.5   | 76.5   | 74.9                              | 72.5   | 56.7               | 66.6   | 6589               | 75.2   |
| 2003 | 2527.0         | 408.0          | 76.6   | 76.5   | 76.6                              | 72.7   | 70.7               | 66.8   | 6735               | 76.9   |
| 2004 | 2943.4         | 408.0          | 89.6   | 77.0   | 89.6                              | 73.5   | 82.1               | 67.5   | 7921               | 90.2   |



## BG-4 KOZLODUY-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 25.3  | 4.6     | PP   | D41  | PLANNED POWER REDUCTION TO 55% NNOM FOR TG#7 BRUSHED REPAIRING   |
| 20 Feb | 7.0   | 0.6     | XP   | N42  | UNPLANNED UNIT POWER REDUCTION FROM 100% DOWN TO 76% NNOM DUE TO TRIP OF CIRCULATION PUMP #16 AFTER THE BUS 8RB-1 DE-ENERGIZING CAUSED BY FLOODING               |
| 20 Feb | 7.3   | 0.6     | PP   | D31  | PLANNED UNIT POWER REDUCTION FROM 100% DOWN TO 78% NNOM DUE TO LEAKAGES IN THE TG#8 MAIN CONDENSER   |
| 29 May | 69.6  | 36.4    | PF   | C    | PLANNED UNIT OUTAGE WITH REFUELING   |
| 01 Jun | 731.0 | 300.3   | PF   | C    | PLANNED UNIT OUTAGE WITH REFUELING   |
| 20 Aug | 7.5   | 5.8     | UP2  | A31  | UNPLANNED POWER REDUCTION AFTER TRIPPING OF TG#7 DUE TO TURBINE STOP VALVE FAILURE   |
| 29 Aug | 62.0  | 25.6    | UF5  | A31  | TRIP OF TG#8 BY ACTIVATION OF ELECTRICAL PROTECTION FOLLOWED BY A FAILURE OF THE FAST ACTING STEAM DUMP STATION.THE OPERATOR IS ACTIVATED REACTOR SCRAM MANUALLY |
| 03 Oct | 0.7   | 0.0     | UP2  | A12  | UNPLANNED POWER REDUCTION DOWN TO 89% NNOM DUE TO RCP2 POWER RELAY FAILURE   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 62        |          |  | 28        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 800             |           |          | 1052                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 79                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 4  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         |          |
| Subtotal   | 800             | 62        | 0        | 1135                                     | 28        | 0        |
| Total  |                 | 862       |          |  | 1163      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 14. Safety Systems                  |                 | 0  |
| 15. Reactor Cooling Systems         |                 | 15                                       |
| 16. Steam generation systems        |                 | 2  |
| 31. Turbine and auxiliaries         | 62              |  |
| 32. Feedwater and Main Steam System |                 | 7  |
| 41. Main Generator Systems          |                 | 1  |
| 42. Electrical Power Supply Systems |                 | 0  |
| Total                               | 62              | 25                                       |

# BG-5 KOZLODUY-5

**Operator:** KOZNPP (KOZLODUY NPP-plc)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 953.0 MW(e)  
**Design Net RUP:** 953.0 MW(e)  
**Design Discharge Burnup:** 27000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4842.0 GW(e).h  
**Energy Availability Factor:** 67.2%  
**Load Factor:** 57.8%  
**Operating Factor:** 67.2%  
**Energy Unavailability Factor:** 32.8%  
**Total Off-line Time:** 2878 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 690.9 | 482.8 | 220.6 | 0.0   | 0.0   | 70.7 | 403.6 | 334.6 | 583.9 | 686.1 | 672.3 | 696.6 | 4842.0 |
| <b>EAF (%)</b>  | 100.0 | 77.5  | 39.7  | 0.0   | 0.0   | 24.2 | 94.4  | 69.6  | 100.0 | 100.0 | 100.0 | 100.0 | 67.2   |
| <b>UCF (%)</b>  | 100.0 | 77.5  | 39.7  | 0.0   | 0.0   | 24.2 | 94.4  | 69.6  | 100.0 | 100.0 | 100.0 | 100.0 | 67.2   |
| <b>LF (%)</b>   | 97.4  | 72.8  | 31.1  | 0.0   | 0.0   | 10.3 | 56.9  | 47.2  | 85.1  | 96.6  | 98.0  | 98.2  | 57.8   |
| <b>OF (%)</b>   | 100.0 | 78.0  | 39.7  | 0.0   | 0.0   | 24.3 | 94.4  | 69.6  | 100.0 | 100.0 | 100.0 | 100.0 | 67.2   |
| <b>EUF (%)</b>  | 0.0   | 22.5  | 60.3  | 100.0 | 100.0 | 75.8 | 5.6   | 30.4  | 0.0   | 0.0   | 0.0   | 0.0   | 32.8   |
| <b>PUF (%)</b>  | 0.0   | 22.0  | 60.3  | 100.0 | 100.0 | 75.5 | 5.6   | 30.4  | 0.0   | 0.0   | 0.0   | 0.0   | 32.7   |
| <b>UCLF (%)</b> | 0.0   | 0.5   | 0.0   | 0.0   | 0.0   | 0.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 09 Jul 1980  
**Date of First Criticality:** 05 Nov 1987  
**Date of Grid Connection:** 29 Nov 1987  
**Date of Commercial Operation:** 23 Dec 1988

**Lifetime Generation:** 64933.0 GW(e).h  
**Cumulative Energy Availability Factor:** 59.6%  
**Cumulative Load Factor:** 48.0%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 40.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 137.0          | 947.0          | 0.0  | 0.0    | 1.7                               | 100.0  | 1.7                | 0.0    | 667                | 7.6    |
| 1988 | 3933.2         | 887.0          | 0.0  | 0.0    | 99.4                              | 100.0  | 50.5               | 0.0    | 7027               | 80.0   |
| 1989 | 3355.1         | 953.0          | 51.5   | 51.5   | 51.5                              | 51.5   | 40.2               | 40.2   | 4663               | 53.2   |
| 1990 | 3380.9         | 953.0          | 58.1   | 54.8   | 41.8                              | 46.6   | 40.5               | 40.3   | 5592               | 63.8   |
| 1991 | 1950.4         | 953.0          | 31.7   | 47.1   | 31.7                              | 41.7   | 23.4               | 34.7   | 2777               | 31.7   |
| 1992 | 3540.7         | 953.0          | 56.6   | 49.5   | 47.0                              | 43.0   | 42.3               | 36.6   | 4982               | 56.7   |
| 1993 | 3278.0         | 953.0          | 50.5   | 49.7   | 47.5                              | 43.9   | 39.3               | 37.1   | 4675               | 53.4   |
| 1994 | 2880.4         | 953.0          | 52.6   | 50.2   | 48.1                              | 44.6   | 34.5               | 36.7   | 4350               | 49.7   |
| 1995 | 4699.3         | 953.0          | 68.1   | 52.8   | 59.4                              | 46.7   | 56.3               | 39.5   | 5988               | 68.4   |
| 1996 | 4720.3         | 953.0          | 73.8   | 55.4   | 73.8                              | 50.1   | 56.4               | 41.6   | 6468               | 73.6   |
| 1997 | 4410.2         | 953.0          | 68.7   | 56.9   | 68.7                              | 52.2   | 52.8               | 42.9   | 6034               | 68.9   |
| 1998 | 3741.0         | 953.0          | 73.3   | 58.5   | 73.3                              | 54.3   | 44.8               | 43.0   | 6467               | 73.8   |
| 1999 | 3423.2         | 953.0          | 54.8   | 58.2   | 50.4                              | 53.9   | 41.0               | 42.9   | 4838               | 55.2   |
| 2000 | 4340.8         | 1000.0         | 63.4   | 58.6   | 54.3                              | 54.0   | 49.6               | 43.4   | 5406               | 61.7   |
| 2001 | 5049.6         | 953.0          | 66.6   | 59.2   | 61.5                              | 54.5   | 60.5               | 44.7   | 5940               | 67.8   |
| 2002 | 5095.8         | 953.0          | 79.8   | 60.7   | 79.4                              | 56.3   | 61.0               | 45.9   | 7003               | 79.9   |
| 2003 | 5596.7         | 953.0          | 98.6   | 63.2   | 98.6                              | 59.1   | 67.0               | 47.3   | 8579               | 97.9   |
| 2004 | 4842.0         | 953.0          | 67.2   | 63.5   | 67.2                              | 59.6   | 57.8               | 48.0   | 5906               | 67.2   |

## BG-5 KOZLODUY-5

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 02 Feb | 146.0 | 140.0   | PF   | D32  | PLANNED UNIT SHUT DOWN DUE TO SECONDARY SIDE CHEMISTRY DETERIORATION  |
| 10 Feb | 147.7 | 3.6     | UP2  | A32  | UNPLANNED POWER REDUCTION TO NEL=950 MW FOR REPAIRING OF LEAKAGES IN HIGH PRESSURE FEEDWATER HEATERS  |
| 01 Feb | 24.8  | 5.6     | PP   | D32  | PLANNED UNIT POWER REDUCTION FOR REPAIRING OF A VALVE ON THE SGFW TURBINE DRIVEN PUMP RECIRULATION LINE   |
| 13 Mar | 449.0 | 427.9   | PF   | F    | PLANNED UNIT OUTAGE WITH REFUELING AND MODERNIZATION  |
| 01 Apr | 720.0 | 686.2   | PF   | F    | PLANNED UNIT OUTAGE WITH REFUELING AND MODERNIZATION  |
| 01 May | 744.0 | 709.0   | PF   | F    | PLANNED UNIT OUTAGE WITH REFUELING AND MODERNIZATION  |
| 01 Jun | 543.3 | 518.3   | PF   | F    | PLANNED UNIT OUTAGE WITH REFUELING AND MODERNIZATION  |
| 28 Jun | 1.4   | 1.9     | UP2  | A35  | AUTOMATICALLY TRIP OF TG#9 DUE TO SPURIOUS ACTIVATION OF LP HTR-2-LEVEL II PROTECTION   |
| 12 Jul | 6.9   | 0.3     | XP   | J    | AUTOMATIC TRANSITION TO FREQUENCY FOLLOWING OPERATION MODE AND AUTOMATIKALLY POWER REDUCTION BY TURBINE CONTROL SYSTEM DUE TO GRID FREQUENCY INCREASING |
| 30 Jul | 268.4 | 255.4   | PF   | D13  | PLANNED UNIT SHUT DOWN FOR REPAIR LEAKAGE OF PIPELINE TO FILTER 5TC10   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 201       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 1703                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  | 414             |           |          | 233                                      |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling   | 2456            |           |          |  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 36                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 0         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 0        |
| Subtotal   | 2870            | 0         | 0        | 1972                                     | 204       | 3        |
| Total  |                 | 2870      |          |  | 2179      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 13. Reactor Auxiliary Systems                  |                 | 1  |
| 15. Reactor Cooling Systems                    |                 | 11                                       |
| 16. Steam generation systems                   |                 | 14                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 21                                       |
| 32. Feedwater and Main Steam System            |                 | 21                                       |
| 35. All other I&C Systems                      |                 | 3  |
| 41. Main Generator Systems                     |                 | 121                                      |
| 42. Electrical Power Supply Systems            |                 | 3  |
| Total  | 0               | 197                                      |

# BG-6 KOZLODUY-6

**Operator:** KOZNPP (KOZLODUY NPP-plc)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 953.0 MW(e)  
**Design Net RUP:** 953.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5298.1 GW(e).h  
**Energy Availability Factor:** 75.2%  
**Load Factor:** 63.3%  
**Operating Factor:** 75.3%  
**Energy Unavailability Factor:** 24.8%  
**Total Off-line Time:** 2170 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 707.7 | 662.6 | 668.1 | 582.8 | 508.3 | 476.8 | 505.7 | 443.7 | 0.0   | 0.0   | 58.0 | 684.3 | 5298.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.8  | 0.0   | 0.0   | 14.1 | 100.0 | 75.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.9  | 0.0   | 0.0   | 14.1 | 100.0 | 75.3   |
| <b>LF (%)</b>   | 99.8  | 99.9  | 94.2  | 85.1  | 71.7  | 69.5  | 71.3  | 62.6  | 0.0   | 0.0   | 8.5  | 96.5  | 63.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 87.9  | 0.0   | 0.0   | 14.6 | 100.0 | 75.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.2  | 100.0 | 100.0 | 85.9 | 0.0   | 24.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.2  | 100.0 | 100.0 | 85.9 | 0.0   | 24.7   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1982  
**Date of First Criticality:** 29 May 1991  
**Date of Grid Connection:** 02 Aug 1991  
**Date of Commercial Operation:** 30 Dec 1993

**Lifetime Generation:** 51792.0 GW(e).h  
**Cumulative Energy Availability Factor:** 67.7%  
**Cumulative Load Factor:** 56.1%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 32.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1991 | 1312.7         | 953.0          | 0.0  | 0.0    | 100.0                             | 100.0  | 15.7               | 0.0    | 2415               | 27.6   |
| 1992 | 2431.0         | 953.0          | 0.0  | 0.0    | 29.9                              | 100.0  | 29.0               | 0.0    | 3472               | 39.5   |
| 1993 | 2799.6         | 953.0          | 0.0  | 0.0    | 41.6                              | 100.0  | 33.5               | 0.0    | 4032               | 46.0   |
| 1994 | 4862.6         | 953.0          | 88.7   | 88.7   | 87.6                              | 87.6   | 58.2               | 58.2   | 7817               | 89.2   |
| 1995 | 3831.9         | 953.0          | 63.6   | 76.1   | 63.6                              | 75.6   | 45.9               | 52.1   | 5568               | 63.6   |
| 1996 | 5495.9         | 953.0          | 76.3   | 76.2   | 76.2                              | 75.8   | 65.7               | 56.6   | 6698               | 76.3   |
| 1997 | 4825.4         | 953.0          | 72.8   | 75.3   | 72.8                              | 75.1   | 57.8               | 56.9   | 6380               | 72.8   |
| 1998 | 3970.0         | 953.0          | 63.7   | 73.0   | 63.7                              | 72.8   | 47.6               | 55.0   | 6079               | 69.4   |
| 1999 | 4407.8         | 953.0          | 69.6   | 72.4   | 60.7                              | 70.8   | 52.8               | 54.7   | 6194               | 70.7   |
| 2000 | 4064.3         | 1000.0         | 66.7   | 71.6   | 51.1                              | 67.8   | 46.4               | 53.4   | 5772               | 65.9   |
| 2001 | 4189.4         | 953.0          | 63.4   | 70.6   | 50.4                              | 65.7   | 50.2               | 53.0   | 5441               | 62.1   |
| 2002 | 5324.9         | 953.0          | 71.5   | 70.7   | 71.5                              | 66.3   | 63.8               | 54.2   | 6256               | 71.4   |
| 2003 | 5480.6         | 953.0          | 72.9   | 70.9   | 72.9                              | 67.0   | 65.6               | 55.4   | 6474               | 73.9   |
| 2004 | 5298.1         | 953.0          | 75.3   | 71.3   | 75.2                              | 67.7   | 63.3               | 56.1   | 6614               | 75.3   |

## BG-6 KOZLODUY-6

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 12 Jul | 5.3   | 0.1     | XP   | J    | AUTOMATIC TRANSITION TO FREQUENCY FOLLOWING OPERATION MODE AND AUTOMATIC POWER REDUCTION BY TURBINE CONTROL SYSTEM DUE TO GRID FREQUENCY INCREASING |
| 28 Aug | 90.3  | 86.2    | PF   | F    | PLANNED UNIT SHUT DOWN FOR OUTAGE, REFUELING AND MODERNIZATION  |
| 01 Sep | 720.0 | 686.2   | PF   | F    | PLANNED UNIT SHUT DOWN FOR OUTAGE, REFUELING AND MODERNIZATION  |
| 01 Oct | 744.0 | 709.0   | PF   | F    | PLANNED UNIT SHUT DOWN FOR OUTAGE, REFUELING AND MODERNIZATION  |
| 01 Nov | 615.0 | 589.5   | PF   | F    | PLANNED UNIT SHUT DOWN FOR OUTAGE, REFUELING AND MODERNIZATION  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1992 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 253       |          |
| C. Inspection, maintenance or repair combined with refuelling                |                 |           |          | 1580                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                      |                 |           |          | 174                                      |           |          |
| E. Testing of plant systems or components                                    |                 |           |          | 13                                       | 0         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling | 2169            |           |          |  |           |          |
| J. Grid failure or grid unavailability                                       |                 |           |          |  |           | 6        |
| Subtotal   | 2169            | 0         | 0        | 1767                                     | 253       | 6        |
| Total  |                 | 2169      |          |  | 2026      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1992 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 7  |
| 14. Safety Systems                  |                 | 39                                       |
| 41. Main Generator Systems          |                 | 11                                       |
| 42. Electrical Power Supply Systems |                 | 194                                      |
| Total                               | 0               | 251                                      |

# CA-10 BRUCE-3

**Operator:** BRUCEPOW (BRUCE POWER)  
**Contractor:** NEI.P (NEI PARSONS)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 769.0 MW(e)  
**Design Net RUP:** 750.0 MW(e)  
**Design Discharge Burnup:** 8750 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4971.6 GW(e).h  
**Energy Availability Factor:** 76.6%  
**Load Factor:** 73.6%  
**Operating Factor:** 81.4%  
**Energy Unavailability Factor:** 23.4%  
**Total Off-line Time:** 1630 hours

## 3. 2004 Monthly Performance Data

|                 | Jan  | Feb  | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 36.7 | 92.6 | 399.9 | 523.3 | 531.7 | 512.1 | 538.0 | 487.7 | 523.4 | 549.9 | 240.9 | 535.4 | 4971.6 |
| <b>EAF (%)</b>  | 6.4  | 20.3 | 72.8  | 96.9  | 95.3  | 94.8  | 96.4  | 87.8  | 96.9  | 98.6  | 45.9  | 100.0 | 76.6   |
| <b>UCF (%)</b>  | 10.6 | 20.3 | 72.8  | 96.9  | 95.3  | 94.8  | 96.4  | 87.8  | 96.9  | 98.6  | 45.9  | 100.0 | 77.0   |
| <b>LF (%)</b>   | 6.4  | 17.7 | 71.7  | 96.9  | 95.3  | 94.8  | 96.4  | 87.4  | 96.9  | 98.6  | 44.6  | 95.9  | 73.6   |
| <b>OF (%)</b>   | 27.3 | 24.4 | 76.3  | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 100.0 | 100.0 | 53.3  | 100.0 | 81.4   |
| <b>EUF (%)</b>  | 93.6 | 79.7 | 27.2  | 3.1   | 4.7   | 5.2   | 3.6   | 12.2  | 3.1   | 1.4   | 54.1  | 0.0   | 23.4   |
| <b>PUF (%)</b>  | 7.7  | 1.6  | 6.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.3    |
| <b>UCLF (%)</b> | 81.7 | 78.0 | 20.7  | 3.1   | 4.7   | 5.2   | 3.6   | 12.2  | 3.1   | 1.4   | 54.1  | 0.0   | 21.7   |
| <b>XUF (%)</b>  | 4.2  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

-DELAYS IN START UP EXPERIENCED-JAN 12TH, PHT PUMP TRIP-DERATES

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1972      **Lifetime Generation:** 107121.4 GW(e).h  
**Date of First Criticality:** 28 Nov 1977      **Cumulative Energy Availability Factor:** 71.4%  
**Date of Grid Connection:** 12 Dec 1977      **Cumulative Load Factor:** 71.4%  
**Date of Commercial Operation:** 01 Feb 1978      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 28.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1978 | 4793.0         | 740.0          | 0.0  | 0.0    | 79.1                              | 100.0  | 74.1               | 0.0    | 7361               | 84.3   |
| 1979 | 4797.9         | 740.0          | 77.8   | 77.8   | 77.8                              | 77.8   | 73.2               | 73.2   | 6885               | 77.7   |
| 1980 | 5939.8         | 740.0          | 91.4   | 84.6   | 91.4                              | 84.6   | 91.4               | 82.3   | 8276               | 94.2   |
| 1981 | 5795.0         | 740.0          | 89.5   | 86.2   | 89.5                              | 86.2   | 89.4               | 84.6   | 7873               | 89.9   |
| 1982 | 6381.9         | 740.0          | 96.7   | 88.8   | 96.7                              | 88.8   | 98.4               | 88.1   | 8497               | 97.0   |
| 1983 | 6091.1         | 740.0          | 89.2   | 88.9   | 89.2                              | 88.9   | 94.0               | 89.2   | 7905               | 90.2   |
| 1984 | 6148.7         | 740.0          | 91.2   | 89.3   | 91.2                              | 89.3   | 94.6               | 90.1   | 8077               | 92.0   |
| 1985 | 6015.1         | 775.0          | 93.9   | 90.0   | 88.6                              | 89.2   | 88.6               | 89.9   | 8118               | 92.7   |
| 1986 | 5891.2         | 796.0          | 86.9   | 89.6   | 84.2                              | 88.5   | 84.5               | 89.2   | 7600               | 86.8   |
| 1987 | 6073.3         | 848.0          | 85.8   | 89.1   | 81.9                              | 87.7   | 81.8               | 88.3   | 7724               | 88.2   |
| 1988 | 3310.6         | 848.0          | 45.6   | 84.3   | 45.6                              | 83.1   | 44.4               | 83.4   | 4044               | 46.0   |
| 1989 | 4031.7         | 848.0          | 57.4   | 81.7   | 54.8                              | 80.3   | 54.3               | 80.6   | 5364               | 61.2   |
| 1990 | 5652.7         | 848.0          | 76.8   | 81.2   | 76.3                              | 79.9   | 76.1               | 80.2   | 7472               | 85.3   |
| 1991 | 6126.3         | 848.0          | 84.3   | 81.5   | 82.4                              | 80.1   | 82.5               | 80.4   | 7950               | 90.8   |
| 1992 | 5801.0         | 848.0          | 77.9   | 81.2   | 77.9                              | 79.9   | 77.9               | 80.2   | 7438               | 84.7   |
| 1993 | 3158.2         | 848.0          | 43.0   | 78.5   | 43.0                              | 77.3   | 42.5               | 77.5   | 6557               | 74.9   |
| 1994 | 2737.6         | 848.0          | 36.9   | 75.7   | 36.9                              | 74.6   | 36.9               | 74.8   | 5006               | 57.1   |
| 1995 | 4225.8         | 848.0          | 56.9   | 74.6   | 56.9                              | 73.5   | 56.9               | 73.7   | 7000               | 79.9   |
| 1996 | 3321.5         | 848.0          | 44.6   | 72.8   | 44.6                              | 71.8   | 44.6               | 72.0   | 5684               | 64.7   |
| 1997 | 4214.8         | 848.0          | 56.8   | 71.9   | 56.8                              | 71.0   | 56.7               | 71.1   | 6325               | 72.2   |
| 1998 | 1642.5         | 848.0          | 94.2   | 72.9   | 81.6                              | 71.2   | 81.6               | 71.3   | 2328               | 98.1   |
| 2004 | 4971.6         | 769.0          | 76.5   | 73.1   | 76.6                              | 71.4   | 73.6               | 71.4   | 7154               | 81.4   |

# CA-10 BRUCE-3

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 177.0 | 136.6   | UF2  | A42  | FORCED OUTAGE DUE TO DELAYS IN START UP OF MOTHBALLED UNIT  |
| 08 Jan | 93.0  | 43.9    | PP   | D34  | SCHEDULED DERATE  |
| 12 Jan | 437.0 | 330.9   | UF2  | A31  | FORCED OUTAGE DUE TO ELECTRICAL BUS FAILURE AND TURBINE BEARING FAILURE   |
| 04 Feb | 543.0 | 407.3   | UF1  | A32  | FORCED OUTAGE DUE TO REPAIR THE LEAK IN HEAT TRANSPORT SYSTEM   |
| 26 Feb | 84.0  | 8.6     | PP   | D34  | SCHEDULED DERATE  |
| 13 Mar | 168.0 | 126.0   | UF2  | A31  | FORCED OUTAGE DUE TO UNIT TRIP AND TURBINE BEARING REPLACEMENT  |
| 25 Aug | 48.0  | 36.0    | UF1  | A15  | FORCED OUTAGE TO REPAIR PRIMARY HEAT TRANSPORT MOTOR LEADS  |
| 10 Nov | 336.0 | 252.0   | UF2  | A41  | FORCED OUTAGE DUE TO PRIMARY HEAT TRANSPORT SYSTEM LEAK AND TURBINE TRIP DUE TO FAULTY GENERATOR EXCITATION FIELD BRAKER, AND LOSS OF EXCITATION. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1709      |          |  | 609       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 7         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 574                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 19                                       | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1         | 18       |
| Subtotal   | 0               | 1709      | 0        | 593                                      | 618       | 18       |
| Total  |                 | 1709      |          |  | 1229      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 79                                       |
| 12. Reactor I&C Systems             |                 | 37                                       |
| 13. Reactor Auxiliary Systems       |                 | 25                                       |
| 14. Safety Systems                  |                 | 52                                       |
| 15. Reactor Cooling Systems         | 48              | 70                                       |
| 16. Steam generation systems        |                 | 136                                      |
| 31. Turbine and auxiliaries         | 605             | 98                                       |
| 32. Feedwater and Main Steam System | 543             | 15                                       |
| 35. All other I&C Systems           |                 | 6  |
| 41. Main Generator Systems          | 336             | 63                                       |
| 42. Electrical Power Supply Systems | 177             | 7  |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 1709            | 589                                      |

# CA-11 BRUCE-4

**Operator:** BRUCEPOW (BRUCE POWER)  
**Contractor:** NEI.P (NEI PARSONS)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 750.0 MW(e)  
**Design Net RUP:** 733.0 MW(e)  
**Design Discharge Burnup:** 8750 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5418.8 GW(e).h  
**Energy Availability Factor:** 83.8%  
**Load Factor:** 80.2%  
**Operating Factor:** 85.0%  
**Energy Unavailability Factor:** 16.2%  
**Total Off-line Time:** 1315 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 524.9 | 499.5 | 354.7 | 539.6 | 381.2 | 9.8  | 436.6 | 548.5 | 531.9 | 556.7 | 476.2 | 559.4 | 5418.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 64.0  | 99.7  | 69.0  | 1.1  | 78.2  | 100.0 | 100.0 | 100.0 | 88.2  | 100.0 | 83.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 64.0  | 99.7  | 69.0  | 1.1  | 78.3  | 100.0 | 100.0 | 100.0 | 88.2  | 100.0 | 83.8   |
| <b>LF (%)</b>   | 94.1  | 95.7  | 63.6  | 99.9  | 68.3  | 1.8  | 78.2  | 98.3  | 98.5  | 99.8  | 88.2  | 100.2 | 80.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 69.0  | 100.0 | 69.0  | 1.8  | 87.1  | 100.0 | 100.0 | 100.0 | 93.1  | 100.0 | 85.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 36.0  | 0.3   | 31.0  | 98.9 | 21.8  | 0.0   | 0.0   | 0.0   | 11.8  | 0.0   | 16.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 31.0  | 91.9 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.9    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 36.0  | 0.3   | 0.0   | 7.1  | 21.8  | 0.0   | 0.0   | 0.0   | 11.8  | 0.0   | 6.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

UNIT AT 750MW FOR THE ENIRE YEAR-MAR 13TH, FORCED OUTAGE DUE TO PRIMARY HEAT TRANSPORT LEAK-MAY 22ND, PLANNED OUTAGE - BOILER INSPECTION-JUNE 28TH, FORCED EXTENSION TO PLANNED OUTAGE-JUNE 30TH, FORCED OUTAGE-NOV 6TH, FORCED OUTAGE DUE DO SAFETY SYSTEM TRIP

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1972      **Lifetime Generation:** 88390447.0 GW(e).h  
**Date of First Criticality:** 10 Dec 1978      **Cumulative Energy Availability Factor:** 68.6%  
**Date of Grid Connection:** 21 Dec 1978      **Cumulative Load Factor:** 68.5%  
**Date of Commercial Operation:** 18 Jan 1979      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 31.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1980 | 4945.1         | 740.0          | 76.1   | 80.3   | 76.1                              | 80.4   | 76.1               | 78.2   | 6962               | 79.3   |
| 1981 | 5753.5         | 740.0          | 89.1   | 83.3   | 89.1                              | 83.3   | 88.8               | 81.7   | 7874               | 89.9   |
| 1982 | 6050.2         | 740.0          | 92.2   | 85.5   | 92.2                              | 85.6   | 93.3               | 84.7   | 8150               | 93.0   |
| 1983 | 6407.4         | 740.0          | 94.3   | 87.3   | 94.3                              | 87.3   | 98.8               | 87.5   | 8345               | 95.3   |
| 1984 | 6664.6         | 740.0          | 97.8   | 89.1   | 97.8                              | 89.1   | 102.5              | 90.1   | 8625               | 98.2   |
| 1985 | 4995.2         | 788.0          | 79.0   | 87.5   | 73.2                              | 86.7   | 72.4               | 87.4   | 6518               | 74.4   |
| 1986 | 6891.6         | 848.0          | 95.5   | 88.7   | 92.8                              | 87.5   | 92.8               | 88.1   | 8644               | 98.7   |
| 1987 | 5045.0         | 848.0          | 71.5   | 86.6   | 67.9                              | 85.1   | 67.9               | 85.6   | 6366               | 72.7   |
| 1988 | 4663.7         | 848.0          | 66.9   | 84.4   | 65.7                              | 83.0   | 62.6               | 83.1   | 5997               | 68.3   |
| 1989 | 5584.2         | 848.0          | 77.0   | 83.7   | 75.3                              | 82.2   | 75.2               | 82.3   | 7290               | 83.2   |
| 1990 | 3533.0         | 848.0          | 48.3   | 80.5   | 47.5                              | 79.1   | 47.6               | 79.2   | 4611               | 52.6   |
| 1991 | 5940.7         | 848.0          | 81.7   | 80.6   | 79.9                              | 79.2   | 80.0               | 79.3   | 7955               | 90.8   |
| 1992 | 5843.4         | 848.0          | 80.1   | 80.5   | 78.4                              | 79.1   | 78.4               | 79.2   | 8070               | 91.9   |
| 1993 | 350.1          | 848.0          | 4.7  | 75.2   | 4.7                               | 73.9   | 4.7                | 73.9   | 527                | 6.0    |
| 1994 | 3656.0         | 848.0          | 49.3   | 73.5   | 49.3                              | 72.2   | 49.2               | 72.3   | 7206               | 82.3   |
| 1995 | 3034.9         | 848.0          | 40.9   | 71.5   | 40.9                              | 70.3   | 40.9               | 70.4   | 5024               | 57.4   |
| 1996 | 5296.3         | 848.0          | 71.2   | 71.4   | 71.2                              | 70.3   | 71.1               | 70.4   | 8686               | 98.9   |
| 1997 | 2923.0         | 848.0          | 39.4   | 69.7   | 39.4                              | 68.6   | 39.3               | 68.7   | 4968               | 56.7   |
| 1998 | 12.3           | 848.0          | 0.8  | 68.9   | 0.8                               | 67.9   | 0.8                | 67.9   | 45                 | 2.5    |
| 2004 | 5418.8         | 769.0          | 83.4   | 69.6   | 83.8                              | 68.6   | 80.2               | 68.5   | 7469               | 85.0   |



# CA-11 BRUCE-4

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 13 Mar | 260.0 | 201.0   | UF2  | A15  | FORCED OUTAGE DUE TO PRIMARY HEAT TRANSPORT SYSTEM LEAK    |
| 22 May | 235.0 | 176.8   | PF   | D16  | PLANNED OUTAGE - INSPECTION OF BOILERS                     |
| 01 Jun | 660.0 | 496.1   | PF   | D16  | PLANNED OUTAGE - INSPECTION OF BOILERS                     |
| 28 Jun | 48.0  | 38.1    | UF3  | A16  | FORCED EXTENSION TO PLANNED OUTAGE - INSPECTION OF BOILERS |
| 09 Jul | 161.0 | 121.4   | UF2  | A14  | FORCED OUTAGE  |
| 06 Nov | 85.0  | 63.8    | UF4  | L14  | FORCED OUTAGE DUE TO SAFETY SYSTEM TRIP                    |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1979 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 469       |          |  | 827       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| D. Inspection, maintenance or repair without refuelling                              | 895             |           |          | 564                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 59                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 6         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 16        | 24       |
| L. Human factor related  |                 | 85        |          |  |           |          |
| Subtotal   | 895             | 554       | 0        | 623                                      | 853       | 24       |
| Total  |                 | 1449      |          |  | 1500      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1979 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 123                                      |
| 12. Reactor I&C Systems                        |                 | 44                                       |
| 14. Safety Systems                             | 161             | 8  |
| 15. Reactor Cooling Systems                    | 260             | 73                                       |
| 16. Steam generation systems                   | 48              | 228                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 58                                       |
| 32. Feedwater and Main Steam System            |                 | 39                                       |
| 35. All other I&C Systems                      |                 | 134                                      |
| 41. Main Generator Systems                     |                 | 24                                       |
| 42. Electrical Power Supply Systems            |                 | 27                                       |
| XX. Miscellaneous Systems                      |                 | 13                                       |
| Total  | 469             | 772                                      |

# CA-18 BRUCE-5

**Operator:** BRUCEPOW (BRUCE POWER)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 790.0 MW(e)  
**Design Net RUP:** 750.0 MW(e)  
**Design Discharge Burnup:** 7920 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5889.1 GW(e).h  
**Energy Availability Factor:** 85.1%  
**Load Factor:** 84.9%  
**Operating Factor:** 85.9%  
**Energy Unavailability Factor:** 14.9%  
**Total Off-line Time:** 1241 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 578.8 | 427.4 | 590.1 | 570.5 | 589.5 | 568.9 | 585.3 | 580.6 | 322.2 | 0.0   | 492.7 | 583.2 | 5889.1 |
| <b>EAF (%)</b>  | 98.7  | 78.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 57.8  | 0.0   | 85.8  | 100.0 | 85.1   |
| <b>UCF (%)</b>  | 98.7  | 78.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 57.8  | 0.0   | 85.8  | 100.0 | 85.1   |
| <b>LF (%)</b>   | 98.5  | 77.7  | 100.4 | 100.3 | 100.3 | 100.0 | 99.6  | 98.8  | 56.6  | 0.0   | 86.6  | 99.2  | 84.9   |
| <b>OF (%)</b>   | 98.7  | 81.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 57.8  | 0.0   | 92.2  | 100.0 | 85.9   |
| <b>EUF (%)</b>  | 1.3   | 21.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 42.2  | 100.0 | 14.2  | 0.0   | 14.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 42.2  | 41.9  | 6.5   | 0.0   | 7.5    |
| <b>UCLF (%)</b> | 1.3   | 21.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 58.1  | 7.7   | 0.0   | 7.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

-PHT PUMP 3 CONTAINMENT BELLOW SEAL LEAK JAN 31ST TO FEB 6TH-PLANNED VACUUM BUILDING INSPECTION OUTAGE, SEPT 18TH TO OCT 14TH-FORCED EXTENSION TO PLANNED OUTAGE, PRIMARY HEAT TRANSPORT PUMP 3 CONTAINMENT BELLOW SEAL LEAK OCT 14TH TO NOV 3RD.

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1978      **Lifetime Generation:** 119054327.0 GW(e).h  
**Date of First Criticality:** 15 Nov 1984      **Cumulative Energy Availability Factor:** 83.4%  
**Date of Grid Connection:** 02 Dec 1984      **Cumulative Load Factor:** 83.4%  
**Date of Commercial Operation:** 01 Mar 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 16.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 187.3          | 854.0          | 0.0  | 0.0    | 96.2                              | 100.0  | 2.5                | 0.0    | 510                | 5.8    |
| 1985 | 5464.2         | 815.0          | 0.0  | 0.0    | 88.1                              | 100.0  | 77.5               | 0.0    | 7163               | 81.8   |
| 1986 | 7078.0         | 835.0          | 98.4   | 98.4   | 96.7                              | 96.7   | 96.8               | 96.8   | 8675               | 99.0   |
| 1987 | 5730.1         | 835.0          | 80.2   | 89.3   | 78.2                              | 87.4   | 78.3               | 87.6   | 7197               | 82.2   |
| 1988 | 6673.6         | 860.0          | 88.5   | 89.0   | 88.5                              | 87.8   | 88.3               | 87.8   | 7824               | 89.1   |
| 1989 | 7130.8         | 860.0          | 97.1   | 91.1   | 94.1                              | 89.4   | 94.7               | 89.6   | 8589               | 98.0   |
| 1990 | 5534.7         | 860.0          | 74.6   | 87.7   | 73.5                              | 86.2   | 73.5               | 86.3   | 6656               | 76.0   |
| 1991 | 6769.6         | 860.0          | 90.7   | 88.3   | 90.3                              | 86.9   | 89.9               | 86.9   | 8130               | 92.8   |
| 1992 | 6452.1         | 860.0          | 85.8   | 87.9   | 85.8                              | 86.7   | 85.4               | 86.7   | 7636               | 86.9   |
| 1993 | 5118.3         | 860.0          | 68.1   | 85.4   | 68.1                              | 84.4   | 67.9               | 84.3   | 7457               | 85.1   |
| 1994 | 5629.3         | 860.0          | 75.0   | 84.2   | 75.0                              | 83.3   | 74.7               | 83.3   | 7671               | 87.6   |
| 1995 | 6125.3         | 860.0          | 81.4   | 84.0   | 81.4                              | 83.1   | 81.3               | 83.1   | 7859               | 89.7   |
| 1996 | 5767.6         | 860.0          | 76.4   | 83.3   | 76.4                              | 82.5   | 76.3               | 82.4   | 7153               | 81.4   |
| 1997 | 6388.3         | 860.0          | 84.8   | 83.4   | 84.8                              | 82.7   | 84.8               | 82.6   | 8148               | 93.0   |
| 1998 | 5623.1         | 785.0          | 81.7   | 83.3   | 81.7                              | 82.6   | 81.8               | 82.6   | 7305               | 83.4   |
| 1999 | 5281.9         | 785.0          | 76.6   | 82.8   | 76.6                              | 82.2   | 76.8               | 82.2   | 6719               | 76.7   |
| 2000 | 6908.7         | 785.0          | 99.1   | 83.8   | 99.1                              | 83.3   | 100.2              | 83.3   | 8719               | 99.3   |
| 2004 | 5889.1         | 790.0          | 85.1   | 83.9   | 85.1                              | 83.4   | 84.9               | 83.4   | 7543               | 85.9   |

## CA-18 BRUCE-5

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 31 Jan | 144.0 | 113.8   | UF2  | A15  | LEAK IN HEAT TRANSPORT SYSTEM  |
| 18 Sep | 600.0 | 474.0   | PF   | D14  | PLANNED VACUUM BUILDING INSPECTION   |
| 14 Oct | 480.0 | 379.2   | UF3  | A15  | FORCED EXTENSION TO PLANNED OUTAGE, PRIMARY HEAT TRANSPORT PUMP #3<br>CONTAINMENT BELLOWS SEAL LEAK NEEDED TO BE FIXED |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 624       |          |   | 258       |          |
| D. Inspection, maintenance or repair without refuelling                              | 600             |           |          | 496   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 9   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 6         | 20       |
| Subtotal   | 600             | 624       | 0        | 505   | 264       | 20       |
| Total  |                 | 1224      |          |   | 789       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 0   |
| 12. Reactor I&C Systems             |                    | 35  |
| 13. Reactor Auxiliary Systems       |                    | 15  |
| 14. Safety Systems                  |                    | 22  |
| 15. Reactor Cooling Systems         | 624                | 92  |
| 16. Steam generation systems        |                    | 9   |
| 31. Turbine and auxiliaries         |                    | 9   |
| 32. Feedwater and Main Steam System |                    | 21  |
| 41. Main Generator Systems          |                    | 20  |
| 42. Electrical Power Supply Systems |                    | 11  |
| XX. Miscellaneous Systems           |                    | 3   |
| Total                               | 624                | 237   |

# CA-19 BRUCE-6

**Operator:** BRUCEPOW (BRUCE POWER)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 790.0 MW(e)  
**Design Net RUP:** 750.0 MW(e)  
**Design Discharge Burnup:** 7920 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5379.1 GW(e).h  
**Energy Availability Factor:** 76.0%  
**Load Factor:** 77.5%  
**Operating Factor:** 76.3%  
**Energy Unavailability Factor:** 24.0%  
**Total Off-line Time:** 2086 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|-------|--------|
| <b>GW(e).h</b>  | 582.5 | 549.8 | 588.5 | 577.7 | 615.6 | 596.7 | 614.3 | 529.5 | 205.2 | 0.0  | 0.0  | 519.2 | 5379.1 |
| <b>EAF (%)</b>  | 99.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.4  | 35.5  | 3.7  | 3.7  | 89.0  | 76.0   |
| <b>UCF (%)</b>  | 99.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.4  | 35.5  | 3.7  | 3.7  | 89.1  | 76.0   |
| <b>LF (%)</b>   | 99.1  | 100.0 | 100.1 | 101.6 | 100.9 | 101.1 | 100.7 | 86.8  | 34.8  | 0.0  | 0.0  | 83.0  | 77.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 96.8  | 100.0 | 100.0 | 90.1  | 35.4  | 0.0  | 0.0  | 92.1  | 76.3   |
| <b>EUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.6   | 64.5  | 96.3 | 96.3 | 11.0  | 24.0   |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 64.5  | 96.3 | 96.3 | 9.1   | 23.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.6   | 0.0   | 0.0  | 0.0  | 1.9   | 1.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

NEW TURBINE PRODUCING 820

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1978  
**Date of First Criticality:** 29 May 1984  
**Date of Grid Connection:** 26 Jun 1984  
**Date of Commercial Operation:** 14 Sep 1984

**Lifetime Generation:** 116269788.0 GW(e).h  
**Cumulative Energy Availability Factor:** 78.5%  
**Cumulative Load Factor:** 78.4%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 21.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 3068.3         | 822.0          | 0.0  | 0.0    | 92.2                              | 100.0  | 45.6               | 0.0    | 4230               | 51.7   |
| 1985 | 5900.1         | 805.0          | 88.7   | 88.7   | 84.0                              | 84.0   | 83.7               | 83.7   | 7369               | 84.1   |
| 1986 | 5716.0         | 835.0          | 81.7   | 85.1   | 77.8                              | 80.8   | 78.1               | 80.9   | 7213               | 82.3   |
| 1987 | 7017.1         | 837.0          | 97.8   | 89.4   | 95.3                              | 85.7   | 95.7               | 85.9   | 8610               | 98.3   |
| 1988 | 6139.5         | 837.0          | 89.2   | 89.4   | 89.1                              | 86.6   | 83.5               | 85.3   | 7880               | 89.7   |
| 1989 | 5386.2         | 837.0          | 78.9   | 87.3   | 73.4                              | 83.9   | 73.5               | 82.9   | 7069               | 80.7   |
| 1990 | 6213.6         | 852.0          | 83.8   | 86.7   | 82.3                              | 83.7   | 83.3               | 83.0   | 7429               | 84.8   |
| 1991 | 7013.4         | 860.0          | 93.3   | 87.7   | 93.0                              | 85.0   | 93.1               | 84.4   | 8194               | 93.5   |
| 1992 | 5328.2         | 860.0          | 70.5   | 85.5   | 70.5                              | 83.2   | 70.5               | 82.7   | 6393               | 72.8   |
| 1993 | 4351.0         | 860.0          | 58.0   | 82.4   | 58.0                              | 80.3   | 57.8               | 79.8   | 6950               | 79.3   |
| 1994 | 6451.7         | 860.0          | 85.8   | 82.7   | 85.7                              | 80.9   | 85.6               | 80.4   | 8760               | 100.0  |
| 1995 | 4671.6         | 860.0          | 62.1   | 80.8   | 62.1                              | 79.1   | 62.0               | 78.7   | 6049               | 69.1   |
| 1996 | 6822.8         | 860.0          | 90.4   | 81.6   | 90.4                              | 80.1   | 90.3               | 79.7   | 8682               | 98.8   |
| 1997 | 4796.4         | 860.0          | 63.7   | 80.2   | 63.7                              | 78.8   | 63.7               | 78.5   | 6201               | 70.8   |
| 1998 | 4678.6         | 785.0          | 68.1   | 79.4   | 68.0                              | 78.1   | 68.0               | 77.8   | 6137               | 70.1   |
| 1999 | 6860.1         | 785.0          | 99.4   | 80.7   | 99.3                              | 79.4   | 99.8               | 79.1   | 8760               | 100.0  |
| 2000 | 4668.2         | 785.0          | 66.8   | 79.8   | 66.8                              | 78.7   | 67.7               | 78.5   | 5912               | 67.3   |
| 2004 | 5379.1         | 790.0          | 76.7   | 79.7   | 76.0                              | 78.5   | 77.5               | 78.4   | 6698               | 76.3   |

# CA-19 BRUCE-6

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 19 Aug | 72.0   | 58.5    | UF4  | L14  | SAFETY SYSTEM #1 TRIP - HUMAN FACTOR RELATED                                    |
| 11 Sep | 1992.0 | 1573.7  | PF   | D14  | PLANNED VACUUM BUILDING INSPECTION, CIGAR, SLAR, AND NEW TURBING UPGRADE OUTAGE |
| 01 Dec | 72.0   | 18.9    | PP   | D14  | START UP AFTER PLANNED OUTAGE   |
| 04 Dec | 13.0   | 11.7    | UF3  | A31  | EXTENSION TO PLANNED OUTAGE   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 13        |          |  | 385       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 5         |          |
| D. Inspection, maintenance or repair without refuelling                              | 1992            |           |          | 649                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 3         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 22        | 20       |
| L. Human factor related  |                 | 72        |          |  |           |          |
| Subtotal   | 1992            | 85        | 0        | 649                                      | 415       | 20       |
| Total  |                 | 2077      |          |  | 1084      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 61                                       |
| 12. Reactor I&C Systems             |                 | 59                                       |
| 14. Safety Systems                  |                 | 29                                       |
| 15. Reactor Cooling Systems         |                 | 88                                       |
| 16. Steam generation systems        |                 | 93                                       |
| 31. Turbine and auxiliaries         | 13              | 17                                       |
| 32. Feedwater and Main Steam System |                 | 17                                       |
| 33. Circulating Water System        |                 | 5  |
| 41. Main Generator Systems          |                 | 2  |
| 42. Electrical Power Supply Systems |                 | 1  |
| Total                               | 13              | 372                                      |

# CA-20 BRUCE-7

**Operator:** BRUCEPOW (BRUCE POWER)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 790.0 MW(e)  
**Design Net RUP:** 750.0 MW(e)  
**Design Discharge Burnup:** 7920 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6428.8 GW(e).h  
**Energy Availability Factor:** 92.8%  
**Load Factor:** 92.6%  
**Operating Factor:** 93.2%  
**Energy Unavailability Factor:** 7.2%  
**Total Off-line Time:** 596 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 591.0 | 554.0 | 593.0 | 569.7 | 588.1 | 566.6 | 584.6 | 582.2 | 326.4 | 318.6 | 568.5 | 586.1 | 6428.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 58.2  | 55.0  | 100.0 | 100.0 | 92.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 58.2  | 55.0  | 100.0 | 100.0 | 92.8   |
| <b>LF (%)</b>   | 100.6 | 100.7 | 100.9 | 100.2 | 100.1 | 99.6  | 99.5  | 99.1  | 57.4  | 54.2  | 99.9  | 99.7  | 92.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 58.2  | 60.3  | 100.0 | 100.0 | 93.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 41.8  | 45.0  | 0.0   | 0.0   | 7.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 41.8  | 44.6  | 0.0   | 0.0   | 7.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

PLANNED VACUUM BUILDING OUTAGE ON SEPTEMBER 18TH TO OCTOBER 13TH TO INSPECT VACUUM BILDING.

## 5. Historical Summary

**Date of Construction Start:** 01 May 1979      **Lifetime Generation:** 112621693.0 GW(e).h  
**Date of First Criticality:** 07 Jan 1986      **Cumulative Energy Availability Factor:** 82.0%  
**Date of Grid Connection:** 22 Feb 1986      **Cumulative Load Factor:** 81.1%  
**Date of Commercial Operation:** 10 Apr 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 18.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 5256.6         | 838.0          | 0.0  | 0.0    | 85.5                              | 100.0  | 76.0               | 0.0    | 6957               | 84.3   |
| 1987 | 6288.1         | 837.0          | 96.9   | 96.9   | 85.9                              | 85.9   | 85.8               | 85.8   | 8489               | 96.9   |
| 1988 | 4866.2         | 860.0          | 74.8   | 85.7   | 74.8                              | 80.4   | 65.4               | 74.9   | 6636               | 75.5   |
| 1989 | 7280.8         | 860.0          | 97.8   | 89.8   | 96.4                              | 85.8   | 96.6               | 82.2   | 8632               | 98.5   |
| 1990 | 6659.4         | 860.0          | 90.7   | 90.0   | 88.5                              | 86.5   | 88.4               | 83.8   | 8065               | 92.1   |
| 1991 | 5733.6         | 860.0          | 76.4   | 87.3   | 76.3                              | 84.4   | 76.1               | 82.2   | 6835               | 78.0   |
| 1992 | 6413.4         | 860.0          | 85.2   | 86.9   | 85.1                              | 84.6   | 84.9               | 82.7   | 7589               | 86.4   |
| 1993 | 5802.3         | 860.0          | 78.1   | 85.7   | 78.1                              | 83.6   | 77.0               | 81.9   | 8760               | 100.0  |
| 1994 | 5496.7         | 860.0          | 73.2   | 84.1   | 73.2                              | 82.3   | 73.0               | 80.8   | 7577               | 86.5   |
| 1995 | 6285.1         | 860.0          | 83.5   | 84.0   | 83.5                              | 82.5   | 83.4               | 81.1   | 8092               | 92.4   |
| 1996 | 5475.7         | 860.0          | 72.6   | 82.9   | 72.5                              | 81.5   | 72.5               | 80.2   | 7000               | 79.7   |
| 1997 | 6154.5         | 860.0          | 81.7   | 82.8   | 81.7                              | 81.5   | 81.7               | 80.3   | 7874               | 89.9   |
| 1998 | 4990.8         | 785.0          | 72.4   | 82.0   | 72.4                              | 80.8   | 72.6               | 79.7   | 6474               | 73.9   |
| 1999 | 6315.7         | 785.0          | 92.3   | 82.7   | 91.8                              | 81.6   | 91.8               | 80.6   | 8208               | 93.7   |
| 2000 | 5322.7         | 785.0          | 78.2   | 82.4   | 76.9                              | 81.3   | 77.2               | 80.4   | 6790               | 77.3   |
| 2004 | 6428.8         | 790.0          | 92.8   | 83.1   | 92.8                              | 82.0   | 92.6               | 81.1   | 8188               | 93.2   |

## CA-20 BRUCE-7

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                        |
|--------|-------|---------|------|------|------------------------------------|
| 18 Sep | 636.0 | 499.5   | PF   | D14  | PLANNED VACUUM BUILDING INSPECTION |
| 22 Oct | 40.0  | 2.4     | UP3  | A14  |                                    |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 270       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| D. Inspection, maintenance or repair without refuelling                              | 636             |           |          | 528   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 15  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 5         | 5        |
| Subtotal   | 636             | 0         | 0        | 543   | 277       | 5        |
| Total  |                 | 636       |          |   | 825       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 32  |
| 13. Reactor Auxiliary Systems       |                    | 3   |
| 15. Reactor Cooling Systems         |                    | 65  |
| 16. Steam generation systems        |                    | 15  |
| 31. Turbine and auxiliaries         |                    | 14  |
| 32. Feedwater and Main Steam System |                    | 26  |
| 41. Main Generator Systems          |                    | 6   |
| 42. Electrical Power Supply Systems |                    | 29  |
| XX. Miscellaneous Systems           |                    | 56  |
| Total                               | 0                  | 246   |

# CA-21 BRUCE-8

**Operator:** BRUCEPOW (BRUCE POWER)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 790.0 MW(e)  
**Design Net RUP:** 750.0 MW(e)  
**Design Discharge Burnup:** 7920 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5695.8 GW(e).h  
**Energy Availability Factor:** 82.8%  
**Load Factor:** 82.1%  
**Operating Factor:** 83.9%  
**Energy Unavailability Factor:** 17.2%  
**Total Off-line Time:** 1410 hours

## 3. 2004 Monthly Performance Data

|                 | Jan  | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 40.7 | 550.6 | 585.8 | 516.9 | 587.1 | 565.1 | 568.8 | 577.7 | 218.9 | 383.1 | 510.6 | 590.6 | 5695.8 |
| <b>EAF (%)</b>  | 6.9  | 100.0 | 100.0 | 91.6  | 100.0 | 100.0 | 97.8  | 99.6  | 42.8  | 66.0  | 89.8  | 100.0 | 82.8   |
| <b>UCF (%)</b>  | 9.4  | 100.0 | 100.0 | 91.6  | 100.0 | 100.0 | 97.8  | 99.6  | 42.8  | 66.0  | 89.8  | 100.0 | 83.0   |
| <b>LF (%)</b>   | 6.9  | 100.1 | 99.7  | 90.9  | 99.9  | 99.3  | 96.8  | 98.3  | 38.5  | 65.2  | 89.8  | 100.5 | 82.1   |
| <b>OF (%)</b>   | 12.1 | 100.0 | 100.0 | 92.8  | 100.0 | 100.0 | 98.4  | 99.6  | 42.8  | 69.4  | 93.2  | 100.0 | 83.9   |
| <b>EUF (%)</b>  | 93.1 | 0.0   | 0.0   | 8.4   | 0.0   | 0.0   | 2.2   | 0.4   | 57.2  | 34.0  | 10.2  | 0.0   | 17.2   |
| <b>PUF (%)</b>  | 2.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 42.6  | 34.0  | 0.0   | 0.0   | 6.6    |
| <b>UCLF (%)</b> | 87.9 | 0.0   | 0.0   | 8.4   | 0.0   | 0.0   | 2.2   | 0.4   | 14.6  | 0.0   | 10.2  | 0.0   | 10.4   |
| <b>XUF (%)</b>  | 2.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

-SEPT 20TH, 2003 TO JAN 28TH 2004 - PLANNED OUTAGE TO REPAIR BOILERS-FEB 8TH, FORCED OUTAGE DUE TO INADVERTENT POISON ADITON-JUL 2ND, FORCED OUTAGE DUE TO DEFECTIVE TURBINE GOVERNOR VALVE-AUG 31ST, FORCED OUTAGE TO REPAIR PRIMARY HEAT TRANSPORT SYSTEM-SEPT 18TH, PLANNED OUTAGE TO INSPECT VACUUMBUILDING-NOV 10TH, FORCED OUTAGE DUE TO LOSS OF CONDENSOR COOLING WATER PUMP LUBE WATER FLOW

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1979      **Lifetime Generation:** 112621693.0 GW(e).h  
**Date of First Criticality:** 15 Feb 1987      **Cumulative Energy Availability Factor:** 80.2%  
**Date of Grid Connection:** 09 Mar 1987      **Cumulative Load Factor:** 79.7%  
**Date of Commercial Operation:** 22 May 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 19.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 3673.2         | 844.0          | 0.0  | 0.0    | 83.2                              | 100.0  | 49.7               | 0.0    | 5849               | 66.8   |
| 1988 | 5958.5         | 837.0          | 86.8   | 86.8   | 86.5                              | 86.5   | 81.0               | 81.0   | 7659               | 87.2   |
| 1989 | 6523.5         | 837.0          | 98.5   | 92.6   | 89.2                              | 87.9   | 89.0               | 85.0   | 8661               | 98.9   |
| 1990 | 5758.7         | 842.0          | 80.7   | 88.6   | 78.1                              | 84.6   | 78.1               | 82.7   | 7186               | 82.0   |
| 1991 | 6932.7         | 860.0          | 93.0   | 89.7   | 92.5                              | 86.6   | 92.0               | 85.1   | 8213               | 93.8   |
| 1992 | 5451.1         | 860.0          | 72.4   | 86.2   | 72.4                              | 83.7   | 72.2               | 82.4   | 6587               | 75.0   |
| 1993 | 4675.9         | 860.0          | 62.3   | 82.2   | 62.3                              | 80.1   | 62.1               | 79.0   | 7064               | 80.6   |
| 1994 | 6443.2         | 860.0          | 86.0   | 82.7   | 86.0                              | 80.9   | 85.5               | 79.9   | 8760               | 100.0  |
| 1995 | 6113.4         | 860.0          | 81.3   | 82.6   | 81.3                              | 81.0   | 81.1               | 80.1   | 7876               | 89.9   |
| 1996 | 6957.8         | 860.0          | 92.1   | 83.6   | 92.1                              | 82.2   | 92.1               | 81.4   | 8783               | 100.0  |
| 1997 | 6346.5         | 860.0          | 84.2   | 83.7   | 84.2                              | 82.5   | 84.2               | 81.7   | 8003               | 91.4   |
| 1998 | 4122.4         | 785.0          | 59.9   | 81.7   | 59.8                              | 80.5   | 59.9               | 79.9   | 5368               | 61.3   |
| 1999 | 4114.4         | 785.0          | 60.0   | 80.0   | 59.8                              | 78.9   | 59.8               | 78.3   | 5414               | 61.8   |
| 2000 | 6530.9         | 785.0          | 93.7   | 81.0   | 93.7                              | 80.0   | 94.7               | 79.5   | 8293               | 94.4   |
| 2004 | 5695.8         | 790.0          | 83.0   | 81.1   | 82.8                              | 80.2   | 82.1               | 79.7   | 7374               | 83.9   |



# CA-21 BRUCE-8

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 654.0 | 511.9   | UF3  | A16  | FORCED EXTENSION TO PLANNED OUTAGE - REPAIRS TO BOILERS. SEPT 20, 2003 TO JANUARY 28, 2004 |
| 28 Jan | 60.0  | 15.7    | PP   | A34  | SCHEDULED DERATE   |
| 06 Apr | 48.0  | 37.9    | UF4  | L14  | INADVERTENT POISON ADDITION TO REACTOR - HUMAN FACTOR FORCED OUTAGE                        |
| 02 Jul | 24.0  | 19.0    | UF5  | A31  | DEFECTIVE TURBINE GOVERNOR VALVE   |
| 01 Sep | 105.0 | 83.2    | UF2  | A15  | REPAIR LEAK IN PRIMARY HEAT TRANSPORT SYSTEM   |
| 18 Sep | 600.0 | 442.2   | PF   | D14  | PLANNED OUTAGE - VACUUM BUILDING INSPECTION  |
| 10 Nov | 73.0  | 58.2    | UF5  | A33  | FORCED OUTAGE - CIRCULATING CONVENTIONAL WATER PUMP BEARING LUBE WATER FLOW LEAK           |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 856       |          |  | 309       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| D. Inspection, maintenance or repair without refuelling                              | 600             |           |          | 574                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 4         |          |
| L. Human factor related  |                 | 48        |          |  |           |          |
| Subtotal   | 600             | 904       | 0        | 574                                      | 315       | 0        |
| Total  |                 | 1504      |          |  | 889       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 19                                       |
| 12. Reactor I&C Systems                        |                 | 3  |
| 14. Safety Systems                             |                 | 27                                       |
| 15. Reactor Cooling Systems                    | 105             | 74                                       |
| 16. Steam generation systems                   | 654             | 133                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    | 24              | 3  |
| 32. Feedwater and Main Steam System            |                 | 12                                       |
| 33. Circulating Water System                   | 73              | 4  |
| 35. All other I&C Systems                      |                 | 2  |
| 42. Electrical Power Supply Systems            |                 | 17                                       |
| XX. Miscellaneous Systems                      |                 | 4  |
| Total  | 856             | 298                                      |

# CA-22 DARLINGTON-1

**Operator:** OPG (ONTARIO POWER GENERATION)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 881.0 MW(e)  
**Design Net RUP:** 881.0 MW(e)  
**Design Discharge Burnup:** 7790 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5612.1 GW(e).h  
**Energy Availability Factor:** 72.7%  
**Load Factor:** 72.7%  
**Operating Factor:** 74.7%  
**Energy Unavailability Factor:** 27.3%  
**Total Off-line Time:** 2220 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 645.4 | 176.1 | 243.5 | 0.0   | 242.7 | 629.0 | 639.8 | 636.6 | 605.2 | 648.5 | 496.8 | 648.4 | 5612.1 |
| <b>EAF (%)</b>  | 99.9  | 25.2  | 37.2  | -0.1  | 36.4  | 100.0 | 97.9  | 97.7  | 95.4  | 99.5  | 78.8  | 99.8  | 72.7   |
| <b>UCF (%)</b>  | 99.9  | 25.2  | 37.2  | -0.1  | 36.4  | 100.0 | 99.9  | 99.8  | 100.0 | 99.9  | 78.8  | 99.8  | 73.5   |
| <b>LF (%)</b>   | 98.5  | 29.7  | 37.2  | 0.0   | 37.0  | 99.2  | 97.6  | 97.1  | 95.4  | 98.8  | 78.3  | 98.9  | 72.7   |
| <b>OF (%)</b>   | 100.0 | 31.5  | 39.1  | 0.0   | 39.5  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 81.0  | 100.0 | 74.7   |
| <b>EUF (%)</b>  | 0.1   | 74.8  | 62.8  | 100.1 | 63.6  | 0.0   | 2.1   | 2.3   | 4.6   | 0.5   | 21.2  | 0.2   | 27.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 61.4  | 100.1 | 60.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 18.6   |
| <b>UCLF (%)</b> | 0.1   | 74.8  | 1.4   | 0.0   | 3.4   | 0.0   | 0.1   | 0.2   | 0.0   | 0.1   | 21.2  | 0.2   | 7.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0   | 2.1   | 4.6   | 0.4   | 0.0   | 0.0   | 0.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1982      **Lifetime Generation:** 78398.6 GW(e).h  
**Date of First Criticality:** 29 Oct 1990      **Cumulative Energy Availability Factor:** 81.6%  
**Date of Grid Connection:** 19 Dec 1990      **Cumulative Load Factor:** 81.2%  
**Date of Commercial Operation:** 14 Nov 1992      **Cumulative Unit Capability Factor:** 80.7%  
**Cumulative Energy Unavailability Factor:** 18.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1991 | 2146.8         | 881.0          | 0.0  | 0.0    | 27.9                              | 100.0  | 27.8               | 0.0    | 2703               | 30.9   |
| 1992 | 974.0          | 881.0          | 0.0  | 0.0    | 99.5                              | 100.0  | 12.6               | 0.0    | 1152               | 13.1   |
| 1993 | 6016.2         | 881.0          | 79.2   | 79.2   | 78.7                              | 78.7   | 78.0               | 78.0   | 7213               | 82.3   |
| 1994 | 6326.6         | 881.0          | 83.5   | 81.3   | 83.1                              | 80.9   | 82.0               | 80.0   | 7446               | 85.0   |
| 1995 | 6853.3         | 881.0          | 90.7   | 84.4   | 89.7                              | 83.9   | 88.8               | 82.9   | 8046               | 91.8   |
| 1996 | 5745.3         | 881.0          | 75.7   | 82.2   | 75.0                              | 81.6   | 74.2               | 80.7   | 6827               | 77.7   |
| 1997 | 4765.1         | 881.0          | 63.0   | 78.4   | 62.3                              | 77.8   | 61.7               | 76.9   | 7236               | 82.6   |
| 1998 | 6427.5         | 881.0          | 84.3   | 79.4   | 83.3                              | 78.7   | 83.3               | 78.0   | 7717               | 88.1   |
| 1999 | 7175.1         | 881.0          | 94.3   | 81.5   | 93.0                              | 80.7   | 93.0               | 80.1   | 8705               | 99.4   |
| 2000 | 6280.6         | 881.0          | 82.0   | 81.6   | 81.2                              | 80.8   | 81.2               | 80.3   | 7615               | 86.7   |
| 2001 | 6980.8         | 881.0          | 91.2   | 82.6   | 90.5                              | 81.9   | 90.5               | 81.4   | 8502               | 97.1   |
| 2002 | 6532.9         | 881.0          | 85.5   | 82.9   | 84.7                              | 82.1   | 84.6               | 81.7   | 7887               | 90.0   |
| 2003 | 6562.4         | 881.0          | 87.5   | 83.3   | 85.1                              | 82.4   | 85.0               | 82.0   | 7846               | 89.6   |
| 2004 | 5612.1         | 881.0          | 73.5   | 82.5   | 72.7                              | 81.6   | 72.7               | 81.2   | 6540               | 74.7   |

# CA-22 DARLINGTON-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 07 Jan | 95.0   | 1.6     | UP2  | A12  | NOPS  |
| 09 Jan | 4.0    | 0.0     | XP   | J    | EMERGENCY REDUCTION FOR SYSTEM LIMITS   |
| 06 Feb | 484.0  | 426.6   | UF2  | A21  | FORCED OUTAGE - REPAIR OF FUEL HANDLING TROLLEY 1/2                                     |
| 27 Feb | 50.0   | 16.1    | UP2  | A21  | RUN-UP FOLLOWING FORCED OUTAGE  |
| 01 Mar | 265.0  | 8.2     | UP2  | A31  | 1ST & 2ND REHEAT O/S  |
| 12 Mar | 4.0    | 3.5     | PP   | D31  | UNIT RAMPDOWN   |
| 13 Mar | 1598.0 | 1407.3  | PF   | D    | PLANNED MAINTENANCE OUTAGE  |
| 18 May | 25.0   | 22.0    | UF3  | Z    | FORCED EXTENSION TO PLANNED MAINTENANCE OUTAGE  |
| 19 May | 107.0  | 20.9    | PP   | D    | RUN-UP FROM PLANNED MAINTENANCE OUTAGE - SYNC OPEN                                      |
| 12 Jul | 212.0  | 2.0     | UP2  | A31  | 2ND STAGE REHEAT P1 O/S   |
| 12 Jul | 1680.0 | 58.5    | XP   | N    | HIGH LAKE WATER TEMPERATURE   |
| 01 Oct | 24.0   | 0.6     | UP2  | A12  | REPLACEMENT OF RTD POWER SUPPLY   |
| 08 Nov | 137.0  | 121.1   | UF2  | A15  | FORCED OUTAGE - DEFICIENCY IN STEAM PROTECTION SYSTEM                                   |
| 13 Nov | 48.0   | 12.5    | UP2  | A15  | SYNC TO GRID  |
| 18 Nov | 42.0   | 0.7     | UP2  | A32  | CD2B - 71140-MV9 ISOLATED   |
| 02 Dec | 39.0   | 1.1     | UP2  | A12  | RX POWER REDUCED TO 97.5% FP PER OM63700-5.1.11 FOR FINCH RTD BRIDGE PANEL MAINTENANCE. |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1991 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                              |                 | 621       |          |  | 636       |          |
| D. Inspection, maintenance or repair without refuelling | 1598            |           |          | 598                                      |           |          |
| J. Grid failure or grid unavailability                  |                 |           |          |  |           | 5        |
| Z. Others   |                 | 25        |          |  |           |          |
| Subtotal  | 1598            | 646       | 0        | 598                                      | 636       | 5        |
| Total   |                 | 2244      |          |  | 1239      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1991 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 19                                       |
| 12. Reactor I&C Systems                  |                 | 54                                       |
| 14. Safety Systems                       |                 | 27                                       |
| 15. Reactor Cooling Systems              | 137             | 349                                      |
| 21. Fuel Handling and Storage Facilities | 484             |  |
| 31. Turbine and auxiliaries              |                 | 17                                       |
| 32. Feedwater and Main Steam System      |                 | 2  |
| 35. All other I&C Systems                |                 | 46                                       |
| 41. Main Generator Systems               |                 | 83                                       |
| 42. Electrical Power Supply Systems      |                 | 15                                       |
| XX. Miscellaneous Systems                |                 | 9  |
| Total                                    | 621             | 621                                      |

## CA-23 DARLINGTON-2

**Operator:** OPG (ONTARIO POWER GENERATION)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

### 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 881.0 MW(e)  
**Design Net RUP:** 881.0 MW(e)  
**Design Discharge Burnup:** 7790 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7038.4 GW(e).h  
**Energy Availability Factor:** 91.4%  
**Load Factor:** 91.0%  
**Operating Factor:** 99.5%  
**Energy Unavailability Factor:** 8.6%  
**Total Off-line Time:** 47 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 563.6 | 298.4 | 474.0 | 632.7 | 640.2 | 629.0 | 629.6 | 637.6 | 604.4 | 647.8 | 627.8 | 653.1 | 7038.4 |
| <b>EAF (%)</b>  | 86.5  | 48.7  | 72.7  | 100.0 | 98.0  | 100.0 | 97.0  | 97.6  | 95.3  | 99.6  | 100.0 | 100.0 | 91.4   |
| <b>UCF (%)</b>  | 88.6  | 70.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 96.7   |
| <b>LF (%)</b>   | 86.0  | 48.7  | 72.3  | 99.7  | 97.7  | 99.2  | 96.1  | 97.3  | 95.3  | 98.8  | 99.0  | 99.6  | 91.0   |
| <b>OF (%)</b>   | 100.0 | 93.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.5   |
| <b>EUF (%)</b>  | 13.5  | 51.3  | 27.3  | 0.0   | 2.0   | 0.0   | 3.0   | 2.4   | 4.7   | 0.4   | 0.0   | 0.0   | 8.6    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 11.5  | 29.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 3.3    |
| <b>XUF (%)</b>  | 2.1   | 22.2  | 27.3  | 0.0   | 2.0   | 0.0   | 3.0   | 2.4   | 4.6   | 0.4   | 0.0   | 0.0   | 5.3    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Sep 1981  
**Date of First Criticality:** 05 Nov 1989  
**Date of Grid Connection:** 15 Jan 1990  
**Date of Commercial Operation:** 09 Oct 1990

**Lifetime Generation:** 79785.5 GW(e).h  
**Cumulative Energy Availability Factor:** 73.0%  
**Cumulative Load Factor:** 72.7%  
**Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 27.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 1153.5         | 881.0          | 0.0  | 0.0    | 91.8                              | 100.0  | 15.3               | 0.0    | 1608               | 18.8   |
| 1991 | 51.5           | 881.0          | 0.7  | 0.7    | 0.7                               | 0.7    | 0.7                | 0.7    | 102                | 1.2    |
| 1992 | 1290.2         | 881.0          | 16.7   | 8.7    | 16.7                              | 8.7    | 16.7               | 8.7    | 2418               | 27.5   |
| 1993 | 6370.2         | 881.0          | 83.3   | 33.5   | 82.7                              | 33.3   | 82.5               | 33.3   | 7594               | 86.7   |
| 1994 | 6750.8         | 881.0          | 88.9   | 47.4   | 88.5                              | 47.1   | 87.5               | 46.8   | 8069               | 92.1   |
| 1995 | 6953.0         | 881.0          | 91.3   | 56.1   | 90.7                              | 55.8   | 90.1               | 55.5   | 8104               | 92.5   |
| 1996 | 6705.7         | 881.0          | 87.8   | 61.4   | 87.2                              | 61.1   | 86.7               | 60.7   | 7752               | 88.3   |
| 1997 | 4710.4         | 881.0          | 61.7   | 61.5   | 61.5                              | 61.1   | 61.0               | 60.7   | 7069               | 80.7   |
| 1998 | 6227.9         | 881.0          | 81.9   | 64.0   | 80.7                              | 63.6   | 80.7               | 63.2   | 7492               | 85.5   |
| 1999 | 6469.1         | 881.0          | 85.1   | 66.4   | 83.8                              | 65.8   | 83.8               | 65.5   | 7824               | 89.3   |
| 2000 | 6885.4         | 881.0          | 90.1   | 68.8   | 89.0                              | 68.1   | 89.0               | 67.9   | 8221               | 93.6   |
| 2001 | 5826.4         | 881.0          | 76.3   | 69.4   | 75.5                              | 68.8   | 75.5               | 68.6   | 7030               | 80.3   |
| 2002 | 7268.9         | 881.0          | 95.4   | 71.6   | 94.2                              | 70.9   | 94.2               | 70.7   | 8627               | 98.5   |
| 2003 | 6084.1         | 881.0          | 81.6   | 72.4   | 79.3                              | 71.6   | 78.8               | 71.3   | 7245               | 82.7   |
| 2004 | 7038.4         | 881.0          | 96.7   | 74.1   | 91.4                              | 73.0   | 91.0               | 72.7   | 8737               | 99.5   |

## CA-23 DARLINGTON-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 09 Jan | 88.0   | 26.7    | XP   | J    | EMERGENCY MW REDUCTION REQUESTED BY IMO  |
| 24 Jan | 343.0  | 139.6   | UP2  | A21  | UNIT DERATED TO 59% DUE TO FUELLING PROBLEMS RELATED TO THE TROLLEY 1/2 POWER TRACK EVENT. |
| 07 Feb | 47.0   | 41.0    | UF2  | A12  | LEVEL 1 IMPAIRMENT OF SDS2 - UNIT SHUTDOWN FROM 59% REACTOR POWER                          |
| 09 Feb | 9.0    | 5.9     | UP2  | A12  | RUN-UP FOLLOWING FORCED OUTAGE   |
| 10 Feb | 120.0  | 11.6    | UP2  | A32  | UNIT DERATED 49% - FRF DRAIN LINE CRACK  |
| 10 Feb | 137.0  | 55.3    | UP2  | A21  | UNIT DERATED TO 59% DUE TO FUELLING PROBLEMS RELATED TO THE TROLLEY 1/2 POWER TRACK EVENT. |
| 15 Feb | 816.0  | 315.6   | UP2  | A21  | UNIT DERATED DUE TO FM TROLLEY INCIDENT  |
| 12 Jul | 1694.0 | 50.0    | XP   | N    | HIGH LAKE WATER TEMPERATURE  |
| 12 Jul | 1296.0 | 17.2    | XP   | T    | UNIT SUPPLYING BUILDING HEAT AND PROCESS STEAM   |
| 05 Sep | 24.0   | 0.7     | UP2  | A42  | BU16 TRIP ON T16 LV WINDING GROUND FAULT   |
| 07 Sep | 5.0    | 0.1     | UP2  | A12  | NOP'S  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 47        |          |  | 886       |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 455                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 436       |          |
| Subtotal   | 0               | 47        | 0        | 455                                      | 1322      | 5        |
| Total  |                 | 47        |          |  | 1782      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1990 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 42                                       |
| 12. Reactor I&C Systems                        | 47              | 47                                       |
| 13. Reactor Auxiliary Systems                  |                 | 2  |
| 14. Safety Systems                             |                 | 15                                       |
| 15. Reactor Cooling Systems                    |                 | 566                                      |
| 16. Steam generation systems                   |                 | 83                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 21. Fuel Handling and Storage Facilities       |                 | 3  |
| 31. Turbine and auxiliaries                    |                 | 28                                       |
| 32. Feedwater and Main Steam System            |                 | 10                                       |
| 35. All other I&C Systems                      |                 | 21                                       |
| 41. Main Generator Systems                     |                 | 12                                       |
| 42. Electrical Power Supply Systems            |                 | 7  |
| XX. Miscellaneous Systems                      |                 | 11                                       |
| Total  | 47              | 850                                      |

# CA-24 DARLINGTON-3

**Operator:** OPG (ONTARIO POWER GENERATION)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 881.0 MW(e)  
**Design Net RUP:** 881.0 MW(e)  
**Design Discharge Burnup:** 6833 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6601.6 GW(e).h  
**Energy Availability Factor:** 85.6%  
**Load Factor:** 85.3%  
**Operating Factor:** 87.1%  
**Energy Unavailability Factor:** 14.4%  
**Total Off-line Time:** 1135 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 645.7 | 606.1 | 649.3 | 631.4 | 629.9 | 630.0 | 616.7 | 633.7 | 605.8 | 18.5 | 280.1 | 654.4 | 6601.6 |
| <b>EAF (%)</b>  | 98.5  | 99.4  | 100.0 | 100.0 | 96.7  | 99.3  | 94.9  | 96.8  | 95.6  | 2.8  | 43.8  | 100.0 | 85.6   |
| <b>UCF (%)</b>  | 99.9  | 99.9  | 100.0 | 100.0 | 99.5  | 99.8  | 97.9  | 99.7  | 100.0 | 2.9  | 43.8  | 100.0 | 86.9   |
| <b>LF (%)</b>   | 98.5  | 98.8  | 99.1  | 99.5  | 96.1  | 99.3  | 94.1  | 96.7  | 95.5  | 2.8  | 44.1  | 99.8  | 85.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 97.3  | 100.0 | 99.1  | 100.0 | 100.0 | 3.2  | 46.1  | 100.0 | 87.1   |
| <b>EUF (%)</b>  | 1.5   | 0.6   | 0.0   | 0.0   | 3.3   | 0.7   | 5.1   | 3.2   | 4.4   | 97.2 | 56.2  | 0.0   | 14.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 97.1 | 2.3   | 0.0   | 8.4    |
| <b>UCLF (%)</b> | 0.1   | 0.1   | 0.0   | 0.0   | 0.5   | 0.2   | 2.2   | 0.3   | 0.0   | 0.0  | 53.9  | 0.0   | 4.7    |
| <b>XUF (%)</b>  | 1.3   | 0.5   | 0.0   | 0.0   | 2.8   | 0.4   | 2.9   | 2.9   | 4.4   | 0.1  | 0.0   | 0.0   | 1.3    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1984  
**Date of First Criticality:** 09 Nov 1992  
**Date of Grid Connection:** 07 Dec 1992  
**Date of Commercial Operation:** 14 Feb 1993

**Lifetime Generation:** 76765.3 GW(e).h  
**Cumulative Energy Availability Factor:** 83.6%  
**Cumulative Load Factor:** 83.3%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 16.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 6003.4         | 881.0          | 0.0  | 0.0    | 90.2                              | 100.0  | 77.8               | 0.0    | 7141               | 81.5   |
| 1994 | 6528.5         | 881.0          | 85.6   | 85.6   | 85.3                              | 85.3   | 84.6               | 84.6   | 7642               | 87.2   |
| 1995 | 7061.5         | 881.0          | 92.9   | 89.3   | 92.2                              | 88.7   | 91.5               | 88.0   | 8219               | 93.8   |
| 1996 | 7391.6         | 881.0          | 97.3   | 92.0   | 96.7                              | 91.4   | 95.5               | 90.5   | 8574               | 97.6   |
| 1997 | 4010.8         | 881.0          | 52.4   | 82.1   | 52.1                              | 81.6   | 52.0               | 80.9   | 6314               | 72.1   |
| 1998 | 7244.9         | 881.0          | 94.7   | 84.6   | 93.9                              | 84.0   | 93.9               | 83.5   | 8593               | 98.1   |
| 1999 | 5629.1         | 881.0          | 75.1   | 83.0   | 72.9                              | 82.2   | 72.9               | 81.7   | 6929               | 79.1   |
| 2000 | 6517.0         | 881.0          | 85.1   | 83.3   | 84.2                              | 82.5   | 84.2               | 82.1   | 7822               | 89.0   |
| 2001 | 6578.0         | 881.0          | 86.3   | 83.7   | 85.2                              | 82.8   | 85.2               | 82.5   | 7901               | 90.2   |
| 2002 | 6371.8         | 881.0          | 83.7   | 83.7   | 82.6                              | 82.8   | 82.6               | 82.5   | 7595               | 86.7   |
| 2003 | 6827.2         | 881.0          | 89.5   | 84.3   | 88.6                              | 83.4   | 88.5               | 83.1   | 8004               | 91.4   |
| 2004 | 6601.6         | 881.0          | 86.9   | 84.5   | 85.6                              | 83.6   | 85.3               | 83.3   | 7649               | 87.1   |

## CA-24 DARLINGTON-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1085.0 | 14.9    | XP   | T    | UNIT SUPPLYING BUILDING HEAT AND TRF PROCESS STEAM                                     |
| 03 Jan | 111.0  | 3.2     | UP2  | A12  | NOPS   |
| 09 Jan | 34.0   | 17.3    | XP   | J    | EMERGENCY REDUCTION FOR SYSTEM LIMITS  |
| 24 May | 109.0  | 2.4     | UP2  | A32  | 48200-P2 O/S FEEDWATER DRAINS  |
| 01 Jun | 76.0   | 0.9     | UP2  | A31  | CONDENSER CD3 EAST O/S   |
| 01 Jun | 102.0  | 2.3     | UP2  | A32  | 2ND STAGE REHEAT PUMP1 O/S   |
| 12 Jul | 1715.0 | 66.8    | XP   | N    | HIGH LAKE WATER TEMPERATURE  |
| 15 Jul | 7.0    | 6.5     | UF2  | A31  | SUDDEN OUTAGE - MOT ALARM (HIGH GAS IN OIL ALARM) SYNC OPEN                            |
| 15 Jul | 55.0   | 4.3     | UP2  | A31  | DERATE TO 59% DUE TO MOT ALARM (HIGH GAS IN OIL ALARM)                                 |
| 01 Oct | 3.0    | 2.1     | PP   | D    | UNIT RAMPDOWN TO PLANNED OUTAGE  |
| 02 Oct | 198.0  | 174.4   | PF   | D    | PLANNED MAINTENANCE OUTAGE.  |
| 10 Oct | 89.0   | 78.4    | PF   | D15  | REPLACEMENT OF PV33/PV34 BELLOWS.  |
| 13 Oct | 433.0  | 381.5   | PF   | D    | PLANNED MAINTENANCE OUTAGE.  |
| 01 Nov | 120.0  | 105.7   | UF3  | A15  | FORCED EXTENSION TO PLANNED MAINTENANCE OUTAGE - DEFICIENCY IN STEAM PROTECTION SYSTEM |
| 05 Nov | 144.0  | 126.9   | UF3  | E    | FORCED EXTENSION TO PLANNED MAINTENANCE OUTAGE - CV7 & CV8 STRESS ANALYSIS             |
| 11 Nov | 124.0  | 109.4   | UF3  | A15  | FORCED EXTENSION TO PLANNED MAINTENANCE OUTAGE - MV1 - PRESSURIZER                     |
| 17 Nov | 90.0   | 14.5    | PP   | D    | RUN-UP   |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1993 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                              |                 | 251       |          |  | 282       |          |
| B. Refuelling without a maintenance                     |                 |           |          |  | 7         |          |
| D. Inspection, maintenance or repair without refuelling | 720             |           |          | 591                                      |           |          |
| E. Testing of plant systems or components               |                 | 144       |          |  |           |          |
| Subtotal  | 720             | 395       | 0        | 591                                      | 289       | 0        |
| Total   |                 | 1115      |          |  | 880       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1993 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 30                                       |
| 13. Reactor Auxiliary Systems                  |                 | 15                                       |
| 14. Safety Systems                             |                 | 6  |
| 15. Reactor Cooling Systems                    | 244             | 69                                       |
| 16. Steam generation systems                   |                 | 27                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 31. Turbine and auxiliaries                    | 7               | 63                                       |
| 35. All other I&C Systems                      |                 | 44                                       |
| 42. Electrical Power Supply Systems            |                 | 14                                       |
| XX. Miscellaneous Systems                      |                 | 8  |
| Total  | 251             | 279                                      |

# CA-25 DARLINGTON-4

**Operator:** OPG (ONTARIO POWER GENERATION)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 881.0 MW(e)  
**Design Net RUP:** 881.0 MW(e)  
**Design Discharge Burnup:** 6833 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7321.1 GW(e).h  
**Energy Availability Factor:** 94.6%  
**Load Factor:** 94.6%  
**Operating Factor:** 96.2%  
**Energy Unavailability Factor:** 5.4%  
**Total Off-line Time:** 333 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 644.1 | 615.4 | 659.8 | 637.2 | 656.6 | 634.1 | 549.2 | 586.3 | 603.2 | 648.1 | 432.5 | 654.4 | 7321.1 |
| <b>EAF (%)</b>  | 98.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.9  | 90.0  | 95.1  | 99.5  | 68.5  | 99.8  | 94.6   |
| <b>UCF (%)</b>  | 98.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 85.2  | 91.7  | 99.6  | 99.9  | 68.5  | 99.8  | 95.3   |
| <b>LF (%)</b>   | 98.3  | 100.4 | 100.7 | 100.5 | 100.2 | 100.0 | 83.8  | 89.5  | 95.1  | 98.9  | 68.2  | 99.8  | 94.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 85.3  | 94.0  | 100.0 | 100.0 | 75.1  | 100.0 | 96.2   |
| <b>EUF (%)</b>  | 1.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.1  | 10.0  | 4.9   | 0.5   | 31.5  | 0.2   | 5.4    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 1.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 14.9  | 8.3   | 0.4   | 0.1   | 31.5  | 0.2   | 4.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.3   | 1.7   | 4.5   | 0.4   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1985  
**Date of First Criticality:** 13 Mar 1993  
**Date of Grid Connection:** 17 Apr 1993  
**Date of Commercial Operation:** 14 Jun 1993

**Lifetime Generation:** 75241.2 GW(e).h  
**Cumulative Energy Availability Factor:** 84.5%  
**Cumulative Load Factor:** 84.4%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 15.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 3528.8         | 881.0          | 0.0  | 0.0    | 78.6                              | 100.0  | 45.7               | 0.0    | 4447               | 50.8   |
| 1994 | 7038.7         | 881.0          | 92.2   | 92.2   | 91.8                              | 91.8   | 91.2               | 91.2   | 8143               | 93.0   |
| 1995 | 6750.6         | 881.0          | 88.1   | 90.2   | 87.7                              | 89.8   | 87.5               | 89.3   | 7751               | 88.5   |
| 1996 | 6105.4         | 881.0          | 79.4   | 86.6   | 79.1                              | 86.2   | 78.9               | 85.8   | 7023               | 80.0   |
| 1997 | 5069.6         | 881.0          | 66.0   | 81.4   | 65.7                              | 81.1   | 65.7               | 80.8   | 7428               | 84.8   |
| 1998 | 6520.9         | 881.0          | 85.3   | 82.2   | 84.5                              | 81.8   | 84.5               | 81.5   | 7699               | 87.9   |
| 1999 | 6216.1         | 881.0          | 81.6   | 82.1   | 80.5                              | 81.6   | 80.5               | 81.4   | 7431               | 84.8   |
| 2000 | 6975.0         | 881.0          | 90.8   | 83.3   | 90.1                              | 82.8   | 90.1               | 82.6   | 8219               | 93.6   |
| 2001 | 6836.3         | 881.0          | 89.6   | 84.1   | 88.6                              | 83.5   | 88.6               | 83.4   | 8037               | 91.7   |
| 2002 | 7449.8         | 881.0          | 97.3   | 85.6   | 96.5                              | 85.0   | 96.5               | 84.8   | 8760               | 100.0  |
| 2003 | 5428.9         | 881.0          | 72.3   | 84.3   | 70.6                              | 83.5   | 70.3               | 83.4   | 6320               | 72.1   |
| 2004 | 7321.1         | 881.0          | 95.3   | 85.3   | 94.6                              | 84.5   | 94.6               | 84.4   | 8451               | 96.2   |



## CA-25 DARLINGTON-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 04 Jan | 40.0   | 10.9    | UP2  | A13  | UNIT TRANSIENT - STEPBACK/SETBACK WHILE SWAPPING LIQUID ZONE PUMP DUTY      |
| 09 Jan | 4.0    | 0.1     | XP   | J    | EMERGENCY REDUCTION FOR SYSTEM LIMITS                                       |
| 15 Jan | 34.0   | 0.5     | UP2  | A12  | UNIT DERATED DUE TO REACTOR POWER CONTROL FLUCTUATIONS                      |
| 12 Jul | 1462.0 | 50.2    | XP   | N    | HIGH LAKE WATER TEMPERATURE   |
| 15 Jul | 67.0   | 10.7    | UP2  | A11  | DERATE - MODERATOR TCV13-2  |
| 27 Jul | 154.0  | 135.7   | UF2  | A33  | UNIT TRANSIENT DUE TO DUAL CCW SCREENWASH PUMP FAILURE - TURBINE TRIP       |
| 02 Aug | 78.0   | 35.3    | UP2  | A31  | TURBINE TRIP OCCURRED ON MSR DRAIN TANK LEVEL DURING LOADING OF THE TURBINE |
| 04 Aug | 302.0  | 3.3     | UP2  | A    | CSDVS PASSING   |
| 02 Sep | 21.0   | 0.3     | UP2  | A12  | REACTOR POWER REDUCED TO CLEAR ALARMS ON HIGH ZONE FLUX.                    |
| 14 Sep | 43.0   | 0.3     | UP2  | A32  | 2ND STAGE REHEAT PUMP 4   |
| 19 Sep | 118.0  | 1.5     | UP2  | A16  | BOILER BLOWDOWN.  |
| 26 Sep | 44.0   | 1.4     | UP2  | A31  | CONDENSER CD3W O/S.   |
| 08 Nov | 179.0  | 157.7   | UF2  | A14  | SAFETY SYSTEM FAILURE   |
| 15 Nov | 46.0   | 42.0    | UP2  | A14  | RUN-UP  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1993 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                              |                 | 333       |          |  | 334       |          |
| D. Inspection, maintenance or repair without refuelling |                 |           |          | 616                                      |           |          |
| E. Testing of plant systems or components               |                 |           |          | 28                                       | 4         |          |
| J. Grid failure or grid unavailability                  |                 |           |          |  |           | 7        |
| Z. Others   |                 |           |          |  | 23        |          |
| Subtotal  | 0               | 333       | 0        | 644                                      | 361       | 7        |
| Total   |                 | 333       |          |  | 1012      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1993 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 51                                       |
| 13. Reactor Auxiliary Systems       |                 | 16                                       |
| 14. Safety Systems                  | 179             | 13                                       |
| 15. Reactor Cooling Systems         |                 | 141                                      |
| 16. Steam generation systems        |                 | 6  |
| 31. Turbine and auxiliaries         |                 | 50                                       |
| 32. Feedwater and Main Steam System |                 | 8  |
| 33. Circulating Water System        | 154             |  |
| 42. Electrical Power Supply Systems |                 | 34                                       |
| XX. Miscellaneous Systems           |                 | 12                                       |
| Total                               | 333             | 331                                      |

# CA-12 GENTILLY-2

**Operator:** HQ (HYDRO QUEBEC)  
**Contractor:** BBC (BROWN BOVERI ET CIE)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 635.0 MW(e)  
**Design Net RUP:** 645.0 MW(e)  
**Design Discharge Burnup:** 8000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4875.4 GW(e).h  
**Energy Availability Factor:** 89.2%  
**Load Factor:** 87.4%  
**Operating Factor:** 90.0%  
**Energy Unavailability Factor:** 10.8%  
**Total Off-line Time:** 879 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 465.8 | 437.7 | 467.8 | 448.7 | 102.7 | 442.2 | 455.3 | 454.6 | 441.5 | 460.7 | 444.9 | 253.5 | 4875.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 18.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 53.9  | 89.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 18.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 53.9  | 89.2   |
| <b>LF (%)</b>   | 98.6  | 99.0  | 99.0  | 98.3  | 21.7  | 96.7  | 96.4  | 96.2  | 96.6  | 97.4  | 97.3  | 53.7  | 87.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 24.5  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 57.4  | 90.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 81.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 46.1  | 10.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 81.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 46.1  | 10.8   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

- FORCED OUTAGE DUE TO INTERNAL GENERATOR STATOR COOLING LEAK IN MAY.- FORCED OUTAGE IN DECEMBER FOR PRESSURE TUBES (FUEL CHANNEL) INSPECTION AND SLAR.- GENTILLY 2 QUALITY MANAGEMENT SYSTEM CERTIFIED ISO 9001 : 2000

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1974      **Lifetime Generation:** 93146.8 GW(e).h  
**Date of First Criticality:** 11 Sep 1982      **Cumulative Energy Availability Factor:** 81.5%  
**Date of Grid Connection:** 04 Dec 1982      **Cumulative Load Factor:** 78.4%  
**Date of Commercial Operation:** 01 Oct 1983      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 18.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 3426.0         | 645.0          | 76.5   | 76.5   | 67.8                              | 67.8   | 60.5               | 60.5   | 6742               | 76.8   |
| 1985 | 3189.4         | 645.0          | 72.7   | 74.6   | 71.1                              | 69.5   | 56.4               | 58.5   | 6347               | 72.5   |
| 1986 | 3792.1         | 645.0          | 85.8   | 78.3   | 85.8                              | 74.9   | 67.1               | 61.3   | 7488               | 85.5   |
| 1987 | 4658.5         | 640.0          | 86.3   | 80.3   | 85.5                              | 77.5   | 83.1               | 66.7   | 7654               | 87.4   |
| 1988 | 5283.6         | 640.0          | 96.0   | 83.5   | 95.3                              | 81.1   | 94.0               | 72.2   | 8372               | 95.3   |
| 1989 | 4870.3         | 640.0          | 90.0   | 84.5   | 89.5                              | 82.5   | 86.9               | 74.6   | 7722               | 88.2   |
| 1990 | 4080.6         | 640.0          | 90.4   | 85.4   | 72.9                              | 81.1   | 72.8               | 74.4   | 7748               | 88.4   |
| 1991 | 3925.5         | 640.0          | 71.4   | 83.6   | 69.9                              | 79.7   | 70.0               | 73.8   | 6317               | 72.1   |
| 1993 | 5154.9         | 685.0          | 88.3   | 84.2   | 87.8                              | 80.7   | 85.9               | 75.2   | 7731               | 88.3   |
| 1994 | 5405.5         | 635.0          | 98.3   | 85.6   | 98.3                              | 82.4   | 97.2               | 77.4   | 8634               | 98.6   |
| 1995 | 4519.0         | 635.0          | 81.7   | 85.2   | 81.7                              | 82.3   | 81.2               | 77.7   | 7229               | 82.5   |
| 1996 | 5242.0         | 635.0          | 93.7   | 85.9   | 93.7                              | 83.3   | 94.0               | 79.1   | 8289               | 94.4   |
| 1997 | 4217.5         | 635.0          | 76.2   | 85.2   | 76.2                              | 82.7   | 75.8               | 78.8   | 6901               | 78.8   |
| 1998 | 3825.1         | 635.0          | 69.2   | 84.1   | 69.2                              | 81.8   | 68.8               | 78.1   | 6258               | 71.4   |
| 1999 | 3793.3         | 635.0          | 87.7   | 84.3   | 69.0                              | 80.9   | 68.2               | 77.5   | 6132               | 70.0   |
| 2000 | 4886.2         | 635.0          | 89.5   | 84.6   | 89.5                              | 81.5   | 87.6               | 78.1   | 7879               | 89.7   |
| 2001 | 4711.2         | 635.0          | 88.3   | 84.8   | 88.3                              | 81.9   | 84.7               | 78.5   | 7766               | 88.7   |
| 2002 | 4532.3         | 635.0          | 83.3   | 84.8   | 83.3                              | 82.0   | 81.5               | 78.6   | 7366               | 84.1   |
| 2003 | 3567.1         | 635.0          | 65.2   | 83.7   | 65.2                              | 81.1   | 64.1               | 77.9   | 5833               | 66.6   |
| 2004 | 4875.4         | 635.0          | 89.2   | 84.0   | 89.2                              | 81.5   | 87.4               | 78.4   | 7905               | 90.0   |

## CA-12 GENTILLY-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 May | 562.0 | 384.0   | UF2  | A41  | INTERNAL GENERATOR STATOR COOLING LEAK   |
| 04 Dec | 317.0 | 218.0   | UF2  | A11  | FUEL CHANNEL (PRESSURE TUBE) INSPECTION AND SLAR (SPACER LOCATION AND REPOSITIONING) |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 879       |          |   | 197       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 25        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 855   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 5         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 24        |          |
| J. Grid failure or grid unavailability   |                 |           |          | 1   | 1         | 4        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 81       |
| Z. Others  |                 |           |          |   | 65        |          |
| Subtotal   | 0               | 879       | 0        | 856   | 317       | 85       |
| Total  |                 | 879       |          |   | 1258      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1983 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    | 317                | 29  |
| 12. Reactor I&C Systems                        |                    | 7   |
| 13. Reactor Auxiliary Systems                  |                    | 5   |
| 15. Reactor Cooling Systems                    |                    | 31  |
| 16. Steam generation systems                   |                    | 2   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 42  |
| 32. Feedwater and Main Steam System            |                    | 9   |
| 41. Main Generator Systems                     | 562                | 33  |
| 42. Electrical Power Supply Systems            |                    | 3   |
| XX. Miscellaneous Systems                      |                    | 9   |
| Total  | 879                | 172   |

## CA-7 PICKERING-4

**Operator:** OPG (ONTARIO POWER GENERATION)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

### 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 515.0 MW(e)  
**Design Net RUP:** 508.0 MW(e)  
**Design Discharge Burnup:** 8080 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 3266.8 GW(e).h  
**Energy Availability Factor:** 72.1%  
**Load Factor:** 72.2%  
**Operating Factor:** 76.7%  
**Energy Unavailability Factor:** 27.9%  
**Total Off-line Time:** 2045 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec  | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|------|--------|
| <b>GW(e).h</b>  | 347.8 | 363.9 | 343.2 | 194.2 | 58.6 | 356.0 | 243.0 | 322.4 | 318.3 | 358.5 | 263.8 | 97.0 | 3266.8 |
| <b>EAF (%)</b>  | 90.8  | 100.0 | 89.7  | 52.0  | 15.3 | 96.1  | 63.8  | 83.8  | 85.9  | 93.9  | 71.1  | 25.2 | 72.1   |
| <b>UCF (%)</b>  | 90.8  | 100.0 | 89.7  | 52.0  | 15.3 | 96.1  | 63.8  | 83.8  | 85.9  | 94.8  | 82.9  | 53.9 | 75.6   |
| <b>LF (%)</b>   | 90.8  | 101.5 | 89.6  | 52.4  | 15.3 | 96.0  | 63.4  | 84.1  | 85.8  | 93.6  | 71.1  | 25.3 | 72.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 93.1  | 52.1  | 24.3 | 100.0 | 64.2  | 86.0  | 91.0  | 100.0 | 82.9  | 29.0 | 76.7   |
| <b>EUF (%)</b>  | 9.2   | 0.0   | 10.3  | 48.0  | 84.7 | 3.9   | 36.2  | 16.2  | 14.1  | 6.1   | 28.9  | 74.8 | 27.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 48.0  | 22.1 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 5.8    |
| <b>UCLF (%)</b> | 9.2   | 0.0   | 10.3  | 0.0   | 62.6 | 3.9   | 36.2  | 16.2  | 14.1  | 5.2   | 17.1  | 46.1 | 18.6   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.9   | 11.8  | 28.8 | 3.5    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 May 1968  
**Date of First Criticality:** 16 May 1973  
**Date of Grid Connection:** 21 May 1973  
**Date of Commercial Operation:** 17 Jun 1973

**Lifetime Generation:** 77650.6 GW(e).h  
**Cumulative Energy Availability Factor:** 66.4%  
**Cumulative Load Factor:** 66.2%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 33.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1978 | 4033.9         | 515.0          | 89.9   | 73.5   | 89.9                              | 73.5   | 89.7               | 73.7   | 7876               | 90.2   |
| 1979 | 4102.2         | 515.0          | 91.0   | 76.4   | 91.0                              | 76.4   | 89.9               | 76.4   | 8059               | 91.0   |
| 1980 | 3700.5         | 515.0          | 81.8   | 77.2   | 81.7                              | 77.2   | 81.8               | 77.2   | 7321               | 83.3   |
| 1981 | 4142.0         | 515.0          | 91.7   | 79.0   | 91.7                              | 79.0   | 91.8               | 79.0   | 8078               | 92.2   |
| 1982 | 4137.9         | 515.0          | 91.8   | 80.4   | 91.7                              | 80.4   | 91.7               | 80.4   | 8087               | 92.3   |
| 1983 | 4170.2         | 515.0          | 92.3   | 81.6   | 92.3                              | 81.6   | 92.4               | 81.6   | 8183               | 93.4   |
| 1984 | 3733.3         | 515.0          | 82.8   | 81.7   | 82.7                              | 81.7   | 82.5               | 81.7   | 7425               | 84.5   |
| 1985 | 3438.9         | 515.0          | 83.5   | 81.9   | 77.5                              | 81.4   | 76.2               | 81.3   | 6824               | 77.9   |
| 1986 | 3687.4         | 515.0          | 83.2   | 82.0   | 83.2                              | 81.5   | 81.7               | 81.3   | 7410               | 84.6   |
| 1987 | 3770.4         | 515.0          | 84.3   | 82.1   | 84.0                              | 81.7   | 83.6               | 81.5   | 7495               | 85.6   |
| 1988 | 3166.2         | 515.0          | 70.1   | 81.3   | 70.1                              | 80.9   | 70.0               | 80.7   | 6525               | 74.3   |
| 1989 | 2255.5         | 515.0          | 50.0   | 79.4   | 50.0                              | 79.0   | 50.0               | 78.8   | 5468               | 62.4   |
| 1990 | 1070.8         | 515.0          | 23.7   | 76.1   | 23.7                              | 75.7   | 23.7               | 75.5   | 2851               | 32.5   |
| 1991 | 2130.8         | 515.0          | 47.3   | 74.5   | 47.3                              | 74.1   | 47.2               | 74.0   | 5185               | 59.2   |
| 1992 | 0.0            | 515.0          | 0.0  | 70.6   | 0.0                               | 70.2   | 0.0                | 70.1   | 0                  | 0.0    |
| 1993 | 3309.6         | 515.0          | 74.2   | 70.8   | 73.8                              | 70.4   | 73.4               | 70.2   | 6711               | 76.6   |
| 1994 | 4009.6         | 515.0          | 89.7   | 71.7   | 89.5                              | 71.3   | 88.9               | 71.1   | 7915               | 90.4   |
| 1995 | 2807.0         | 515.0          | 63.8   | 71.3   | 63.3                              | 71.0   | 62.2               | 70.7   | 5684               | 64.9   |
| 1996 | 1134.9         | 515.0          | 25.1   | 69.3   | 25.1                              | 69.0   | 25.1               | 68.7   | 2230               | 25.4   |
| 1997 | 0.0            | 515.0          | 0.0  | 66.4   | 0.0                               | 66.1   | 0.0                | 65.9   | 0                  | 0.0    |
| 2003 | 844.8          | 515.0          | 69.8   | 66.4   | 69.7                              | 66.1   | 69.7               | 65.9   | 1880               | 79.9   |
| 2004 | 3266.8         | 515.0          | 75.6   | 66.8   | 72.1                              | 66.4   | 72.2               | 66.2   | 6739               | 76.7   |

# CA-7 PICKERING-4

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 704.0 | 27.1    | UP2  | A21  | FUELING EXPERIENCE   |
| 27 Jan | 421.0 | 18.3    | UP2  | A11  | RX POWER REDUCTION ON MODERATOR LEVEL SETBACK  |
| 17 Mar | 51.0  | 26.5    | UF2  | A12  | FOLLOWING FAILURE OF THE POWER SUPPLY TO THE ADJUSTER RODS                             |
| 20 Mar | 186.0 | 12.9    | UP2  | A12  | RAMP-UP FOLLOWING FORCED OUTAGE  |
| 16 Apr | 4.0   | 0.1     | PP   | D    | RAMP-DOWN IN PREPARATION FOR PLANNED OUTAGE  |
| 16 Apr | 504.0 | 0.3     | PF   | D13  | LIQUID ZONE CONTROL ENVIRONMENTAL QUALIFICATION IS THE CRITICAL PATH                   |
| 07 May | 93.0  | 47.8    | UF2  | A15  | COOLING PUMP 1 SEAL REPAIRS DUE TO DEGRADATION OF THE PUMP MECHANICAL SEALS.           |
| 11 May | 13.0  | 3.1     | PP   | D15  | RAMP-UP FOLLOWING FEPO   |
| 12 May | 38.0  | 2.1     | UP2  | A15  | RAMP-UP FOLLOWING FEPO   |
| 13 May | 311.0 | 160.4   | UF2  | A15  | FOLLOWING RAMP-UP FROM THE PUMP SEAL FEPO  |
| 26 May | 470.0 | 45.5    | UP2  | A15  | RAMP-UP FOLLOWING FO   |
| 20 Jul | 370.0 | 190.4   | UF2  | A12  | ZONE 8 LEVEL INDICATION DID NOT MATCH THE FLUX AS SEEN IN THE MAIN CONTROL ROOM PANEL. |
| 05 Aug | 438.0 | 8.8     | UP2  | A12  | RAMP-UP FOLLOWING FO   |
| 02 Sep | 431.0 | 7.9     | UP2  | A21  | SPECIAL OPERATING INSTRUCTIONS WHEN FUELLING IN ZONE 2                                 |
| 12 Sep | 117.0 | 2.0     | UP2  | A21  | RAMPDOWN FOR FORCED OUTAGE   |
| 17 Sep | 65.0  | 33.6    | UF2  | A34  | REPAIR A SERVICE WATER LEAK DOWNSTREAM   |
| 20 Sep | 177.0 | 12.2    | UP2  | A34  | RAMP-UP FROM FORCED OUTAGE   |
| 16 Oct | 22.0  | 0.3     | UP2  | A21  | FM'S UNAVAILABLE AND LOW AZL   |
| 20 Oct | 236.0 | 14.7    | UP2  | A32  | TURBINE STEAM RELEASE VALVES MV16 & MV17 FAILED TO OPEN                                |
| 29 Oct | 647.0 | 0.0     | XP   | J    | P4 OUTAGE WAS REQUESTED AND REJECTED BY THE IMO  |
| 25 Nov | 123.0 | 63.3    | UF2  | A32  | REPAIR FOUR RELEASE VALVES   |
| 01 Dec | 190.0 | 97.9    | UF2  | A32  | REVIEW OF DNGS'S STEAM BARRIER   |
| 08 Dec | 13.0  | 1.7     | UP2  | A32  | RAMP-UP FOR FORCED OUTAGE.   |
| 09 Dec | 205.4 | 105.8   | XF2  | J    | FAULT IN TRANSMISSION LINE   |
| 18 Dec | 143.0 | 0.0     | XP   | J    | RAMP-UP FROM ABNO.   |
| 23 Dec | 133.0 | 68.5    | UF4  | A11  | REACTOR TRIP DUE TO FAILURE IN MODERATOR SYSTEM.                                       |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1336      |          |  | 814       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| D. Inspection, maintenance or repair without refuelling                              | 504             |           |          | 1185                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          | 69                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           | 205      |  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 8         | 16       |
| Subtotal   | 504             | 1336      | 205      | 1254                                     | 826       | 16       |
| Total  |                 | 2045      |          |  | 2096      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1973 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         | 133             | 46                                       |
| 12. Reactor I&C Systems             | 421             | 25                                       |
| 13. Reactor Auxiliary Systems       |                 | 196                                      |
| 14. Safety Systems                  |                 | 15                                       |
| 15. Reactor Cooling Systems         | 404             | 403                                      |
| 31. Turbine and auxiliaries         |                 | 30                                       |
| 32. Feedwater and Main Steam System | 313             | 22                                       |
| 35. All other I&C Systems           |                 | 3  |
| 41. Main Generator Systems          |                 | 59                                       |
| 42. Electrical Power Supply Systems |                 | 2  |
| XX. Miscellaneous Systems           | 65              |  |
| Total                               | 1336            | 801                                      |

# CA-13 PICKERING-5

**Operator:** OPG (ONTARIO POWER GENERATION)

**Contractor:** OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 516.0 MW(e)  
**Design Net RUP:** 516.0 MW(e)  
**Design Discharge Burnup:** 8420 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4159.8 GW(e).h  
**Energy Availability Factor:** 92.2%  
**Load Factor:** 91.8%  
**Operating Factor:** 94.1%  
**Energy Unavailability Factor:** 7.8%  
**Total Off-line Time:** 520 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 382.8 | 357.6 | 383.3 | 367.6 | 379.3 | 363.6 | 367.8 | 372.8 | 188.0 | 337.2 | 281.3 | 378.4 | 4159.8 |
| <b>EAF (%)</b>  | 100.0 | 99.9  | 99.9  | 99.9  | 99.9  | 98.3  | 96.2  | 97.1  | 50.6  | 88.2  | 75.4  | 99.6  | 92.2   |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 99.9  | 99.9  | 99.9  | 99.3  | 97.5  | 98.5  | 51.9  | 88.4  | 75.5  | 99.6  | 92.6   |
| <b>LF (%)</b>   | 99.7  | 99.6  | 99.9  | 99.0  | 98.8  | 97.9  | 95.8  | 97.1  | 50.6  | 87.8  | 75.7  | 98.6  | 91.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 57.9  | 90.6  | 79.6  | 100.0 | 94.1   |
| <b>EUF (%)</b>  | 0.0   | 0.1   | 0.1   | 0.1   | 0.1   | 1.7   | 3.8   | 2.9   | 49.4  | 11.8  | 24.6  | 0.4   | 7.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 37.7  | 0.0   | 0.0   | 0.0   | 3.1    |
| <b>UCLF (%)</b> | 0.0   | 0.1   | 0.1   | 0.1   | 0.1   | 0.7   | 2.5   | 1.6   | 10.4  | 11.6  | 24.6  | 0.5   | 4.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.0   | 1.4   | 1.4   | 1.3   | 0.2   | 0.0   | 0.0   | 0.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1974  
**Date of First Criticality:** 23 Oct 1982  
**Date of Grid Connection:** 19 Dec 1982  
**Date of Commercial Operation:** 10 May 1983

**Lifetime Generation:** 72662.5 GW(e).h  
**Cumulative Energy Availability Factor:** 73.3%  
**Cumulative Load Factor:** 73.1%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 26.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3202.4         | 516.0          | 0.0  | 0.0    | 71.3                              | 100.0  | 70.8               | 0.0    | 6968               | 79.5   |
| 1984 | 3517.5         | 516.0          | 77.8   | 77.8   | 77.8                              | 77.8   | 77.6               | 77.6   | 7035               | 80.1   |
| 1985 | 3366.5         | 516.0          | 83.1   | 80.4   | 77.7                              | 77.7   | 74.5               | 76.0   | 6989               | 79.8   |
| 1986 | 4068.6         | 516.0          | 91.2   | 84.0   | 90.7                              | 82.1   | 90.0               | 80.7   | 8057               | 92.0   |
| 1987 | 3600.1         | 516.0          | 80.3   | 83.1   | 79.6                              | 81.4   | 79.6               | 80.4   | 7148               | 81.6   |
| 1988 | 4397.2         | 516.0          | 97.5   | 86.0   | 97.5                              | 84.7   | 97.0               | 83.8   | 8683               | 98.9   |
| 1989 | 3400.8         | 516.0          | 75.7   | 84.3   | 75.4                              | 83.1   | 75.2               | 82.3   | 6862               | 78.3   |
| 1990 | 3885.0         | 516.0          | 86.4   | 84.6   | 86.4                              | 83.6   | 85.9               | 82.9   | 7821               | 89.3   |
| 1991 | 2887.1         | 516.0          | 64.6   | 82.1   | 64.4                              | 81.2   | 63.9               | 80.5   | 5724               | 65.3   |
| 1992 | 1345.2         | 516.0          | 29.8   | 76.3   | 29.8                              | 75.5   | 29.7               | 74.8   | 2621               | 29.8   |
| 1993 | 3841.8         | 516.0          | 85.6   | 77.2   | 85.4                              | 76.5   | 85.0               | 75.8   | 8307               | 94.8   |
| 1994 | 3074.4         | 516.0          | 68.5   | 76.4   | 68.5                              | 75.7   | 68.0               | 75.1   | 6196               | 70.7   |
| 1995 | 3372.9         | 516.0          | 75.0   | 76.3   | 74.8                              | 75.7   | 74.6               | 75.1   | 7008               | 80.0   |
| 1996 | 3042.6         | 516.0          | 67.1   | 75.6   | 67.1                              | 75.0   | 67.1               | 74.5   | 6429               | 73.2   |
| 1997 | 3924.9         | 516.0          | 86.8   | 76.4   | 86.8                              | 75.8   | 86.8               | 75.4   | 7908               | 90.3   |
| 1998 | 3490.6         | 516.0          | 77.2   | 76.4   | 77.2                              | 75.9   | 77.2               | 75.5   | 7296               | 83.3   |
| 1999 | 2511.6         | 516.0          | 55.6   | 75.1   | 55.6                              | 74.7   | 55.6               | 74.2   | 5302               | 60.5   |
| 2000 | 2631.5         | 516.0          | 58.1   | 74.1   | 58.0                              | 73.7   | 58.1               | 73.3   | 5457               | 62.1   |
| 2001 | 2980.2         | 516.0          | 66.6   | 73.7   | 65.9                              | 73.2   | 65.9               | 72.9   | 5986               | 68.3   |
| 2002 | 2655.7         | 516.0          | 59.2   | 73.0   | 58.8                              | 72.5   | 58.8               | 72.1   | 5565               | 63.5   |
| 2003 | 3295.0         | 516.0          | 71.1   | 72.9   | 69.1                              | 72.3   | 72.9               | 72.2   | 6566               | 75.0   |
| 2004 | 4159.8         | 516.0          | 92.6   | 73.8   | 92.2                              | 73.3   | 91.8               | 73.1   | 8264               | 94.1   |

# CA-13 PICKERING-5

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 07 Jan | 208.0  | 1.8     | UP2  | A12  | REACTOR POWER LOWERED DUE TO ROP TRIP MARGIN < 6% DURING FUELLING.                 |
| 16 Feb | 17.0   | 0.4     | UP2  | A12  | THE CPU FOR DCCX HAD FAILED AND WAS REPLACED.                                      |
| 20 Feb | 1.0    | 0.0     | UP2  | A12  | REACTOR CONTROL SYSTEM (RCS) FAILURE ON DCCY                                       |
| 10 Mar | 125.0  | 4.3     | UP2  | A32  | LOSS OF REHEAT RETURN FLOW DUE TO FAILED AIRLINE                                   |
| 18 Mar | 109.0  | 2.0     | UP2  | A12  | HIGH TEMPERATURE ABSOLUTE ALARM ON CHANNEL K-10.                                   |
| 01 Jun | 1400.0 | 4.6     | UP2  | Z    | MW OUTPUT LIMITED DUE TO CONDENSER INEFFICIENCIES.                                 |
| 01 Jun | 1891.0 | 14.0    | XP   | N    | MW OUTPUT LIMITED DUE TO HIGH LAKE WATER TEMPERATURE.                              |
| 16 Jul | 1110.0 | 7.8     | UP2  | A32  | TURBINE CYCLE LOSSES THROUGH THE CONDENSATE/FEEDWATER SYSTEMS.                     |
| 23 Jul | 414.0  | 0.0     | XP   | T    | BUILDING HEATING STEAM.  |
| 27 Jul | 49.0   | 1.4     | XP2  | N    | CCW PUMP 1 SHUTDOWN DUE TO SCREENHOUSE ALGAE RUN                                   |
| 28 Jul | 395.0  | 6.6     | UP2  | Z    | THERMAL POWER ERROR IN EFFECT.   |
| 25 Aug | 2.0    | 0.0     | UP2  | A13  | TO RAISE THE SETPOINT ON THE LIQUID ZONE CONTROL PRIMARY BALANCE HEADER CONTROLLER |
| 01 Sep | 322.0  | 2.1     | UP2  | Z    | MW OUTPUT REDUCED DUE TO UNIDENTIFIED LOSSES.                                      |
| 09 Sep | 19.0   | 1.5     | UP2  | A13  | FAILURE OF LIQUID ZONE CONTROL VALVE   |
| 09 Sep | 72.0   | 1.2     | UP2  | A12  | REACTOR POWER LOWERED DUE TO ROP TRIP MARGIN < 6%.                                 |
| 10 Sep | 63.0   | 32.3    | UF2  | A13  | UNIT FORCED OUT TO REPAIR LIQUID ZONE CONTROL VALVE CV 92.                         |
| 12 Sep | 55.0   | 0.1     | PF   | D    | PLANNED OUTAGE BEGINS. CRITICAL PATH IS THROUGH CIGAR INSPECTIONS.                 |
| 22 Sep | 80.0   | 16.1    | PP   | D    | POWER RAMP-UP AFTER PLANNED OUTAGE.  |
| 25 Sep | 14.0   | 1.7     | UP2  | A41  | POWER HOLD DUE TO POWER SYSTEM STABILITY (PSS) UNAVAILABLE.                        |
| 26 Sep | 187.0  | 1.7     | XP   | N    | MW OUTPUT LIMITED DUE TO HIGH LAKE WATER TEMPERATURE.                              |
| 29 Oct | 2.0    | 0.5     | UP2  | Z    | RAMP DOWN TO FORCED OUTAGE.  |
| 29 Oct | 217.0  | 112.0   | UF2  | A15  | HIGH LEAKAGE TO CONTAINMENT FROM PRIMARY HEAT TRANSPORT MAIN CIRCUIT VALVE MV30.   |
| 07 Nov | 56.0   | 14.2    | UP2  | A15  | UNIT RAMP-UP AFTER FORCED OUTAGE.  |
| 07 Dec | 44.0   | 0.7     | XP2  | N    | CCW PUMP 1 SHUTDOWN DUE TO ALGAE RUN.  |
| 25 Dec | 13.0   | 0.2     | UP2  | A15  | SRV 36 AND SRV 42 OPENED 25% FOR FRAZIL ICE PROTECTION.                            |
| 25 Dec | 5.0    | 0.1     | UP2  | A31  | REACTOR POWER LOWERED FOR TURBINE VALVE TESTING.                                   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 280       |          |  | 925       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 82        |          |
| D. Inspection, maintenance or repair without refuelling                              | 55              |           |          | 798                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 2         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 41                                       | 12        | 20       |
| Z. Others  |                 |           |          |  | 24        |          |
| Subtotal   | 55              | 280       | 0        | 839                                      | 1045      | 20       |
| Total  |                 | 335       |          |  | 1904      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 4  |
| 12. Reactor I&C Systems             |                 | 97                                       |
| 13. Reactor Auxiliary Systems       | 63              | 77                                       |
| 14. Safety Systems                  |                 | 28                                       |
| 15. Reactor Cooling Systems         | 217             | 75                                       |
| 16. Steam generation systems        |                 | 428                                      |
| 31. Turbine and auxiliaries         |                 | 31                                       |
| 32. Feedwater and Main Steam System |                 | 10                                       |
| 33. Circulating Water System        |                 | 4  |
| 35. All other I&C Systems           |                 | 8  |
| 41. Main Generator Systems          |                 | 108                                      |
| 42. Electrical Power Supply Systems |                 | 43                                       |
| Total                               | 280             | 913                                      |

**CA-14 PICKERING-6**

Operator: OPG (ONTARIO POWER GENERATION)

Contractor: OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 516.0 MW(e)  
 Design Net RUP: 516.0 MW(e)  
 Design Discharge Burnup: 8420 MW.d/t

**2. Production Summary 2004**

Energy Production: 2780.8 GW(e).h  
 Energy Availability Factor: 61.5%  
 Load Factor: 61.4%  
 Operating Factor: 63.7%  
 Energy Unavailability Factor: 38.5%  
 Total Off-line Time: 3187 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb  | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 90.3 | 1.4  | 0.0   | 213.2 | 370.9 | 279.4 | 338.4 | 359.7 | 377.5 | 367.8 | 382.3 | 2780.8 |
| EAF (%)  | 0.0   | 25.2 | 0.4  | 0.0   | 55.6  | 100.0 | 72.9  | 88.2  | 96.8  | 98.6  | 100.0 | 99.8  | 61.5   |
| UCF (%)  | 0.0   | 25.2 | 0.4  | 0.0   | 55.6  | 100.0 | 73.2  | 88.4  | 97.9  | 99.1  | 100.0 | 99.8  | 61.7   |
| LF (%)   | 0.0   | 25.2 | 0.4  | 0.0   | 55.5  | 99.8  | 72.8  | 88.1  | 96.8  | 98.3  | 99.0  | 99.6  | 61.4   |
| OF (%)   | 0.0   | 32.9 | 0.4  | 0.0   | 60.8  | 100.0 | 77.8  | 92.2  | 100.0 | 100.0 | 100.0 | 100.0 | 63.7   |
| EUF (%)  | 100.0 | 74.8 | 99.6 | 100.0 | 44.4  | 0.0   | 27.1  | 11.8  | 3.2   | 1.4   | 0.0   | 0.2   | 38.5   |
| PUF (%)  | 100.0 | 64.7 | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.6   |
| UCLF (%) | 0.0   | 10.2 | 99.6 | 100.0 | 44.4  | 0.0   | 26.8  | 11.6  | 2.1   | 0.9   | 0.0   | 0.2   | 24.7   |
| XUF (%)  | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.2   | 0.2   | 1.1   | 0.5   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Oct 1975      Lifetime Generation: 73223.1 GW(e).h  
 Date of First Criticality: 15 Oct 1983      Cumulative Energy Availability Factor: 76.5%  
 Date of Grid Connection: 08 Nov 1983      Cumulative Load Factor: 76.4%  
 Date of Commercial Operation: 01 Feb 1984      Cumulative Unit Capability Factor: 78.1%  
    Cumulative Energy Unavailability Factor: 23.5%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 257.7             | 516.0             | 0.0  | 0.0    | 90.8                                 | 100.0  | 5.8                | 0.0    | 856                   | 10.0   |
| 1984 | 3816.1            | 516.0             | 0.0  | 0.0    | 84.4                                 | 100.0  | 84.2               | 0.0    | 7636                  | 86.9   |
| 1985 | 3289.1            | 516.0             | 79.5   | 79.5   | 73.1                                 | 73.1   | 72.8               | 72.8   | 6540                  | 74.7   |
| 1986 | 3395.2            | 516.0             | 76.1   | 77.8   | 75.8                                 | 74.5   | 75.1               | 73.9   | 6763                  | 77.2   |
| 1987 | 3949.9            | 516.0             | 88.5   | 81.4   | 86.6                                 | 78.5   | 87.4               | 78.4   | 7791                  | 88.9   |
| 1988 | 4496.8            | 516.0             | 98.5   | 85.7   | 98.4                                 | 83.5   | 99.2               | 83.6   | 8775                  | 99.9   |
| 1989 | 3950.2            | 516.0             | 87.9   | 86.1   | 87.6                                 | 84.3   | 87.4               | 84.4   | 7794                  | 89.0   |
| 1990 | 3473.5            | 516.0             | 77.7   | 84.7   | 76.9                                 | 83.1   | 76.8               | 83.1   | 7017                  | 80.1   |
| 1991 | 4469.7            | 516.0             | 99.2   | 86.8   | 99.0                                 | 85.4   | 98.9               | 85.4   | 8721                  | 99.6   |
| 1992 | 4050.5            | 516.0             | 89.3   | 87.1   | 89.3                                 | 85.8   | 89.4               | 85.9   | 7936                  | 90.3   |
| 1993 | 2689.2            | 516.0             | 60.4   | 84.1   | 59.9                                 | 83.0   | 59.5               | 82.9   | 5506                  | 62.9   |
| 1994 | 4043.0            | 516.0             | 90.2   | 84.7   | 90.1                                 | 83.7   | 89.4               | 83.6   | 8036                  | 91.7   |
| 1995 | 3493.3            | 516.0             | 77.5   | 84.1   | 77.2                                 | 83.1   | 77.3               | 83.0   | 6962                  | 79.5   |
| 1996 | 2591.7            | 516.0             | 57.2   | 81.8   | 57.2                                 | 80.9   | 57.2               | 80.9   | 5707                  | 65.0   |
| 1997 | 3386.2            | 516.0             | 74.9   | 81.3   | 74.9                                 | 80.5   | 74.9               | 80.4   | 6841                  | 78.1   |
| 1998 | 3130.1            | 516.0             | 69.7   | 80.5   | 69.2                                 | 79.7   | 69.2               | 79.6   | 6384                  | 72.9   |
| 1999 | 3353.7            | 516.0             | 74.4   | 80.1   | 74.2                                 | 79.3   | 74.2               | 79.2   | 6863                  | 78.3   |
| 2000 | 2738.7            | 516.0             | 60.6   | 78.8   | 60.5                                 | 78.1   | 60.4               | 78.1   | 6449                  | 73.4   |
| 2001 | 2618.1            | 516.0             | 57.7   | 77.6   | 57.7                                 | 76.9   | 57.9               | 76.9   | 5286                  | 60.3   |
| 2002 | 3982.3            | 516.0             | 88.9   | 78.2   | 88.3                                 | 77.5   | 88.1               | 77.5   | 7985                  | 91.2   |
| 2003 | 3267.4            | 516.0             | 74.3   | 78.0   | 72.5                                 | 77.3   | 72.3               | 77.2   | 6566                  | 75.0   |
| 2004 | 2780.8            | 516.0             | 61.7   | 77.2   | 61.5                                 | 76.5   | 61.4               | 76.4   | 5597                  | 63.7   |



# CA-14 PICKERING-6

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 600.0  | 0.3     | PF   | D21  | CRITICAL PATH IS THROUGH THE UNIVERSAL DELIVERY MACHINE/SLAR        |
| 26 Jan | 144.0  | 0.1     | PF   | D14  | CRITICAL PATH IS THROUGH (ECI) VALVE AND HEADER MAINTENANCE.        |
| 01 Feb | 96.0   | 0.0     | PF   | D13  | CRITICAL PATH IS THROUGH PHT PURIFICATION MAINTENANCE.              |
| 05 Feb | 96.0   | 0.0     | PF   | D14  | CRITICAL PATH IS THROUGH (ECI) HEADER RE-FILL                       |
| 09 Feb | 216.0  | 0.1     | PF   | D15  | CRITICAL PATH IS THROUGH PRESSURIZATION.                            |
| 17 Feb | 59.0   | 30.5    | UF2  | A15  | CRITICAL PATH IS THROUGH HT FLOW VERIFICATION                       |
| 20 Feb | 78.0   | 21.8    | PP   | D15  | UNIT RAMP-UP AFTER PLANNED OUTAGE.                                  |
| 23 Feb | 60.0   | 1.3     | UP2  | A12  | REACTOR POWER LIMITED BY HIGH ROPS.                                 |
| 24 Feb | 98.0   | 4.3     | UP2  | A32  | PROBLEMS WITH NEWLY INSTALLED DEAERATOR LEVEL CONTROL VALVES.       |
| 28 Feb | 301.0  | 3.1     | UP2  | A12  | REACTOR POWER LIMITED DUE TO SET POINT MAX.                         |
| 01 Mar | 1.0    | 0.2     | UP2  | A13  | REPAIR REACTOR BUILDING COOLING FANS.                               |
| 01 Mar | 1364.0 | 704.2   | UF2  | A41  | TRANSIENT OCCURRED DUE TO HYDROGEN LEAK FROM UNIT 6 GENERATOR.      |
| 27 Apr | 312.0  | 161.0   | UF2  | A31  | CRITICAL PATH IS THROUGH SEAL OIL SYSTEM INSPECTIONS AND REPAIRS.   |
| 10 May | 76.0   | 39.2    | UF2  | A31  | FORCED OUTAGE   |
| 13 May | 107.0  | 16.9    | UP2  | A31  | POWER RAMP UP AFTER FORCED OUTAGE.                                  |
| 20 May | 277.0  | 0.0     | XP   | J    | BUILDING HEATING STEAM.   |
| 25 May | 194.0  | 0.7     | UP2  | A31  | MW OUTPUT REDUCED DUE TO CONDENSER LOSSES.                          |
| 01 Jul | 936.0  | 7.9     | UP2  | A31  | MW OUTPUT REDUCED DUE TO CONDENSER CD1W OUT OF SERVICE.             |
| 01 Jul | 1.0    | 0.0     | PP   | E31  | REACTOR POWER REDUCED TO PERFORM OUTSTANDING TURBINE TESTING.       |
| 12 Jul | 55.0   | 2.7     | UP2  | A12  | MAINTENANCE ON RAW FLUX DETECTOR (AMP REPLACEMENT AND CALIBRATION). |
| 16 Jul | 224.0  | 115.4   | UF2  | A32  | BLEED CONDENSER CV113 POSITIONER FAILED                             |
| 23 Jul | 123.0  | 25.9    | UP2  | A32  | POWER RAMP-UP AFTER SUDDEN OUTAGE.                                  |
| 25 Jul | 7.0    | 1.0     | PP   | E    | REACTOR POWER HOLD FOR PSS TESTING.                                 |
| 26 Jul | 1035.0 | 6.4     | XP   | N    | MW OUTPUT LIMITED DUE TO HIGH LAKE WATER TEMPERATURE.               |
| 27 Jul | 112.0  | 3.8     | XP2  | N    | CCW PUMP 1 SHUTDOWN DUE TO SCREENHOUSE ALGAE RUN.                   |
| 08 Sep | 67.0   | 2.1     | XP2  | N    | SCREENHOUSE ALGAE RUN CAUSING CCW PUMP 1 TO TRIP.                   |
| 19 Sep | 1.0    | 0.1     | UP2  | A32  | FAILURE OF BOILER FEED PUMP 8 RECIRCULATING CONTROL VALVE.          |
| 22 Oct | 7.0    | 0.0     | UP2  | A12  | REACTOR POWER LOWERED DUE TO ROP TRIP MARGIN < 6% DURING FUELLING.  |
| 20 Dec | 10.0   | 0.1     | UP2  | A32  | STEAM DRAINS VALVE MV1 OPENS CAUSING A REDUCTION IN MW OUTPUT.      |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 2035      |          |  | 583       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 60        |          |
| D. Inspection, maintenance or repair without refuelling                              | 1152            |           |          | 842                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 5         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 28       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         | 27       |
| Subtotal   | 1152            | 2035      | 0        | 842                                      | 651       | 55       |
| Total  |                 | 3187      |          |  | 1548      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 74                                       |
| 12. Reactor I&C Systems                  |                 | 57                                       |
| 13. Reactor Auxiliary Systems            |                 | 47                                       |
| 14. Safety Systems                       |                 | 56                                       |
| 15. Reactor Cooling Systems              | 59              | 54                                       |
| 16. Steam generation systems             |                 | 116                                      |
| 21. Fuel Handling and Storage Facilities |                 | 3  |
| 31. Turbine and auxiliaries              | 388             | 46                                       |
| 32. Feedwater and Main Steam System      | 224             | 45                                       |
| 33. Circulating Water System             |                 | 3  |
| 35. All other I&C Systems                |                 | 4  |
| 41. Main Generator Systems               | 1364            | 33                                       |
| 42. Electrical Power Supply Systems      |                 | 12                                       |
| XX. Miscellaneous Systems                |                 | 19                                       |
| Total                                    | 2035            | 569                                      |

**CA-15 PICKERING-7**

Operator: OPG (ONTARIO POWER GENERATION)

Contractor: OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 516.0 MW(e)  
 Design Net RUP: 516.0 MW(e)  
 Design Discharge Burnup: 8420 MW.d/t

**2. Production Summary 2004**

Energy Production: 3116.1 GW(e).h  
 Energy Availability Factor: 68.9%  
 Load Factor: 68.7%  
 Operating Factor: 69.8%  
 Energy Unavailability Factor: 31.1%  
 Total Off-line Time: 2657 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec  | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|--------|
| GW(e).h  | 377.1 | 358.8 | 384.0 | 371.3 | 381.0 | 371.0 | 378.8 | 379.3 | 59.5 | 0.0   | 0.0   | 55.2 | 3116.1 |
| EAF (%)  | 98.3  | 99.9  | 100.0 | 100.0 | 98.9  | 100.0 | 99.1  | 99.6  | 16.0 | 0.0   | 0.0   | 14.5 | 68.9   |
| UCF (%)  | 98.4  | 99.9  | 100.0 | 100.0 | 98.9  | 100.0 | 99.8  | 99.6  | 16.0 | 0.0   | 0.0   | 14.5 | 68.9   |
| LF (%)   | 98.2  | 99.9  | 100.0 | 99.9  | 99.2  | 99.9  | 98.7  | 98.8  | 16.0 | 0.0   | 0.0   | 14.4 | 68.7   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 18.8 | 0.0   | 0.0   | 18.3 | 69.8   |
| EUF (%)  | 1.7   | 0.1   | 0.0   | 0.0   | 1.1   | 0.0   | 0.9   | 0.4   | 84.0 | 100.0 | 100.0 | 85.5 | 31.1   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 83.9 | 100.0 | 100.0 | 49.3 | 27.7   |
| UCLF (%) | 1.6   | 0.1   | 0.0   | 0.0   | 1.1   | 0.0   | 0.2   | 0.4   | 0.1  | 0.0   | 0.0   | 36.2 | 3.4    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0  | 0.1    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Mar 1976      Lifetime Generation: 71317.5 GW(e).h  
 Date of First Criticality: 22 Oct 1984      Cumulative Energy Availability Factor: 78.8%  
 Date of Grid Connection: 17 Nov 1984      Cumulative Load Factor: 78.5%  
 Date of Commercial Operation: 01 Jan 1985      Cumulative Unit Capability Factor: 78.1%  
    Cumulative Energy Unavailability Factor: 21.2%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1984 | 312.7             | 516.0             | 0.0  | 0.0    | 94.7                                 | 100.0  | 7.2                | 0.0    | 861                   | 10.3   |
| 1985 | 4094.0            | 516.0             | 99.0   | 99.0   | 92.6                                 | 92.6   | 90.6               | 90.6   | 8277                  | 94.5   |
| 1986 | 3373.3            | 516.0             | 75.5   | 87.2   | 75.2                                 | 83.9   | 74.6               | 82.6   | 7002                  | 79.9   |
| 1987 | 4339.9            | 516.0             | 97.4   | 90.6   | 96.0                                 | 87.9   | 96.0               | 87.1   | 8642                  | 98.7   |
| 1988 | 4340.4            | 516.0             | 95.9   | 92.0   | 95.4                                 | 89.8   | 95.8               | 89.2   | 8519                  | 97.0   |
| 1989 | 3408.7            | 516.0             | 77.1   | 89.0   | 75.4                                 | 86.9   | 75.4               | 86.5   | 6939                  | 79.2   |
| 1990 | 3500.8            | 516.0             | 78.3   | 87.2   | 77.7                                 | 85.4   | 77.4               | 85.0   | 7420                  | 84.7   |
| 1991 | 4258.8            | 516.0             | 94.9   | 88.3   | 94.5                                 | 86.7   | 94.2               | 86.3   | 8436                  | 96.3   |
| 1992 | 3727.4            | 516.0             | 82.4   | 87.6   | 82.4                                 | 86.2   | 82.2               | 85.8   | 7349                  | 83.7   |
| 1993 | 4415.9            | 516.0             | 99.9   | 89.0   | 99.0                                 | 87.6   | 97.7               | 87.1   | 8760                  | 100.0  |
| 1994 | 3709.9            | 516.0             | 83.4   | 88.4   | 83.4                                 | 87.2   | 82.1               | 86.6   | 7386                  | 84.3   |
| 1995 | 4056.8            | 516.0             | 90.4   | 88.6   | 90.0                                 | 87.4   | 89.7               | 86.9   | 8140                  | 92.9   |
| 1996 | 2050.7            | 516.0             | 45.4   | 85.0   | 45.4                                 | 83.9   | 45.2               | 83.4   | 4416                  | 50.3   |
| 1997 | 2936.2            | 516.0             | 65.0   | 83.4   | 65.0                                 | 82.5   | 65.0               | 82.0   | 6208                  | 70.9   |
| 1998 | 3084.7            | 516.0             | 68.9   | 82.4   | 68.2                                 | 81.4   | 68.2               | 81.0   | 6495                  | 74.1   |
| 1999 | 4433.8            | 516.0             | 98.8   | 83.5   | 98.0                                 | 82.5   | 98.1               | 82.2   | 8751                  | 99.9   |
| 2000 | 2099.0            | 516.0             | 46.4   | 81.2   | 46.3                                 | 80.3   | 46.3               | 79.9   | 4445                  | 50.6   |
| 2001 | 4020.8            | 516.0             | 89.0   | 81.6   | 88.7                                 | 80.8   | 89.0               | 80.4   | 7968                  | 91.0   |
| 2002 | 4246.9            | 516.0             | 94.5   | 82.3   | 93.9                                 | 81.5   | 94.0               | 81.2   | 8538                  | 97.5   |
| 2003 | 1790.7            | 516.0             | 39.8   | 80.1   | 39.7                                 | 79.3   | 39.6               | 79.0   | 3811                  | 43.5   |
| 2004 | 3116.1            | 516.0             | 68.9   | 79.5   | 68.9                                 | 78.8   | 68.7               | 78.5   | 6127                  | 69.8   |

# CA-15 PICKERING-7

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 11.0   | 0.1     | UP3  | A    | SDS1 HIGH TEMPERATURE LOOP TRIP MARGIN ON T1E.                                   |
| 01 Jan | 492.0  | 7.8     | UP2  | A    | MAINTAIN ADEQUATE TRIP MARGIN ON HTHT LOOP T1E.                                  |
| 24 Jan | 17.0   | 0.3     | PP   | E31  | REACTOR POWER REDUCED TO ALLOW FOR TURBINE TESTING.                              |
| 28 Jan | 16.0   | 0.0     | XP   | N    | LOW IN-TAKE TEMPERATURES. MW OUTPUT REDUCED.                                     |
| 09 Feb | 12.0   | 0.4     | UP2  | A11  | REACTOR POWER LOWERED AS PER BLIND CHANNELS PROCEDURE                            |
| 14 May | 112.0  | 3.8     | UP2  | A32  | REACTOR POWER REDUCED TO REMOVE REHEAT SYSTEM FROM SERVICE.                      |
| 20 May | 36.0   | 0.5     | UP2  | A33  | MW PRODUCTION REDUCED DUE TO SHUTDOWN OF CIRCULATING COOLING WATER (CCW) PUMP 1. |
| 20 Jul | 2.0    | 0.0     | UP2  | A12  | REACTOR POWER LOWERED DUE TO LIMITING ROP MARGIN TO TRIP.                        |
| 20 Jul | 288.0  | 2.9     | XP   | N    | MW OUTPUT REDUCED DUE TO HIGH LAKE WATER TEMPERATURE.                            |
| 01 Sep | 8.0    | 0.2     | UP2  | A42  | REACTOR POWER LOWERED TO REMOVE DCCX FROM SERVICE FOR POWER SUPPLY MAINTENANCE.  |
| 01 Sep | 28.0   | 0.2     | UP2  | A    | REACTOR POWER LIMITED DUE TO HIGH TEMPERATURE TRIP MARGINS ON SDS1.              |
| 02 Sep | 9.0    | 1.8     | PP   | E    | REACTOR POWER LOWERED FOR BOILER STEAM SAFETY VALVE TESTING.                     |
| 02 Sep | 14.0   | 0.7     | PP   | D    | REACTOR POWER REDUCED TO LOWER HT HIGH TEMPERATURE SET POINTS.                   |
| 03 Sep | 85.0   | 7.4     | PP   | D    | UNIT DERATED FOR PRE-OUTAGE ACTIVITIES.  |
| 06 Sep | 153.0  | 0.1     | PF   | D    | CRITICAL PATH IS THROUGH EAST VAULT INSPECTIONS AND MAINTENANCE.                 |
| 13 Sep | 2211.3 | 1.1     | PF   | D    | CRITICAL PATH IS THROUGH EAST VAULT FEEDER INSPECTIONS.                          |
| 21 Oct | 24.0   | 0.0     | PF   | D    | PLANNED OUTAGE   |
| 15 Dec | 21.0   | 10.7    | UF3  | A15  | CRITICAL PATH IS THROUGH SHUTDOWN COOLING LINE INSULATION REPLACEMENT.           |
| 16 Dec | 73.0   | 37.6    | UF3  | A15  | FORCED EXTENSION CONTINUES. UNIT WARM-UP ACTIVITIES IN PROGRESS.                 |
| 19 Dec | 83.0   | 14.3    | PP   | D15  | UNIT RUN-UP AFTER PLANNED OUTAGE.  |
| 24 Dec | 175.3  | 90.4    | UF2  | Z    | FORCED OUTAGE  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 94        |          |  | 370       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 202       |          |
| D. Inspection, maintenance or repair without refuelling                              | 2388            |           |          | 729                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  | 14        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 4        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 10        | 22       |
| Z. Others  |                 | 175       |          |  | 37        |          |
| Subtotal   | 2388            | 269       | 0        | 730                                      | 633       | 26       |
| Total  |                 | 2657      |          |  | 1389      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             |                 | 27                                       |
| 13. Reactor Auxiliary Systems       |                 | 19                                       |
| 14. Safety Systems                  |                 | 48                                       |
| 15. Reactor Cooling Systems         | 94              | 53                                       |
| 16. Steam generation systems        |                 | 29                                       |
| 31. Turbine and auxiliaries         |                 | 32                                       |
| 32. Feedwater and Main Steam System |                 | 13                                       |
| 33. Circulating Water System        |                 | 16                                       |
| 41. Main Generator Systems          |                 | 111                                      |
| 42. Electrical Power Supply Systems |                 | 10                                       |
| Total                               | 94              | 359                                      |

**CA-16 PICKERING-8**

Operator: OPG (ONTARIO POWER GENERATION)

Contractor: OH/AECL (ONTARIO HYDRO / ATOMIC ENERGY OF CANADA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 516.0 MW(e)  
 Design Net RUP: 516.0 MW(e)  
 Design Discharge Burnup: 8420 MW.d/t

**2. Production Summary 2004**

Energy Production: 2489.5 GW(e).h  
 Energy Availability Factor: 55.1%  
 Load Factor: 54.9%  
 Operating Factor: 59.0%  
 Energy Unavailability Factor: 44.9%  
 Total Off-line Time: 3602 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 311.4 | 304.6 | 252.9 | 0.0   | 0.0   | 0.0   | 20.6 | 184.5 | 312.7 | 354.5 | 368.0 | 380.4 | 2489.5 |
| EAF (%)  | 81.1  | 84.8  | 65.9  | 0.0   | 0.0   | 0.0   | 5.4  | 48.1  | 84.2  | 93.1  | 99.8  | 100.0 | 55.1   |
| UCF (%)  | 81.1  | 84.8  | 65.9  | 0.0   | 0.0   | 0.0   | 5.4  | 48.7  | 86.2  | 93.1  | 99.8  | 100.0 | 55.4   |
| LF (%)   | 81.1  | 84.8  | 65.9  | 0.0   | 0.0   | 0.0   | 5.4  | 48.1  | 84.2  | 92.3  | 99.1  | 99.1  | 54.9   |
| OF (%)   | 86.6  | 93.4  | 69.8  | 0.0   | 0.0   | 0.0   | 18.5 | 54.8  | 88.6  | 96.9  | 100.0 | 100.0 | 59.0   |
| EUF (%)  | 18.9  | 15.2  | 34.1  | 100.0 | 100.0 | 100.0 | 94.6 | 51.9  | 15.8  | 6.9   | 0.2   | 0.0   | 44.9   |
| PUF (%)  | 0.0   | 0.0   | 31.3  | 100.0 | 100.0 | 78.7  | 19.6 | 3.3   | 0.0   | 0.0   | 0.0   | 0.0   | 27.7   |
| UCLF (%) | 18.9  | 15.2  | 2.8   | 0.0   | 0.0   | 21.3  | 75.0 | 48.0  | 13.8  | 6.9   | 0.2   | 0.0   | 16.9   |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.7   | 2.1   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Sep 1976      Lifetime Generation: 64186.7 GW(e).h  
 Date of First Criticality: 17 Dec 1985      Cumulative Energy Availability Factor: 74.3%  
 Date of Grid Connection: 21 Jan 1986      Cumulative Load Factor: 74.2%  
 Date of Commercial Operation: 28 Feb 1986      Cumulative Unit Capability Factor: 78.4%  
    Cumulative Energy Unavailability Factor: 25.7%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1986 | 3792.3            | 516.0             | 0.0  | 0.0    | 89.8                                 | 100.0  | 89.0               | 0.0    | 8086                  | 97.9   |
| 1987 | 3759.4            | 516.0             | 84.7   | 84.7   | 83.3                                 | 83.3   | 83.2               | 83.2   | 7585                  | 86.6   |
| 1988 | 3710.4            | 516.0             | 82.5   | 83.6   | 82.3                                 | 82.8   | 81.9               | 82.5   | 7296                  | 83.1   |
| 1989 | 4295.2            | 516.0             | 96.6   | 87.9   | 95.4                                 | 87.0   | 95.0               | 86.7   | 8569                  | 97.8   |
| 1990 | 3014.7            | 516.0             | 66.7   | 82.6   | 66.6                                 | 81.9   | 66.7               | 81.7   | 6743                  | 77.0   |
| 1991 | 4485.0            | 516.0             | 99.5   | 86.0   | 98.9                                 | 85.3   | 99.2               | 85.2   | 8759                  | 100.0  |
| 1992 | 4212.0            | 516.0             | 93.0   | 87.2   | 92.9                                 | 86.6   | 92.9               | 86.5   | 8280                  | 94.3   |
| 1993 | 3670.5            | 516.0             | 82.2   | 86.5   | 81.7                                 | 85.9   | 81.2               | 85.7   | 7233                  | 82.6   |
| 1994 | 4341.9            | 516.0             | 96.8   | 87.8   | 96.8                                 | 87.2   | 96.1               | 87.0   | 8579                  | 97.9   |
| 1995 | 4012.1            | 516.0             | 89.4   | 87.9   | 89.0                                 | 87.4   | 88.8               | 87.2   | 8066                  | 92.1   |
| 1996 | 1300.3            | 516.0             | 28.7   | 82.0   | 28.7                                 | 81.6   | 28.7               | 81.3   | 2597                  | 29.6   |
| 1997 | 360.8             | 516.0             | 8.0  | 75.3   | 8.0                                  | 74.9   | 8.0                | 74.7   | 995                   | 11.3   |
| 1998 | 3493.6            | 516.0             | 78.0   | 75.5   | 77.3                                 | 75.1   | 77.3               | 74.9   | 7009                  | 80.0   |
| 1999 | 3509.1            | 516.0             | 78.4   | 75.7   | 77.6                                 | 75.3   | 77.6               | 75.1   | 7077                  | 80.8   |
| 2000 | 2711.2            | 516.0             | 60.8   | 74.7   | 59.9                                 | 74.2   | 59.8               | 74.0   | 5508                  | 62.7   |
| 2001 | 3502.2            | 516.0             | 78.2   | 74.9   | 77.5                                 | 74.4   | 77.5               | 74.2   | 6999                  | 79.9   |
| 2002 | 3605.4            | 516.0             | 81.1   | 75.3   | 80.0                                 | 74.7   | 79.8               | 74.6   | 7244                  | 82.7   |
| 2003 | 3921.3            | 516.0             | 89.7   | 76.1   | 86.9                                 | 75.5   | 86.8               | 75.3   | 8026                  | 91.6   |
| 2004 | 2489.5            | 516.0             | 55.4   | 75.0   | 55.1                                 | 74.3   | 54.9               | 74.2   | 5182                  | 59.0   |

# CA-16 PICKERING-8

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 628.0  | 4.5     | UP2  | Z    | THERMAL POWER ERROR IN EFFECT.  |
| 01 Jan | 628.0  | 6.9     | UP2  | A32  | PRODUCTION LOSSES DUE TO INACCURATE FEEDWATER FLOW MEASUREMENTS.          |
| 06 Jan | 574.0  | 12.1    | UP2  | A12  | REACTOR POWER LIMITED DUE TO ROP TRIP MARGIN < 6% DURING FUELLING.        |
| 27 Jan | 100.0  | 51.4    | UF2  | A42  | FORCED OUTAGE TO REPAIR DEFECTIVE UNINTERRUPTIBLE POWER SUPPLY UPS-A.     |
| 03 Feb | 46.0   | 23.5    | UF2  | A16  | UNIT FORCED OUT AFTER TURBINE GENERATOR TRIP ON HIGH BOILER LEVEL.        |
| 06 Feb | 1136.0 | 6.1     | UP2  | Z    | THERMAL POWER ERROR IN EFFECT.  |
| 06 Feb | 1085.0 | 12.0    | UP2  | A35  | PRODUCTION LOSSES DUE TO INACCURATE FEEDWATER FLOW MEASUREMENTS.          |
| 22 Mar | 33.0   | 0.0     | PF   | D15  | HEAT TRANSPORT SYSTEM COOL DOWN AND DE-PRESSURIZATION IN PROGRESS.        |
| 24 Mar | 48.0   | 0.0     | PF   | D11  | PLANNED OUTAGE CONTINUES. MODERATOR DRAIN IN PROGRESS.                    |
| 26 Mar | 792.0  | 0.4     | PF   | D12  | CRITICAL PATH IS THE FLUX DETECTOR REPLACEMENT PROGRAM.                   |
| 28 Apr | 24.0   | 0.0     | PF   | D42  | CRITICAL PATH IS THROUGH CLASS II BUA MAINTENANCE AND RE-ALIGNMENT.       |
| 29 Apr | 792.0  | 0.4     | PF   | D    | CRITICAL PATH IS THROUGH THE SLAR CAMPAIGN.                               |
| 01 Jun | 144.0  | 0.1     | PF   | D34  | CRITICAL PATH IS THROUGH HIGH PRESSURE SERVICE WATER FLOW TESTING.        |
| 07 Jun | 96.0   | 0.0     | PF   | D    | CRITICAL PATH IS THROUGH TSS.   |
| 11 Jun | 84.0   | 0.0     | PF   | D    | CRITICAL PATH IS THROUGH THE REACTOR BUILDING PRESSURE TEST.              |
| 14 Jun | 98.0   | 0.1     | PF   | D    | PLANNED OUTAGE CONTINUES WITH TSS ON THE CRITICAL PATH.                   |
| 18 Jun | 82.0   | 0.0     | PF   | D    | CHANNEL M10 RE-INSPECTED FOR MISSING DOWEL PIN.                           |
| 22 Jun | 63.0   | 0.0     | PF   | D    | CRITICAL PATH IS THROUGH REMOVAL OF THE UNIVERSAL DELIVERY MACHINE (UDM). |
| 24 Jun | 211.0  | 108.9   | UF3  | A21  | FEPO BEGINS. UDM REMOVAL CONTINUES ON THE CRITICAL PATH.                  |
| 03 Jul | 469.0  | 242.2   | UF3  | A42  | CRITICAL PATH IS THROUGH 4.16 KV AUTO TRANSFER TESTING.                   |
| 21 Jul | 138.0  | 50.5    | PP   | E    | UNIT IS DERATED FOR IN CORE FLUX DETECTOR RESPONSE TESTING.               |
| 27 Jul | 48.0   | 0.0     | PF   | D12  | FEPO CONTINUES. IN CORE FLUX DETECTOR TESTING IN PROGRESS.                |
| 29 Jul | 367.0  | 189.3   | UF2  | A32  | REPLACE HEAT TRANSPORT NON-RETURN VALVE NV2 ON THE FEED CIRCUIT.          |
| 15 Aug | 49.0   | 12.7    | PP   | D    | UNIT RAMP UP AFTER PLANNED OUTAGE AND FORCED EXTENSION.                   |
| 17 Aug | 634.0  | 5.6     | UP2  | A35  | PRODUCTION LOSSES DUE TO INACCURATE FEEDWATER FLOW MEASUREMENTS.          |
| 17 Aug | 997.0  | 11.1    | UP2  | Z    | MW OUTPUT REDUCED DUE TO UNIDENTIFIED LOSSES.                             |
| 17 Aug | 125.0  | 1.4     | UP2  | A33  | HIGH VIBRATIONS ON BLEED CIRCUIT CONTROL VALVE CV113.                     |
| 17 Aug | 997.0  | 7.6     | XP   | N    | MW OUTPUT REDUCED DUE TO HIGH LAKE WATER TEMPERATURE.                     |
| 10 Sep | 419.0  | 0.0     | XP   | J    | UNIT 8 SUPPLYING BUILDING HEATING.  |
| 27 Sep | 105.0  | 54.0    | UF2  | A15  | FORCED OUTAGE TO REPAIR PHT MAIN CIRCUIT VALVE MV26.                      |
| 01 Oct | 38.0   | 10.3    | UP2  | A15  | UNIT RAMP UP AFTER FORCED OUTAGE.   |
| 03 Oct | 44.0   | 3.3     | UP2  | A32  | REACTOR POWER LIMITED TO FINE TUNE DEAERATOR LEVEL CONTROL.               |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1298      |          |  | 335       |          |
| B. Refuelling without a maintenance  |                 |           |          | 281                                      | 274       |          |
| D. Inspection, maintenance or repair without refuelling                              | 2304            |           |          | 810                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 7        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 5         |          |
| Subtotal   | 2304            | 1298      | 0        | 1092                                     | 614       | 7        |
| Total  |                 | 3602      |          |  | 1713      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 31                                       |
| 13. Reactor Auxiliary Systems            |                 | 4  |
| 14. Safety Systems                       |                 | 26                                       |
| 15. Reactor Cooling Systems              | 105             | 50                                       |
| 16. Steam generation systems             | 46              | 26                                       |
| 21. Fuel Handling and Storage Facilities | 211             | 9  |
| 31. Turbine and auxiliaries              |                 | 45                                       |
| 32. Feedwater and Main Steam System      | 367             | 25                                       |
| 33. Circulating Water System             |                 | 12                                       |
| 35. All other I&C Systems                |                 | 2  |
| 41. Main Generator Systems               |                 | 14                                       |
| 42. Electrical Power Supply Systems      | 569             | 2  |
| Total                                    | 1298            | 246                                      |

# CA-17 POINT LEPREAU

**Operator:** NBEPC (NEW BRUNSWICK ELECTRIC POWER COMMISSION)  
**Contractor:** AECL (ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 635.0 MW(e)  
**Design Net RUP:** 630.0 MW(e)  
**Design Discharge Burnup:** 7500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4299.7 GW(e).h  
**Energy Availability Factor:** 82.6%  
**Load Factor:** 77.1%  
**Operating Factor:** 83.2%  
**Energy Unavailability Factor:** 17.4%  
**Total Off-line Time:** 1474 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 448.5 | 417.7 | 445.9 | 427.2 | 0.0   | 282.6 | 400.4 | 439.8 | 427.2 | 143.4 | 427.4 | 439.8 | 4299.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 99.7  | 0.0   | 66.5  | 91.3  | 100.0 | 100.0 | 35.9  | 100.0 | 99.9  | 82.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 99.7  | 0.0   | 66.5  | 100.0 | 100.0 | 100.0 | 35.9  | 100.0 | 99.9  | 83.3   |
| <b>LF (%)</b>   | 94.9  | 94.5  | 94.4  | 93.6  | 0.0   | 61.8  | 84.8  | 93.1  | 93.4  | 30.3  | 93.5  | 93.1  | 77.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 99.9  | 0.0   | 69.2  | 92.6  | 100.0 | 100.0 | 39.3  | 100.0 | 100.0 | 83.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.3   | 100.0 | 33.5  | 8.7   | 0.0   | 0.0   | 64.1  | 0.0   | 0.1   | 17.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.3   | 100.0 | 19.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.7  | 0.0   | 0.0   | 0.0   | 64.1  | 0.0   | 0.1   | 6.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

A 38 DAY PLANNED OUTAGE IN MAY, ENDED UP AS A 42 DAY OUTAGE MAINLY DUE TO FEEDER PROBLEMS.

## 5. Historical Summary

**Date of Construction Start:** 01 May 1975      **Lifetime Generation:** 101681.2 GW(e).h  
**Date of First Criticality:** 25 Jul 1982      **Cumulative Energy Availability Factor:** 81.8%  
**Date of Grid Connection:** 11 Sep 1982      **Cumulative Load Factor:** 82.3%  
**Date of Commercial Operation:** 01 Feb 1983      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 18.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4742.9         | 640.0          | 0.0  | 0.0    | 84.8                              | 100.0  | 84.6               | 0.0    | 7875               | 89.9   |
| 1984 | 5000.9         | 635.0          | 89.0   | 89.0   | 88.9                              | 88.9   | 89.7               | 89.7   | 7927               | 90.2   |
| 1985 | 5421.9         | 635.0          | 96.9   | 93.0   | 96.9                              | 92.9   | 97.5               | 93.6   | 8547               | 97.6   |
| 1986 | 5223.1         | 635.0          | 94.0   | 93.3   | 93.4                              | 93.1   | 93.9               | 93.7   | 8257               | 94.3   |
| 1987 | 5107.7         | 635.0          | 91.3   | 92.8   | 91.2                              | 92.6   | 91.8               | 93.2   | 8110               | 92.6   |
| 1988 | 5338.3         | 635.0          | 94.8   | 93.2   | 94.9                              | 93.1   | 95.7               | 93.7   | 8383               | 95.4   |
| 1989 | 5266.7         | 635.0          | 93.8   | 93.3   | 93.6                              | 93.2   | 94.7               | 93.9   | 8271               | 94.4   |
| 1990 | 5333.7         | 635.0          | 95.0   | 93.5   | 94.7                              | 93.4   | 95.9               | 94.2   | 8384               | 95.7   |
| 1991 | 5437.2         | 635.0          | 96.7   | 93.9   | 96.7                              | 93.8   | 97.7               | 94.6   | 8500               | 97.0   |
| 1992 | 4829.8         | 635.0          | 85.8   | 93.0   | 85.8                              | 92.9   | 86.6               | 93.7   | 7748               | 88.2   |
| 1993 | 5320.0         | 635.0          | 95.1   | 93.2   | 95.1                              | 93.1   | 95.6               | 93.9   | 8391               | 95.8   |
| 1994 | 5230.1         | 635.0          | 93.5   | 93.3   | 93.5                              | 93.1   | 94.0               | 93.9   | 8270               | 94.4   |
| 1995 | 1611.4         | 635.0          | 29.0   | 87.9   | 29.0                              | 87.8   | 29.0               | 88.5   | 2615               | 29.9   |
| 1996 | 4587.8         | 635.0          | 81.4   | 87.4   | 81.4                              | 87.3   | 82.3               | 88.0   | 7363               | 83.8   |
| 1997 | 3455.6         | 635.0          | 62.2   | 85.6   | 61.6                              | 85.5   | 62.1               | 86.2   | 5564               | 63.5   |
| 1998 | 3782.4         | 635.0          | 67.1   | 84.4   | 66.0                              | 84.2   | 68.0               | 85.0   | 6111               | 69.8   |
| 1999 | 4082.7         | 635.0          | 75.5   | 83.8   | 72.0                              | 83.4   | 73.4               | 84.2   | 6797               | 77.6   |
| 2000 | 3966.9         | 635.0          | 77.6   | 83.5   | 70.5                              | 82.7   | 71.1               | 83.5   | 6792               | 77.3   |
| 2001 | 4451.3         | 635.0          | 84.6   | 83.5   | 79.1                              | 82.5   | 80.0               | 83.3   | 7418               | 84.7   |
| 2002 | 3760.6         | 635.0          | 71.6   | 82.9   | 67.6                              | 81.7   | 67.6               | 82.5   | 6107               | 69.7   |
| 2003 | 4739.5         | 635.0          | 89.8   | 83.2   | 84.4                              | 81.8   | 85.2               | 82.6   | 7869               | 89.8   |
| 2004 | 4299.7         | 635.0          | 83.3   | 83.2   | 82.6                              | 81.8   | 77.1               | 82.3   | 7310               | 83.2   |

## CA-17 POINT LEPREAU

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                     |
|--------|-------|---------|------|------|---|
| 30 Apr | 888.0 | 564.3   | PF   | G    | 2004 ANNUAL PLANNED OUTAGE                      |
| 06 Jun | 98.0  | 62.7    | UP3  | Z    | PLANNED OUTAGE EXTENSION                        |
| 09 Jul | 55.0  | 41.3    | XF5  | N    | LIGHTNING STRIKE GRID INSTABILITY               |
| 02 Oct | 451.0 | 303.0   | UF4  | A14  | SDS1 TRIP FOLLOWED BY A MAIN STEAM HEADER CRACK |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 451       |          |  | 235       | 1        |
| B. Refuelling without a maintenance  |                 |           |          |  | 92        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 516                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 2         |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling  | 888             |           |          |  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 2         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  |           | 2        |
| L. Human factor related  |                 |           |          |  | 2         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 55       |  |           |          |
| Z. Others  |                 |           |          |  | 41        |          |
| Subtotal   | 888             | 451       | 55       | 516                                      | 374       | 4        |
| Total  |                 | 1394      |          |  | 894       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 13                                       |
| 13. Reactor Auxiliary Systems       |                 | 3  |
| 14. Safety Systems                  | 451             | 5  |
| 15. Reactor Cooling Systems         |                 | 83                                       |
| 16. Steam generation systems        |                 | 70                                       |
| 31. Turbine and auxiliaries         |                 | 15                                       |
| 32. Feedwater and Main Steam System |                 | 25                                       |
| 41. Main Generator Systems          |                 | 9  |
| 42. Electrical Power Supply Systems |                 | 4  |
| Total                               | 451             | 227                                      |

**CN-2 GUANGDONG-1**

Operator: GNPJVC (GUANGDONG NUCLEAR POWER JOINT VENTURE COMPANY LIMITED(GNPJVC))

Contractor: GEC (GENERAL ELECTRIC COMPANY (UK))

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 944.0 MW(e)  
 Design Net RUP: 930.0 MW(e)  
 Design Discharge Burnup: 39000 MW.d/t

**2. Production Summary 2004**

Energy Production: 7540.9 GW(e).h  
 Energy Availability Factor: 88.2%  
 Load Factor: 90.9%  
 Operating Factor: 88.7%  
 Energy Unavailability Factor: 11.8%  
 Total Off-line Time: 995 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 713.4 | 688.9 | 734.4 | 709.0 | 728.0 | 699.8 | 723.3 | 724.9 | 674.3 | 0.0   | 410.5 | 734.5 | 7540.9 |
| EAFF (%) | 96.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.6  | 100.0 | 96.9  | 0.0   | 66.4  | 100.0  |
| UCF (%)  | 99.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.0  | 0.0   | 66.5  | 100.0 | 88.5   |
| LF (%)   | 101.6 | 104.8 | 104.6 | 104.5 | 103.6 | 103.0 | 103.0 | 103.2 | 99.2  | 0.0   | 60.4  | 104.6 | 90.9   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 97.4  | 0.0   | 67.8  | 100.0 | 88.7   |
| EUF (%)  | 3.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 0.0   | 3.1   | 100.0 | 33.6  | 0.0   | 11.8   |
| PUF (%)  | 0.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.1   | 100.0 | 33.6  | 0.0   | 11.5   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| XUF (%)  | 2.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

UNIT WAS BASICALLY OPERATED IN BASE-LOAD MODE. THERE WAS NO SCRAM IN 2004. BY THE REQUEST OF GRID SYSTEM, UNIT WAS DELOADED AROUND 73.87 HOURS IN 2004.

**5. Historical Summary**

Date of Construction Start: 07 Aug 1987      Lifetime Generation: 64487.3 GW(e).h  
 Date of First Criticality: 28 Jul 1993      Cumulative Energy Availability Factor: 78.3%  
 Date of Grid Connection: 31 Aug 1993      Cumulative Load Factor: 78.6%  
 Date of Commercial Operation: 01 Feb 1994      Cumulative Unit Capability Factor: 81.5%  
    Cumulative Energy Unavailability Factor: 21.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1994 | 5917.4         | 944.0          | 0.0  | 0.0    | 78.3                              | 100.0  | 71.6               | 0.0    | 6539               | 74.6   |
| 1995 | 3723.6         | 944.0          | 84.6   | 84.6   | 46.2                              | 46.2   | 45.0               | 45.0   | 4088               | 46.7   |
| 1996 | 6252.7         | 944.0          | 76.8   | 80.7   | 76.0                              | 61.1   | 75.4               | 60.2   | 6847               | 77.9   |
| 1997 | 6491.2         | 944.0          | 82.0   | 81.1   | 74.6                              | 65.6   | 78.5               | 66.3   | 7272               | 83.0   |
| 1998 | 6040.5         | 944.0          | 79.6   | 80.8   | 72.0                              | 67.2   | 73.0               | 68.0   | 7344               | 83.8   |
| 1999 | 6723.7         | 944.0          | 87.7   | 82.1   | 82.7                              | 70.3   | 81.3               | 70.7   | 7680               | 87.7   |
| 2001 | 7009.3         | 944.0          | 87.5   | 83.0   | 84.8                              | 72.7   | 84.8               | 73.0   | 7619               | 87.0   |
| 2002 | 7387.2         | 944.0          | 89.6   | 84.0   | 89.5                              | 75.1   | 89.3               | 75.3   | 7924               | 90.5   |
| 2003 | 7400.8         | 944.0          | 91.0   | 84.8   | 90.4                              | 77.0   | 89.5               | 77.1   | 7958               | 90.8   |
| 2004 | 7540.9         | 944.0          | 88.5   | 85.3   | 88.2                              | 78.3   | 90.9               | 78.6   | 7789               | 88.7   |



## CN-2 GUANGDONG-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 19 Jan | 26.5  | 5.2     | PP   | D33  | FROM 2004/01/19 23:00 TO 2004/01/21 1:30 DELOADED TO 600MWE TO REPLACE COARSE BAR SCREEN OF THE CIRCULATING WATER FILTRATION SYSTEM.                   |
| 21 Jan | 58.0  | 16.8    | XP   | J    | FROM 2004/01/21 1:30 TO 2004/01/23 11:30 DELOADED TO 760MWE ON THE DEMAND OF THE GIRD.   |
| 16 Jul | 15.9  | 3.1     | XP   | J    | FROM 2004/07/16 11:23 TO 2004/07/17 3:15 DELOADED TO 760MWE ON THE DEMAND OF THE GIRD.   |
| 16 Sep | 327.5 | 6.4     | PP   | S    | DU1C10 LOAD IS DESIGNED TO BE 502EFPD, ACTUAL SHUTDOWN BURNUP IS 519.8EFPD, STRETCH-OUT OPERATION BEGAN AT 8:30 16TH SEP. 2004 TO 0:00 29TH SEP. 2004. |
| 30 Sep | 995.0 | 939.3   | PF   | C    | FROM 2004/09/30 2:55 TO 2004/11/10 15:45 SHUTDOWN FOR ITS 10TH REFUELING OUTAGE.   |
| 16 Dec | 0.6   | 0.2     | PP   | E12  | FROM 2004/12/16 23:00 TO 2004/12/16 23:33 FOR PERIOD TEST RGL004.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1994 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 163       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 995             |           |          | 860                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 26                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 24       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 280      |
| Subtotal   | 995             | 0         | 0        | 886                                      | 163       | 304      |
| Total  |                 | 995       |          |  | 1353      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1994 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 9  |
| 13. Reactor Auxiliary Systems       |                 | 8  |
| 15. Reactor Cooling Systems         |                 | 1  |
| 31. Turbine and auxiliaries         |                 | 1  |
| 32. Feedwater and Main Steam System |                 | 28                                       |
| 41. Main Generator Systems          |                 | 88                                       |
| 42. Electrical Power Supply Systems |                 | 26                                       |
| Total                               | 0               | 161                                      |

**CN-3 GUANGDONG-2**

Operator: GNPJVC (GUANDONG NUCLEAR POWER JOINT VENTURE COMPANY LIMITED(GNPJVC))

Contractor: GEC (GENERAL ELECTRIC COMPANY (UK))

**1. Station Details**

Type: PWR  
 Net Reference Unit Power at the beginning of 2004: 944.0 MW(e)  
 Design Net RUP: 930.0 MW(e)  
 Design Discharge Burnup: 39000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6358.9 GW(e).h  
 Energy Availability Factor: 74.2%  
 Load Factor: 76.7%  
 Operating Factor: 74.9%  
 Energy Unavailability Factor: 25.8%  
 Total Off-line Time: 2204 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 719.5 | 683.9 | 731.0 | 542.6 | 0.0   | 0.0   | 103.4 | 716.5 | 699.1 | 725.7 | 704.4 | 732.8 | 6358.9 |
| EAFF (%) | 98.1  | 100.0 | 100.0 | 75.5  | 0.0   | 0.0   | 19.4  | 99.1  | 99.9  | 99.9  | 99.8  | 100.0 | 74.2   |
| UCF (%)  | 99.8  | 100.0 | 100.0 | 75.5  | 0.0   | 0.0   | 19.4  | 99.1  | 99.9  | 100.0 | 100.0 | 100.0 | 74.4   |
| LF (%)   | 102.4 | 104.1 | 104.1 | 79.9  | 0.0   | 0.0   | 14.7  | 102.0 | 102.9 | 103.2 | 103.6 | 104.3 | 76.7   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 77.2  | 0.0   | 0.0   | 22.7  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 74.9   |
| EUF (%)  | 1.9   | 0.0   | 0.0   | 24.5  | 100.0 | 100.0 | 80.6  | 0.9   | 0.1   | 0.1   | 0.2   | 0.0   | 25.8   |
| PUF (%)  | 0.2   | 0.0   | 0.0   | 24.5  | 80.6  | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 8.9    |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 19.4  | 100.0 | 80.6  | 0.9   | 0.0   | 0.0   | 0.0   | 0.0   | 16.7   |
| XUF (%)  | 1.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.2   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

UNIT WAS BASICALLY OPERATED IN BASE-LOAD MODE. THERE WAS ONE SCRAM IN 2004. BY THE REQUEST OF GRID SYSTEM, UNIT WAS DELOADED AROUND 339 HOURS IN 2004.

**5. Historical Summary**

Date of Construction Start: 07 Apr 1988      Lifetime Generation: 63751.1 GW(e).h  
 Date of First Criticality: 21 Jan 1994      Cumulative Energy Availability Factor: 77.4%  
 Date of Grid Connection: 07 Feb 1994      Cumulative Load Factor: 77.9%  
 Date of Commercial Operation: 07 May 1994      Cumulative Unit Capability Factor: 81.5%  
    Cumulative Energy Unavailability Factor: 22.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1994 | 5741.2         | 944.0          | 0.0  | 0.0    | 94.8                              | 100.0  | 69.4               | 0.0    | 6889               | 78.6   |
| 1995 | 6343.3         | 944.0          | 81.1   | 81.1   | 77.5                              | 77.5   | 76.7               | 76.7   | 7146               | 81.6   |
| 1996 | 5276.9         | 944.0          | 67.4   | 74.3   | 63.9                              | 70.7   | 63.6               | 70.2   | 5740               | 65.3   |
| 1997 | 5914.8         | 944.0          | 70.1   | 72.9   | 67.4                              | 69.6   | 71.5               | 70.6   | 6194               | 70.7   |
| 1998 | 6259.1         | 944.0          | 82.9   | 75.4   | 74.7                              | 70.9   | 75.7               | 71.9   | 7302               | 83.4   |
| 1999 | 6789.5         | 944.0          | 86.2   | 77.5   | 83.3                              | 73.4   | 82.1               | 73.9   | 7594               | 86.7   |
| 2001 | 7355.5         | 944.0          | 91.1   | 79.8   | 89.5                              | 76.0   | 88.9               | 76.4   | 7986               | 91.2   |
| 2002 | 6728.9         | 944.0          | 82.2   | 80.1   | 81.6                              | 76.8   | 81.4               | 77.1   | 7224               | 82.5   |
| 2003 | 6983.1         | 944.0          | 84.6   | 80.7   | 84.5                              | 77.8   | 84.4               | 78.0   | 7503               | 85.7   |
| 2004 | 6358.9         | 944.0          | 74.4   | 80.0   | 74.2                              | 77.4   | 76.7               | 77.9   | 6580               | 74.9   |

## CN-3 GUANGDONG-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 17 Jan | 29.3   | 1.7     | PP   | E32  | FROM 2004/01/17 7:40 TO 2004/01/18 13:00 DELOADED TO 930MWE FOR PERIOD TEST VVP.       |
| 20 Jan | 77.0   | 11.8    | XP   | J    | FROM 2004/01/20 22:00 TO 2004/01/24 3:00 DELOADED TO 800MWE ON THE DEMAND OF THE GIRD. |
| 23 Apr | 768.0  | 755.7   | PF   | C    | FROM 2004/04/23 23:00 TO 2004/05/25 SHUTDOWN FOR ITS 10TH REFUELLING OUTAGE.           |
| 25 May | 1085.4 | 1025.0  | UF3  | A21  | EXTENSION OF OUTAGE DUE TO FUEL ASSEMBLY DEFORMATION EVENT AT 19TH MAY 2004.           |
| 10 Jul | 351.0  | 331.4   | UF4  | L41  | EXTENSION OF OUTAGE DUE TO GENERATOR ROTOR DAMAGE EVENT AT 10TH JULY 2004.             |
| 24 Aug | 145.9  | 6.1     | UP   | A31  | FROM 2004/08/24 15:04 TO 2004/08/30 16:57 DELOADED TO 900MWE FOR DEALING D2GRE007VV.   |
| 07 Sep | 2.3    | 0.5     | PP   | E31  | FROM 2004/09/07 20:00 TO 2004/09/07 22:19 DELOADED TO 930MWE FOR PERIOD TEST GRE01/02. |
| 16 Sep | 0.6    | 0.5     | PP   | E12  | FROM 2004/09/16 22:47 TO 2004/09/16 23:20 DELOADED TO 500MWE FOR PERIOD TEST 2RGL004.  |
| 22 Oct | 262.0  | 2.1     | XP   | J    | FROM 2004/10/22 4:50 TO 2004/10/27 2:06 DELOADED TO 930MWE ON THE DEMAND OF THE GIRD.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1994 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 1085      |          |  | 94        |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling | 768             |           |          | 893                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 20                                       |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |  |           | 30       |
| L. Human factor related                                       |                 | 351       |          |  |           |          |
| Subtotal  | 768             | 1436      | 0        | 913                                      | 100       | 30       |
| Total   |                 | 2204      |          |  | 1043      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1994 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 21. Fuel Handling and Storage Facilities       | 1085            |  |
| 31. Turbine and auxiliaries                    |                 | 5  |
| 32. Feedwater and Main Steam System            |                 | 3  |
| 35. All other I&C Systems                      |                 | 3  |
| 41. Main Generator Systems                     |                 | 80                                       |
| 42. Electrical Power Supply Systems            |                 | 0  |
| Total  | 1085            | 92                                       |

# CN-6 LINGAO 1

**Operator:** LANPC (LINGAO NUCLEAR POWER COMPANY LTD.)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 938.0 MW(e)  
**Design Net RUP:** 0.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 7331.4 GW(e).h  
**Energy Availability Factor:** 88.7%  
**Load Factor:** 89.0%  
**Operating Factor:** 89.8%  
**Energy Unavailability Factor:** 11.3%  
**Total Off-line Time:** 900 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 667.1 | 371.6 | 61.2 | 682.2 | 704.1 | 676.2 | 697.6 | 698.7 | 675.4 | 701.1 | 681.5 | 714.8 | 7331.4 |
| <b>EAF (%)</b>  | 97.4  | 52.4  | 14.3 | 100.0 | 100.0 | 99.9  | 99.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.7   |
| <b>UCF (%)</b>  | 99.9  | 52.4  | 14.3 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.0   |
| <b>LF (%)</b>   | 95.6  | 56.9  | 8.8  | 101.1 | 100.9 | 100.1 | 100.0 | 100.1 | 100.0 | 100.3 | 100.9 | 102.4 | 89.0   |
| <b>OF (%)</b>   | 100.0 | 55.3  | 20.8 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 89.8   |
| <b>EUF (%)</b>  | 2.6   | 47.6  | 85.7 | 0.0   | 0.0   | 0.1   | 0.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.3   |
| <b>PUF (%)</b>  | 0.0   | 47.6  | 75.0 | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.1   |
| <b>UCLF (%)</b> | 0.1   | 0.0   | 10.7 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.9    |
| <b>XUF (%)</b>  | 2.5   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

UNIT WAS BASICALLY OPERATED IN BASE-LOAD MODE. THERE WAS ONE SCRAM IN 2004 DUE TO ONE FUSE OF CONTROL ROD R1 LIFTING COIL BURNT ACCIDENTLY, WHICH CAUSED 36828MWEH FORCED ENERGY LOSSES. BY THE REQUEST OF GRID SYSTEM, UNIT WAS DELOADED AROUND 108.48 HOURS IN 2004

## 5. Historical Summary

**Date of Construction Start:** 15 May 1997      **Lifetime Generation:** 18290.2 GW(e).h  
**Date of First Criticality:** 04 Feb 2002      **Cumulative Energy Availability Factor:** 84.5%  
**Date of Grid Connection:** 26 Feb 2002      **Cumulative Load Factor:** 83.3%  
**Date of Commercial Operation:** 28 May 2002      **Cumulative Unit Capability Factor:** 82.9%  
**Cumulative Energy Unavailability Factor:** 15.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2002 | 4583.8         | 938.0          | 0.0  | 0.0    | 95.7                              | 100.0  | 83.1               | 0.0    | 5184               | 88.1   |
| 2003 | 6375.0         | 938.0          | 82.3   | 82.3   | 80.4                              | 80.4   | 77.6               | 77.6   | 7215               | 82.4   |
| 2004 | 7331.4         | 938.0          | 89.0   | 85.6   | 88.7                              | 84.5   | 89.0               | 83.3   | 7884               | 89.8   |

# CN-6 LINGAO 1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 19 Jan | 85.9  | 17.3    | XP   | J    | CN6 WAS DELOADED TO 800MW ON JAN.19 AND RESUMED FULL POWER ON JAN. 23 AS REQUIRED BY THE GRID.   |
| 30 Jan | 0.0   | 0.5     | UP2  | A31  | CN6 WAS DELOADED FROM 984MW TO 945MW AT FAST SPEED DUE TO GSE004VV CLOSURE CAUSED BY A9 FAILURE.   |
| 15 Feb | 39.0  | 2.4     | PP   | E32  | CN6 WAS DELOADED TO 930MW ON FEB.15 FOR SAFETY VALVE RECALIBRATION OF VVP (MAIN STEAM SYSTEM),AND RESUMED FULL POWER ON NEXT DAY.  |
| 17 Feb | 838.0 | 831.6   | PF   | C    | CN6 WAS BEARING ITS SECOND REFUELING OUTAGE FROM FEB. 17 TO MAR. 24, LASTING 36.6 DAYS.  |
| 23 Mar | 38.4  | 37.9    | UF3  | A42  | THE ADDITIONAL INSPECTION FOR MAIN TRANSFORMER INSPECTION LEADED TO 1.6 DAYS DURATION DELAY.   |
| 27 Mar | 24.1  | 36.8    | UF4  | A12  | ON MAR. 27, CN6 TRIPPED DUE TO FUSE BLOWING WITH THE DRIVING POWER SUPPLY FOR R1 ROD LIFTING COIL. AFTER RESYNCHRONISATION ON MAR. 28, THE TURBINE WAS FORCED DOWN TWICE DUE TO HIGH VIBRATION WITH THE BEARING AND SHAFT.THE UNIT WAS PUT INTO OPERATION SUCCESSFULLY ON MAR. 29. |
| 16 Jun | 1.9   | 0.5     | PP   | E31  | CN6 WAS DELOADED TO 920MW ON JUN.16 FOR PERIODIC TESTS (GRE001/002),AND RESUMED FULL POWER ON THE SAME DAY.  |
| 17 Jun | 0.7   | 0.5     | PP   | E12  | CN6 WAS DELOADED TO 500MW ON JUN 17 FOR PERIODIC TESTS(RGL04) RESUMED FULL POWER ON THE SAME DAY.  |
| 16 Jul | 22.5  | 4.3     | XP   | J    | CN6 WAS DELOADED TO TO 800MW ON JUL.16 DURING TYPHOON "KOMPASU", AND RESUMED FULL POWER ON JUL.17  |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2003 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair combined with refuelling | 838             | 62        |          | 555                                      | 217       |          |
| Subtotal  | 838             | 62        | 0        | 555                                      | 217       | 0        |
| Total   | 900             |           |          | 772                                      |           |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2003 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 24              |  |
| 42. Electrical Power Supply Systems | 38              | 217                                      |
| Total                               | 62              | 217                                      |

## CN-7 LINGAO 2

Operator: LANPC (LINGAO NUCLEAR POWER COMPANY LTD.)

Contractor: FRAM (FRAMATOME)

### 1. Station Details

Type: PWR  
 Net Reference Unit Power at the beginning of 2004: 938.0 MW(e)  
 Design Net RUP: 0.0 MW(e)  
 Design Discharge Burnup: —

### 2. Production Summary 2004

Energy Production: 6669.4 GW(e).h  
 Energy Availability Factor: 79.8%  
 Load Factor: 80.9%  
 Operating Factor: 80.9%  
 Energy Unavailability Factor: 20.2%  
 Total Off-line Time: 1675 hours

### 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 236.5 | 696.8 | 682.7 | 702.7 | 676.0 | 697.4 | 699.5 | 679.5 | 704.9 | 682.0 | 211.2 | 6669.4 |
| EAF (%)  | 0.0   | 33.7  | 100.0 | 99.9  | 100.0 | 100.0 | 99.4  | 100.0 | 100.0 | 100.0 | 99.3  | 25.0  | 79.8   |
| UCF (%)  | 0.0   | 33.7  | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.3  | 25.0  | 79.9   |
| LF (%)   | 0.0   | 36.2  | 99.8  | 101.2 | 100.7 | 100.1 | 99.9  | 100.2 | 100.6 | 100.9 | 101.0 | 30.3  | 80.9   |
| OF (%)   | 0.0   | 46.6  | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 24.9  | 80.9   |
| EUF (%)  | 100.0 | 66.3  | 0.0   | 0.1   | 0.0   | 0.0   | 0.6   | 0.0   | 0.0   | 0.0   | 0.7   | 75.0  | 20.2   |
| PUF (%)  | 100.0 | 36.9  | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 75.0  | 17.8   |
| UCLF (%) | 0.0   | 29.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.3    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

UNIT WAS BASICALLY OPERATED IN BASE-LOAD MODE. THERE WAS NO SCRAM IN 2004. BY THE REQUEST OF GRID SYSTEM, CN7 WAS DELOADED AROUND 21 HOURS IN 2004.

### 5. Historical Summary

Date of Construction Start: 28 Nov 1997      Lifetime Generation: 13604.3 GW(e).h  
 Date of First Criticality: 27 Aug 2002      Cumulative Energy Availability Factor: 84.9%  
 Date of Grid Connection: 15 Dec 2002      Cumulative Load Factor: 82.7%  
 Date of Commercial Operation: 08 Jan 2003      Cumulative Unit Capability Factor: 82.9%  
    Cumulative Energy Unavailability Factor: 15.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2003 | 6934.9         | 938.0          | 90.6   | 90.6   | 89.9                              | 89.9   | 84.4               | 84.4   | 7494               | 85.5   |
| 2004 | 6669.4         | 938.0          | 79.8   | 85.2   | 79.8                              | 84.9   | 80.9               | 82.7   | 7109               | 80.9   |

**CN-7 LINGAO 2****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1056.0 | 990.5   | PF   | C    | CN7 COMMENCED ITS FIRST REFUELING OUTAGE ON NOVEMBER 28 2003,AND ENDED ON THE FEBRUARY 13 2004,LASTING 77.4 DAYS.  |
| 13 Feb | 132.8  | 57.0    | UP2  | A31  | CN7 WAS SHUT DOWN INSTANTLY AFTER GRID SYNCHRONISATION DUE TO WATER DRAINING PROBLEM WITH L2GSS AND L2AHP.IT REACHED FULL POWER ON FEB.19 AFTER THE PROBLEM WAS RESOLVED.  |
| 27 Feb | 63.7   | 78.2    | UF2  | A41  | CN7 WAS DOWN FROM FEB.27 TO 29 TO REPAIR HYDROGEN LEAKAGE OF THE GENERATOR.  |
| 20 Apr | 4.8    | 0.5     | PP   | E31  | FROM 4/20/2004 8:40 TO 4/20/2004 13:25,DELOADED TO 920MW FOR TURBINE GOVERNING SYSTEM PERIOD TEST ACCORDING THE PLAN.  |
| 22 Apr | 0.5    | 0.2     | PP   | E12  | FROM 4/22/2004 11:50 TO 4/22/2004 12:23,DELOADED TO 500 MW FOR PERIOD TEST (FULL LENGTH ROD CONTROL SYSTEM)ACCORDING THE PLAN.   |
| 16 Jul | 21.0   | 4.0     | XP   | N    | FROM 7/16/2004 13:20 TO 7/17/2004 10:20,DELOADED TO 800MW BECAUSE OF TYPHON KOMPASU.   |
| 17 Nov | 44.2   | 2.1     | PP   | E31  | FROM 11/17/2004 5:20 TO 11/17/2004 12:30, POWER REDUCED TO 920MW FOR TURBINE GOVERING SYSTEM PERID TEST. FROM 11/17/2004 12:30 TO 11/19/2004 1:31 POWER REDUCED TO 940 MW FOR SAFETY VALVE RECALIBRATION OF VVP. |
| 26 Nov | 327.0  | 8.1     | PP   | S    | LU2C2 LOAD WAS DESIGNED TO BE 275EPFD,ACTUAL SHUTDOWN BURNUP WAS 294EFPD,STRETCH-OUT OPERATION BEGAN AT 8:00 NOBEMBER 26TH.  |
| 09 Dec | 529.0  | 496.2   | PF   | C    | CN7 WAS DECOUPLED FROM THE GRID ON DECEMBER 10 TO COMMENCE SECOND OUTAGE.  |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 2003 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair combined with refuelling | 1585            | 63        |          | 396                                      |           |          |
| Subtotal  | 1585            | 63        | 0        | 396                                      | 0         | 0        |
| Total   |                 | 1648      |          |  | 396       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                     | 2004 Hours Lost | 2003 to 2004 Average Hours Lost Per Year |
|----------------------------|-----------------|--|
| 41. Main Generator Systems | 63              |  |
| Total                      | 63              | 0  |

# CN-1 QINSHAN 1

**Operator:** QNPC (QINSHAN NUCLEAR POWER COMPANY)  
**Contractor:** CNNC (CHINA NATIONAL NUCLEAR CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 288.0 MW(e)  
**Design Net RUP:** 288.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2565.2 GW(e).h  
**Energy Availability Factor:** 99.1%  
**Load Factor:** 101.4%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.9%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 207.3 | 206.8 | 221.1 | 213.5 | 220.8 | 211.8 | 213.8 | 212.5 | 210.7 | 216.7 | 211.9 | 218.4 | 2565.2 |
| <b>EAF (%)</b>  | 93.3  | 99.5  | 99.8  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 98.3  | 99.5  | 99.2  | 99.1   |
| <b>UCF (%)</b>  | 99.9  | 99.5  | 99.8  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.8  | 99.2  | 99.8   |
| <b>LF (%)</b>   | 96.8  | 103.2 | 103.2 | 103.1 | 103.0 | 102.1 | 99.8  | 99.2  | 101.6 | 101.0 | 102.2 | 101.9 | 101.4  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 6.7   | 0.5   | 0.2   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 1.7   | 0.5   | 0.8   | 0.9    |
| <b>PUF (%)</b>  | 0.1   | 0.1   | 0.2   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.2   | 0.0   | 0.1    |
| <b>UCLF (%)</b> | 0.1   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8   | 0.1    |
| <b>XUF (%)</b>  | 6.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.5   | 0.4   | 0.0   | 0.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

IN 2004, THE PLANT WAS IN STABLE POWER OPERATION.

## 5. Historical Summary

**Date of Construction Start:** 20 Mar 1985      **Lifetime Generation:** 22328.6 GW(e).h  
**Date of First Criticality:** 31 Oct 1991      **Cumulative Energy Availability Factor:** 73.7%  
**Date of Grid Connection:** 15 Dec 1991      **Cumulative Load Factor:** 75.2%  
**Date of Commercial Operation:** 01 Apr 1994      **Cumulative Unit Capability Factor:** 81.5%  
**Cumulative Energy Unavailability Factor:** 26.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 1740.5         | 288.0          | 0.0  | 0.0    | 64.8                              | 100.0  | 69.0               | 0.0    | 6185               | 70.6   |
| 1994 | 1648.6         | 279.0          | 0.0  | 0.0    | 66.4                              | 100.0  | 67.5               | 0.0    | 6439               | 73.5   |
| 1995 | 2063.9         | 300.0          | 86.8   | 86.8   | 82.3                              | 82.3   | 78.5               | 78.5   | 7886               | 90.0   |
| 1996 | 2073.7         | 279.0          | 81.2   | 84.1   | 81.2                              | 81.8   | 84.6               | 81.5   | 7479               | 85.1   |
| 1997 | 2011.7         | 300.0          | 81.8   | 83.3   | 76.1                              | 79.8   | 76.5               | 79.8   | 7185               | 82.0   |
| 1998 | 1149.5         | 279.0          | 48.8   | 75.0   | 42.6                              | 70.9   | 47.0               | 71.9   | 4331               | 49.4   |
| 1999 | 680.9          | 279.0          | 27.8   | 65.8   | 27.8                              | 62.5   | 27.9               | 63.4   | 2519               | 28.8   |
| 2000 | 2035.5         | 300.0          | 77.6   | 67.9   | 77.6                              | 65.1   | 77.2               | 65.8   | 6840               | 77.9   |
| 2001 | 2319.4         | 279.0          | 93.5   | 71.4   | 92.8                              | 69.0   | 94.9               | 69.8   | 8370               | 95.5   |
| 2002 | 1783.2         | 279.0          | 69.2   | 71.1   | 66.3                              | 68.6   | 73.0               | 70.2   | 5989               | 68.4   |
| 2003 | 2256.6         | 288.0          | 88.5   | 73.1   | 88.4                              | 70.8   | 89.4               | 72.3   | 7798               | 89.0   |
| 2004 | 2565.2         | 288.0          | 99.8   | 75.8   | 99.1                              | 73.7   | 101.4              | 75.2   | 8784               | 100.0  |



# CN-1 QINSHAN 1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 21 Jan | 126.0 | 14.0    | XP1  | K    | THE PLANT OPERATED IN 200MWE REQUIRED BY LOAD-FOLLOWING FROM JAN. 21TH TO 26TH                                  |
| 02 Oct | 31.5  | 3.3     | XP1  | K    | THE PLANT OPERATED IN 230 MWE REQUIRED BY LOAD-FOLLOWING FROM OCT. 2 TO OCT. 3.                                 |
| 30 Nov | 14.0  | 0.7     | XP1  | J    | THE PLANT OPERATED IN 270MWE ON NOV. 30 DUE TO ONE GRID MAINTENANCE BEYOND THE PLANT MANAGEMENT.                |
| 21 Dec | 45.0  | 1.8     | UP2  | A32  | FROM DEC. 21 TO 23, THE PLANT OPERATED IN 270MWE DUE TO REPAIRING THE HIGH PRESSURE HEATER OF FEEDWATER SYSTEM. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1993 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 50        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1166                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 103                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 3         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 516       | 3        |
| Subtotal   | 0               | 0         | 0        | 1269                                     | 578       | 3        |
| Total  | 0               |           |          | 1850                                     |           |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1993 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 3  |
| 13. Reactor Auxiliary Systems       |                 | 7  |
| 15. Reactor Cooling Systems         |                 | 1  |
| 31. Turbine and auxiliaries         |                 | 2  |
| 32. Feedwater and Main Steam System |                 | 20                                       |
| 33. Circulating Water System        |                 | 6  |
| 35. All other I&C Systems           |                 | 2  |
| 41. Main Generator Systems          |                 | 3  |
| XX. Miscellaneous Systems           |                 | 3  |
| Total                               | 0               | 47                                       |

# CN-4 QINSHAN 2 - 1

**Operator:** NPQJVC (NUCLEAR POWER PLANT QINSHAN JOINT VENTURE COMPANY LTD.)  
**Contractor:** CNNC (CHINA NATIONAL NUCLEAR CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 610.0 MW(e)  
**Design Net RUP:** 0.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 4395.7 GW(e).h  
**Energy Availability Factor:** 80.1%  
**Load Factor:** 82.0%  
**Operating Factor:** 81.0%  
**Energy Unavailability Factor:** 19.9%  
**Total Off-line Time:** 1667 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 470.9 | 438.1 | 0.7  | 0.2   | 295.1 | 446.8 | 454.8 | 451.6 | 445.4 | 466.7 | 454.6 | 471.0 | 4395.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 0.1  | 0.0   | 63.5  | 99.4  | 100.0 | 99.9  | 99.6  | 100.0 | 100.0 | 99.7  | 80.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 0.2  | 0.1   | 63.5  | 99.4  | 100.0 | 99.9  | 99.6  | 100.0 | 100.0 | 99.7  | 80.1   |
| <b>LF (%)</b>   | 103.7 | 103.2 | 0.1  | 0.0   | 65.0  | 101.7 | 100.2 | 99.5  | 101.4 | 102.8 | 103.5 | 103.8 | 82.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 0.4  | 1.0   | 71.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 81.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 99.9 | 100.0 | 36.5  | 0.6   | 0.0   | 0.1   | 0.4   | 0.0   | 0.0   | 0.3   | 19.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 99.9 | 100.0 | 5.5   | 0.0   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.3   | 17.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0  | 0.0   | 31.0  | 0.6   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 2.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 02 Jun 1996  
**Date of First Criticality:** 15 Nov 2001  
**Date of Grid Connection:** 06 Feb 2002  
**Date of Commercial Operation:** 18 Apr 2002

**Lifetime Generation:** 11688.3 GW(e).h  
**Cumulative Energy Availability Factor:** 80.5%  
**Cumulative Load Factor:** 81.5%  
**Cumulative Unit Capability Factor:** 82.9%  
**Cumulative Energy Unavailability Factor:** 19.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2002 | 2965.3         | 610.0          | 0.0  | 0.0    | 81.6                              | 100.0  | 73.6               | 0.0    | 4631               | 70.2   |
| 2003 | 4327.3         | 610.0          | 81.0   | 81.0   | 80.9                              | 80.9   | 81.0               | 81.0   | 7123               | 81.3   |
| 2004 | 4395.7         | 610.0          | 80.1   | 80.5   | 80.1                              | 80.5   | 82.0               | 81.5   | 7117               | 81.0   |

**CN-4 QINSHAN 2 - 1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Mar | 741.0 | 453.2   | PF   | C    | FROM MAR. 1ST TO MAY. 4TH, MAINTENANCE COMBINED WITH REFUELING.                 |
| 01 Apr | 720.0 | 439.0   | PF   | C    | FROM MAR. 1ST TO MAY. 4TH, MAINTENANCE COMBINED WITH REFUELING.                 |
| 01 May | 79.5  | 25.1    | PP   | C    | FROM MAR. 1ST TO MAY. 4TH, MAINTENANCE COMBINED WITH REFUELING.                 |
| 04 May | 202.0 | 137.1   | UF1  | A41  | FROM MAY 4 TO MAY 13, REPAIR THE LEAKAGE OF GENERATOR COOLING GAS SYSTEM.       |
| 22 May | 3.0   | 3.6     | UF4  | A32  | AUTOMATIC SCRAM, FAILURE OF PRESSURE AIR PIPING OF CONTROL VALVE OF FEEDWATER . |
| 05 Jun | 11.9  | 2.8     | UP1  | A32  | FROM JUN. 5TH TO 6TH, REPAIR THE SEAL OF A DRAINAGE VALVE AT POWER OPERATION.   |
| 03 Jul | 3.5   | 0.1     | UP1  | A32  | A VALVE OF HIGH PRESSURE RE-EATER SYSTEM MALFUNCTION AT POWER OPERATION.        |
| 07 Aug | 41.0  | 0.6     | UP1  | A33  | MAINTENANCE THE SEAL OF PUMP'S MOTOR AT POWER OPERATION.                        |
| 11 Sep | 7.0   | 1.6     | PP   | E31  | PLANNED TESTING TURBINE CONTROL VALVES.   |
| 19 Oct | 5.0   | 0.1     | UP1  | A32  | A VALVE OF LOW PRESSURE RE-EATER SYSTEM MALFUNCTION AT POWER OPERATION.         |
| 12 Dec | 8.0   | 1.3     | PP   | E31  | PLANNED TESTING TURBINE CONTROL VALVES.   |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 2003 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 205       |          |  |           |          |
| C. Inspection, maintenance or repair combined with refuelling | 1461            |           |          | 744                                      |           |          |
| Z. Others   |                 |           |          |  | 73        |          |
| Subtotal  | 1461            | 205       | 0        | 744                                      | 73        | 0        |
| Total   |                 | 1666      |          |  | 817       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004 Hours Lost | 2003 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 32. Feedwater and Main Steam System | 3               |  |
| 41. Main Generator Systems          | 202             |  |
| Total                               | 205             | 0  |

**CN-5 QINSHAN 2 - 2**

Operator: NPQJVC (NUCLEAR POWER PLANT QINSHAN JOINT VENTURE COMPANY LTD.)

Contractor: CNNC (CHINA NATIONAL NUCLEAR CORPORATION)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power at the beginning of 2004: —  
 Design Net RUP: 0.0 MW(e)  
 Design Discharge Burnup: —

**2. Production Summary 2004**

Energy Production: 3514.3 GW(e).h  
 Energy Availability Factor: 96.2%  
 Load Factor: 98.0%  
 Operating Factor: 96.6%  
 Energy Unavailability Factor: 3.8%  
 Total Off-line Time: 199 hours

**3. 2004 Monthly Performance Data**

|          | Jan | Feb | Mar | Apr | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  |     |     |     |     | 460.7 | 431.9 | 454.3 | 449.7 | 436.2 | 468.3 | 365.1 | 448.0 | 3514.3 |
| EAF (%)  |     |     |     |     | 98.5  | 96.2  | 100.0 | 100.0 | 98.3  | 100.0 | 80.3  | 96.1  | 96.2   |
| UCF (%)  |     |     |     |     | 98.5  | 96.2  | 100.0 | 100.0 | 98.3  | 100.0 | 80.3  | 96.1  | 96.2   |
| LF (%)   |     |     |     |     | 101.5 | 98.3  | 100.1 | 99.1  | 99.3  | 103.0 | 83.1  | 98.7  | 98.0   |
| OF (%)   |     |     |     |     | 98.5  | 96.9  | 100.0 | 100.0 | 100.0 | 99.9  | 80.7  | 96.5  | 96.6   |
| EUF (%)  |     |     |     |     | 1.5   | 3.8   | 0.0   | 0.0   | 1.7   | 0.0   | 19.7  | 3.9   | 3.8    |
| PUF (%)  |     |     |     |     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 19.7  | 3.7   | 2.9    |
| UCLF (%) |     |     |     |     | 1.5   | 3.8   | 0.0   | 0.0   | 1.7   | 0.0   | 0.0   | 0.2   | 0.9    |
| XUF (%)  |     |     |     |     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

UNIT WAS FIRST CONNECTED TO THE GRID IN MARCH, 2004.

**5. Historical Summary**

Date of Construction Start: 01 Apr 1997      Lifetime Generation: 3514.3 GW(e).h  
 Date of First Criticality: 25 Feb 2004      Cumulative Energy Availability Factor: —  
 Date of Grid Connection: 11 Mar 2004      Cumulative Load Factor: —  
 Date of Commercial Operation: 03 May 2004      Cumulative Unit Capability Factor: —  
    Cumulative Energy Unavailability Factor: —

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 3514.3         | 610.0          | 0.0  | 0.0    | 96.2                              | 100.0  | 98.0               | 0.0    | 5682               | 96.6   |

## CN-5 QINSHAN 2 - 2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 21 May | 1.5   | 0.2     | UP2  | A33  | A PUMP OF CIRCULATING WATER SYSTEM TRIPPED.   |
| 31 May | 11.0  | 6.5     | UF4  | A42  | FORM MAY. 31ST TO JUN. 1ST, A SWITCH OF VITAL PLANT POWER SUPPLY SYSTEM MALFUNCTION. AUTOMATIC SCRAM. |
| 01 Jun | 16.0  | 10.6    | UF4  | A42  | FORM MAY. 31ST TO JUN. 1ST, A SWITCH OF VITAL PLANT POWER SUPPLY SYSTEM MALFUNCTION. AUTOMATIC SCRAM. |
| 22 Jun | 6.0   | 5.8     | UF2  | A32  | LEAKAGE OF STREAM SAMPLING PIPING AT POWER OPERATION.   |
| 27 Jun | 3.0   | 0.2     | UP2  | A31  | A VALVE OF TURBINE BY-PASS SYSTEM SUDDENLY OPEN.  |
| 15 Sep | 59.0  | 7.3     | UP1  | A32  | A BOLT OF FEEDWATOR PUMP'S SUPPORT BECOME FLEXIBLE AT POWER OPERATION.                                |
| 25 Nov | 139.0 | 86.6    | PF   | D    | FROM DEC. 25TH TO NOV. 2ND, MAINTENANCE WITHOUT REFUELING.  |
| 01 Dec | 26.0  | 16.8    | PF   | D    | FROM DEC. 25TH TO NOV. 2ND, MAINTENANCE WITHOUT REFUELING.  |
| 25 Dec | 6.5   | 0.8     | UP2  | A32  | A VALVE OF HIGH PRESSURE RE-HEATER SYSTEM MALFUNCTION AT POWER OPERATION.                             |

### 7. Full Outages, Analysis by Cause

| Outage Cause | 2004 Hours Lost |           |          | 2004 to 2004<br>Average Hours Lost Per Year |           |          |
|--------------|-----------------|-----------|----------|---|-----------|----------|
|              | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
|              |                 |           |          |   |           |          |

The reactor has not yet completed a full year of commercial operation.

### 8. Equipment Related Full Outages, Analysis by System

| System | 2004<br>Hours Lost | 2004 to 2004<br>Average Hours Lost Per Year |
|--------|--------------------|---|
|        |                    |   |

The reactor has not yet completed a full year of commercial operation.

# CN-8 QINSHAN 3 - 1

**Operator:** TQNPC (The Third Qinshan Jointed Venture Company Ltda.)

**Contractor:** AECL (ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 650.0 MW(e)  
**Design Net RUP:** 0.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 4405.5 GW(e).h  
**Energy Availability Factor:** 75.6%  
**Load Factor:** 77.2%  
**Operating Factor:** 76.8%  
**Energy Unavailability Factor:** 24.4%  
**Total Off-line Time:** 2039 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 457.0 | 469.1 | 500.5 | 0.1   | 0.0   | 308.7 | 477.2 | 405.5 | 470.1 | 493.8 | 481.8 | 341.8 | 4405.5 |
| <b>EAF (%)</b>  | 94.2  | 99.7  | 99.7  | 0.0   | 0.0   | 63.1  | 100.0 | 84.6  | 100.0 | 100.0 | 100.0 | 66.3  | 75.6   |
| <b>UCF (%)</b>  | 94.3  | 99.7  | 99.7  | 0.0   | 0.0   | 63.1  | 100.0 | 84.6  | 100.0 | 100.0 | 100.0 | 66.3  | 75.6   |
| <b>LF (%)</b>   | 94.5  | 103.7 | 103.5 | 0.0   | 0.0   | 66.0  | 98.7  | 83.8  | 100.4 | 102.1 | 103.0 | 70.7  | 77.2   |
| <b>OF (%)</b>   | 94.4  | 100.0 | 100.0 | 0.3   | 0.0   | 70.1  | 100.0 | 87.2  | 100.0 | 100.0 | 100.0 | 69.8  | 76.8   |
| <b>EUF (%)</b>  | 5.8   | 0.3   | 0.3   | 100.0 | 100.0 | 36.9  | 0.0   | 15.4  | 0.0   | 0.0   | 0.0   | 33.7  | 24.4   |
| <b>PUF (%)</b>  | 0.3   | 0.3   | 0.0   | 100.0 | 100.0 | 36.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 33.7  | 22.6   |
| <b>UCLF (%)</b> | 5.4   | 0.0   | 0.3   | 0.0   | 0.0   | 0.0   | 0.0   | 15.4  | 0.0   | 0.0   | 0.0   | 0.0   | 1.8    |
| <b>XUF (%)</b>  | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

1. AT 6:10 JAN.22, THE FAILURE OF THE MAIN FEED WATER FLOW SIGNAL OF SG#1 RESULTED IN TURBINE TRIP AND THE REACTOR POISONED OUT (DUE TO INSTRUMENTATION LINE FROZEN). AT 23:53 JAN.23, THE UNIT RETURNED TO SERVICE.2. AT 2:20 APR.1, THE UNIT WAS BEGINNING THE FIRST PLANNED OUTAGE. AT 21:12 JUNE 9, THE UNIT RETURNED TO SERVICE.3. AT 13:00 AUG.13, THE UNIT WAS BEGINNING A PLANNED MINI-OVERHAUL. AT 17:50 AUG.17, THE UNIT RETURNED TO SERVICE.4. AT 20:42 DEC.15, THE UNIT WAS BEGINNING A PLANNED MINI-OVERHAUL. AT 8:15 DEC.25, THE UNIT RETURNED TO SERVICE.

## 5. Historical Summary

**Date of Construction Start:** 08 Jun 1998      **Lifetime Generation:** 9767.6 GW(e).h  
**Date of First Criticality:** 21 Sep 2002      **Cumulative Energy Availability Factor:** 81.1%  
**Date of Grid Connection:** 19 Nov 2002      **Cumulative Load Factor:** 84.0%  
**Date of Commercial Operation:** 31 Dec 2002      **Cumulative Unit Capability Factor:** 82.9%  
**Cumulative Energy Unavailability Factor:** 18.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2003 | 5174.7         | 650.0          | 89.7   | 89.7   | 86.6                              | 86.6   | 90.9               | 90.9   | 7977               | 91.1   |
| 2004 | 4405.5         | 650.0          | 75.6   | 82.6   | 75.6                              | 81.1   | 77.2               | 84.0   | 6745               | 76.8   |

## CN-8 QINSHAN 3 - 1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 02 Jan | 27.0   | 4.4     | UP   | A33  | THE CCW PUMP #1 OPERATED ABNORMALLY.  |
| 11 Jan | 6.3    | 0.5     | PP   | E11  | THE CHANNEL FLOW VERIFICATION TEST.   |
| 22 Jan | 36.0   | 23.4    | UF5  | A32  | AT 6:10 JAN.22, THE FAILURE OF THE MAIN FEED WATER FLOW SIGNAL OF SG#1 RESULTED IN TURBINE TRIP AND THE REACTOR POISONED OUT (DUE TO INSTRUMENTATION LINE FROZEN). AT 23:53 JAN.23, THE UNIT RETURNED TO SERVICE. |
| 23 Mar | 4.0    | 1.0     | UP   | A12  | THE MISTAKEN OPENED OF TWO CSDVS CAUSED BY AN ERROR SIGNAL FROM DO BOARD IN PLANT DCCX, GANERATOR POWER WAS DROPPED TO 60%FP.   |
| 01 Apr | 1684.0 | 1094.6  | PF   | D    | AT 2:20 APR.1, THE UNIT WAS BEGINNING THE FIRST PLANNED OUTAGE. AT 21:12 JUNE 9, THE UNIT RETURNED TO SERVICE.  |
| 13 Aug | 47.0   | 30.6    | PF   | D    | AT 13:00 AUG.13, THE UNIT WAS BEGINNING A PLANNED MINI-OVERHAUL. AT 17:50 AUG.17, THE UNIT RETURNED TO SERVICE.   |
| 15 Dec | 220.0  | 143.0   | PF   | D    | AT 20:42 DEC.15, THE UNIT WAS BEGINNING A PLANNED MINI-OVERHAUL. AT 8:15 DEC.25, THE UNIT RETURNED TO SERVICE.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2003 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                              |                 | 36        |          |  | 389       |          |
| D. Inspection, maintenance or repair without refuelling | 1951            |           |          |  |           |          |
| Subtotal  | 1951            | 36        | 0        | 0  | 389       | 0        |
| Total   |                 | 1987      |          |  | 389       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2003 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 66                                       |
| 15. Reactor Cooling Systems         |                 | 148                                      |
| 32. Feedwater and Main Steam System | 36              |  |
| 42. Electrical Power Supply Systems |                 | 174                                      |
| Total                               | 36              | 388                                      |

# CN-9 QINSHAN 3 - 2

**Operator:** TQNPC (The Third Qinshan Jointed Venture Company Ltda.)

**Contractor:** AECL (ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 665.0 MW(e)  
**Design Net RUP:** 0.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 5358.6 GW(e).h  
**Energy Availability Factor:** 92.3%  
**Load Factor:** 93.9%  
**Operating Factor:** 93.8%  
**Energy Unavailability Factor:** 7.7%  
**Total Off-line Time:** 548 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 498.5 | 394.4 | 500.7 | 482.8 | 413.7 | 401.6 | 463.9 | 429.5 | 468.7 | 492.8 | 480.4 | 331.6 | 5358.6 |
| <b>EAF (%)</b>  | 98.8  | 86.5  | 99.7  | 100.0 | 88.5  | 85.2  | 97.9  | 90.7  | 100.0 | 100.0 | 100.0 | 62.0  | 92.3   |
| <b>UCF (%)</b>  | 99.3  | 86.5  | 99.7  | 100.0 | 88.5  | 85.2  | 97.9  | 96.9  | 100.0 | 100.0 | 100.0 | 62.0  | 92.8   |
| <b>LF (%)</b>   | 100.8 | 85.2  | 101.2 | 101.0 | 83.6  | 83.9  | 93.8  | 86.8  | 97.9  | 99.5  | 100.3 | 67.0  | 93.9   |
| <b>OF (%)</b>   | 100.0 | 86.5  | 100.0 | 100.1 | 87.1  | 90.4  | 100.0 | 93.0  | 100.0 | 99.9  | 100.0 | 68.1  | 93.8   |
| <b>EUF (%)</b>  | 1.2   | 13.5  | 0.3   | 0.0   | 11.5  | 14.8  | 2.1   | 9.3   | 0.0   | 0.0   | 0.0   | 38.0  | 7.7    |
| <b>PUF (%)</b>  | 0.3   | 0.0   | 0.3   | 0.0   | 0.0   | 12.3  | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 38.0  | 4.4    |
| <b>UCLF (%)</b> | 0.4   | 13.5  | 0.0   | 0.0   | 11.5  | 2.6   | 2.0   | 3.1   | 0.0   | 0.0   | 0.0   | 0.0   | 2.8    |
| <b>XUF (%)</b>  | 0.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

1. AT 2:36 FEB.18, REZCTOR SHUTDOWN DUE TO PART OF SDS#2 POISON INJECTING INTO MODERATOR SYSTEM, WHEN EXECUTING A SRST MISTAKENLY. AT 0:45 FEB.22, THE UNIT RETURNED TO SERVICE.2. AT 14:02 MAY 8, GENERATOR OUTLET BREAKER TRIPPED DUE TO EXCITATION SYSTEM FAILURE, THEN TURBINE TRIPPED, AND REACTOR SETBACK TO 60%FP. AT 7:54 MAY 9, THE UNIT RETURNED TO SERVICE.3. AT 18:13 MAY 14, TURBINE TRIPPED AND REACTOR SHUTDOWN DUE TO UST COMMON-BOX BUS FAILURE. AT 0:24 MAY 18, THE UNIT RETURNED TO SERVICE.4. AT 22:49 JUNE 25, A PLANNED MINI-OVERHAUL BEGAN AND THE UNIT PLACED IN POISON PREVENTIVE MODE. AT 22:22 JUNE 28, THE UNIT RETURNED TO SERVICE.5. AT 18:18 AUG.21, THE 4 TURBINE RE-HEATING CONTROL VALVES CLOSED DUE TO THUNDER-STORM WEATHER, TURBINE POWER DROP AUTOMATICALLY. AT 18:46 , THE CONDENSER VACUUM WORSE, OPERATOR MANUALLY TRIP SDS#1 TO SHUTDOWN THE REACTOR. AT 22:23 AUG.23, THE UNIT RETURNED TO SERVICE.6. AT 20:38 DEC.3, THE UNIT OUT OF SERVICE FOR CONDUCTING A PLANNED MINI-OVERHAUL. AT 22:36 DEC.13, THE UNIT RETURNED TO SERVICE.

## 5. Historical Summary

**Date of Construction Start:** 25 Sep 1998      **Lifetime Generation:** 7464.3 GW(e).h  
**Date of First Criticality:** 18 Jan 2003      **Cumulative Energy Availability Factor:** 92.3%  
**Date of Grid Connection:** 12 Jun 2003      **Cumulative Load Factor:** 93.9%  
**Date of Commercial Operation:** 24 Jul 2003      **Cumulative Unit Capability Factor:** 84.2%  
**Cumulative Energy Unavailability Factor:** 7.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 5358.6         | 650.0          | 93.0   | 93.0   | 92.3                              | 92.3   | 93.9               | 93.9   | 8236               | 93.8   |



## CN-9 QINSHAN 3 - 2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 20 Jan | 3.0   | 0.2     | PP   | E11  | THE CHANNEL FLOW VERIFICATION TEST.   |
| 18 Feb | 94.0  | 61.1    | UF4  | L12  | AT 2:36 FEB.18, REACTOR SHUTDOWN DUE TO PART OF SDS#2 POISON INJECTING INTO MODERATOR SYSTEM, WHEN EXECUTING A SRST MISTAKENLY. AT 0:45 FEB.22, THE UNIT RETURNED TO SERVICE.   |
| 05 May | 35.7  | 5.8     | UP   | A31  | THE CONDENSER LEAKED.   |
| 08 May | 18.0  | 4.7     | UP   | A41  | GENERATOR OUTLET BREAKER TRIPPED DUE TO EXCITATION SYSTEM FAILURE.  |
| 14 May | 78.0  | 50.7    | UF5  | A42  | AT 18:13 MAY 14, TURBINE TRIPPED AND REACTOR SHUTDOWN DUE TO UST COMMON-BOX BUS FAILURE. AT 0:24 MAY 18, THE UNIT RETURNED TO SERVICE.  |
| 25 Jun | 72.0  | 46.8    | PF   | D    | AT 22:49 JUNE 25, A PLANNED MINI-OVERHAUL BEGAN AND THE UNIT PLACED IN POISON PREVENTIVE MODE. AT 22:22 JUNE 28, THE UNIT RETURNED TO SERVICE.  |
| 21 Aug | 47.0  | 30.6    | XF5  | N31  | AT 18:18 AUG.21, THE 4 TURBINE RE-HEATING CONTROL VALVES CLOSED DUE TO THUNDER-STORM WEATHER, TURBINE POWER DROP AUTOMATICALLY. AT 18:46 , THE CONDENSER VACUUM WORSE, OPERATOR MANUALLY TRIP SDS#1 TO SHUTDOWN THE REACTOR. AT 22:23 AUG.23, THE UNIT RETURNED TO SERVICE. |
| 03 Dec | 237.0 | 154.1   | PF   | D    | AT 20:38 DEC.3, THE UNIT OUT OF SERVICE FOR CONDUCTING A PLANNED MINI-OVERHAUL. AT 22:36 DEC.13, THE UNIT RETURNED TO SERVICE.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 2004 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 78        |          |  |           |          |
| D. Inspection, maintenance or repair without refuelling  | 309             |           |          |  |           |          |
| L. Human factor related  |                 | 94        |          |  |           |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 47       |  |           |          |
| Subtotal   | 309             | 172       | 47       | 0  | 0         | 0        |
| Total  |                 | 528       |          |  | 0         |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2004 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 42. Electrical Power Supply Systems | 78              |  |
| Total                               | 78              | 0  |

## TW-1 CHIN SHAN-1

Operator: TPC (TAI POWER CO.)

Contractor: GE (GENERAL ELECTRIC COMPANY (US))

### 1. Station Details

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 604.0 MW(e)  
 Design Net RUP: 604.0 MW(e)  
 Design Discharge Burnup: —

### 2. Production Summary 2004

Energy Production: 4541.9 GW(e).h  
 Energy Availability Factor: 85.8%  
 Load Factor: 85.6%  
 Operating Factor: 87.0%  
 Energy Unavailability Factor: 14.2%  
 Total Off-line Time: 1138 hours

### 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 334.7 | 0.0   | 267.6 | 438.0 | 449.5 | 430.5 | 438.3 | 430.4 | 428.3 | 438.1 | 435.3 | 451.1 | 4541.9 |
| EAF (%)  | 74.2  | 0.0   | 58.6  | 99.9  | 100.0 | 99.7  | 98.7  | 97.2  | 99.7  | 97.8  | 100.0 | 99.8  | 85.8   |
| UCF (%)  | 75.7  | 0.0   | 58.6  | 99.9  | 100.0 | 99.7  | 99.9  | 100.0 | 99.7  | 99.8  | 100.0 | 99.8  | 86.4   |
| LF (%)   | 74.5  | 0.0   | 59.6  | 100.7 | 100.0 | 99.0  | 97.5  | 95.8  | 98.5  | 97.5  | 100.1 | 100.4 | 85.6   |
| OF (%)   | 75.7  | 0.0   | 64.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.0   |
| EUF (%)  | 25.8  | 100.0 | 41.4  | 0.1   | 0.0   | 0.3   | 1.3   | 2.8   | 0.3   | 2.2   | 0.0   | 0.2   | 14.2   |
| PUF (%)  | 20.2  | 100.0 | 39.4  | 0.1   | 0.0   | 0.3   | 0.1   | 0.0   | 0.3   | 0.2   | 0.0   | 0.2   | 13.1   |
| UCLF (%) | 4.1   | 0.0   | 2.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5    |
| XUF (%)  | 1.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2   | 2.8   | 0.0   | 2.1   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

|                               |             |  |                  |
|-------------------------------|-------------|--|------------------|
| Date of Construction Start:   | 02 Jun 1972 | Lifetime Generation:                     | 108475.0 GW(e).h |
| Date of First Criticality:    | 16 Oct 1977 | Cumulative Energy Availability Factor:   | 80.4%            |
| Date of Grid Connection:      | 16 Nov 1977 | Cumulative Load Factor:                  | 79.8%            |
| Date of Commercial Operation: | 10 Dec 1978 | Cumulative Unit Capability Factor:       | 77.5%            |
|                               |             | Cumulative Energy Unavailability Factor: | 19.6%            |

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1989 | 2783.4            | 604.0             | 55.3   | 55.3   | 55.3                                 | 55.3   | 52.6               | 52.6   | 5226                  | 59.7   |
| 1990 | 2968.5            | 591.0             | 55.4   | 55.3   | 54.8                                 | 55.1   | 57.3               | 54.9   | 5315                  | 60.7   |
| 1991 | 4391.4            | 604.0             | 83.9   | 64.9   | 82.0                                 | 64.1   | 83.0               | 64.4   | 7602                  | 86.8   |
| 1992 | 4017.7            | 604.0             | 77.6   | 68.1   | 76.6                                 | 67.3   | 75.7               | 67.2   | 7260                  | 82.7   |
| 1993 | 4424.0            | 604.0             | 86.5   | 71.8   | 83.0                                 | 70.4   | 83.6               | 70.5   | 7854                  | 89.7   |
| 1994 | 3645.4            | 604.0             | 69.4   | 71.4   | 67.7                                 | 70.0   | 68.9               | 70.2   | 6458                  | 73.7   |
| 1995 | 4154.3            | 604.0             | 81.0   | 72.8   | 80.5                                 | 71.5   | 78.5               | 71.4   | 7168                  | 81.8   |
| 1996 | 4070.9            | 604.0             | 81.8   | 73.9   | 78.6                                 | 72.4   | 76.7               | 72.1   | 7051                  | 80.3   |
| 1997 | 4990.5            | 604.0             | 96.4   | 76.4   | 96.2                                 | 75.0   | 94.3               | 74.6   | 8558                  | 97.7   |
| 1998 | 4295.1            | 604.0             | 85.2   | 77.3   | 83.5                                 | 75.9   | 81.2               | 75.2   | 7448                  | 85.0   |
| 1999 | 4081.1            | 604.0             | 81.2   | 77.7   | 78.8                                 | 76.1   | 77.1               | 75.4   | 7156                  | 81.7   |
| 2000 | 5226.1            | 604.0             | 99.8   | 79.5   | 99.2                                 | 78.1   | 98.5               | 77.3   | 8784                  | 100.0  |
| 2001 | 4319.7            | 604.0             | 82.1   | 79.7   | 81.5                                 | 78.3   | 81.6               | 77.7   | 7282                  | 83.1   |
| 2002 | 4376.0            | 604.0             | 83.5   | 80.0   | 83.4                                 | 78.7   | 82.7               | 78.0   | 7367                  | 84.1   |
| 2003 | 5240.0            | 604.0             | 99.6   | 81.3   | 99.4                                 | 80.1   | 99.0               | 79.4   | 8760                  | 100.0  |
| 2004 | 4541.9            | 604.0             | 86.4   | 81.6   | 85.8                                 | 80.4   | 85.6               | 79.8   | 7646                  | 87.0   |

## TW-1 CHIN SHAN-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 07 Jan | 419.0  | 6.8     | XP1  | S21  | EOC-20 COASTDOWN OPERATION.   |
| 24 Jan | 37.0   | 18.4    | UF4  | A31  | REACTOR SCRAM DUE TO TURBINE TRIP WHICH RESULTED FROM DEH DPU 2/52 FAILURE. |
| 26 Jan | 1075.0 | 687.7   | PF   | C21  | REFUELLING OUTAGE   |
| 24 Aug | 38.0   | 12.4    | XP   | N42  | LOAD RESTRICTION DUE TO TYPHOON.  |
| 25 Oct | 22.0   | 9.3     | XP   | N42  | LOAD RESTRICTION DUE TO TYPHOON.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 37        |          |   | 212       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1075            |           |          | 1079  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 44  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 13        |          |
| H. Nuclear regulatory requirements   |                 |           |          |   |           | 1        |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 8        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 19       |
| Subtotal   | 1075            | 37        | 0        | 1123  | 225       | 28       |
| Total  |                 | 1112      |          |   | 1376      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 2   |
| 14. Safety Systems                  |                    | 70  |
| 15. Reactor Cooling Systems         |                    | 53  |
| 31. Turbine and auxiliaries         | 37                 | 36  |
| 32. Feedwater and Main Steam System |                    | 3   |
| 41. Main Generator Systems          |                    | 0   |
| 42. Electrical Power Supply Systems |                    | 45  |
| Total                               | 37                 | 209   |

# TW-2 CHIN SHAN-2

**Operator:** TPC (TAI POWER CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 604.0 MW(e)  
**Design Net RUP:** 604.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 5247.6 GW(e).h  
**Energy Availability Factor:** 98.0%  
**Load Factor:** 98.9%  
**Operating Factor:** 99.1%  
**Energy Unavailability Factor:** 2.0%  
**Total Off-line Time:** 80 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 458.0 | 430.1 | 458.6 | 411.9 | 450.9 | 432.9 | 438.9 | 435.2 | 432.0 | 443.7 | 440.4 | 415.0 | 5247.6 |
| <b>EAF (%)</b>  | 99.5  | 100.0 | 99.9  | 93.3  | 100.0 | 99.9  | 98.2  | 97.5  | 99.6  | 97.8  | 100.0 | 90.3  | 98.0   |
| <b>UCF (%)</b>  | 99.5  | 100.0 | 99.9  | 93.3  | 100.0 | 99.9  | 99.5  | 100.0 | 99.6  | 99.9  | 100.0 | 91.4  | 98.6   |
| <b>LF (%)</b>   | 101.9 | 102.3 | 102.1 | 94.8  | 100.3 | 99.5  | 97.7  | 96.8  | 99.3  | 98.6  | 101.3 | 92.4  | 98.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 95.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 93.4  | 99.1   |
| <b>EUF (%)</b>  | 0.5   | 0.0   | 0.1   | 6.7   | 0.0   | 0.1   | 1.8   | 2.5   | 0.4   | 2.2   | 0.0   | 9.7   | 2.0    |
| <b>PUF (%)</b>  | 0.3   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 0.3   | 0.0   | 0.4   | 0.1   | 0.0   | 0.1   | 0.1    |
| <b>UCLF (%)</b> | 0.2   | 0.0   | 0.0   | 6.7   | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5   | 1.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.3   | 2.5   | 0.0   | 2.0   | 0.0   | 1.0   | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 07 Dec 1973  
**Date of First Criticality:** 09 Nov 1978  
**Date of Grid Connection:** 19 Dec 1978  
**Date of Commercial Operation:** 15 Jul 1979

**Lifetime Generation:** 106671.0 GW(e).h  
**Cumulative Energy Availability Factor:** 79.7%  
**Cumulative Load Factor:** 79.7%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 20.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 3059.8         | 604.0          | 59.3   | 59.3   | 59.3                              | 59.3   | 57.8               | 57.8   | 6010               | 68.6   |
| 1990 | 3436.8         | 593.0          | 65.4   | 62.3   | 64.8                              | 62.1   | 66.2               | 62.0   | 6242               | 71.3   |
| 1991 | 3783.5         | 604.0          | 72.5   | 65.8   | 70.1                              | 64.8   | 71.5               | 65.2   | 6847               | 78.2   |
| 1992 | 4129.2         | 604.0          | 79.1   | 69.1   | 78.5                              | 68.2   | 77.8               | 68.3   | 7326               | 83.4   |
| 1993 | 3934.9         | 604.0          | 76.7   | 70.6   | 73.1                              | 69.2   | 74.4               | 69.6   | 6992               | 79.8   |
| 1994 | 3979.5         | 604.0          | 78.8   | 72.0   | 76.6                              | 70.4   | 75.2               | 70.5   | 7001               | 79.9   |
| 1995 | 3885.7         | 604.0          | 77.5   | 72.8   | 75.9                              | 71.2   | 73.4               | 70.9   | 6808               | 77.7   |
| 1996 | 4001.5         | 604.0          | 78.0   | 73.4   | 77.5                              | 72.0   | 75.4               | 71.5   | 6897               | 78.5   |
| 1997 | 4325.5         | 604.0          | 80.6   | 74.2   | 80.1                              | 72.9   | 81.8               | 72.6   | 7168               | 81.8   |
| 1998 | 4841.5         | 604.0          | 96.0   | 76.4   | 94.7                              | 75.1   | 91.5               | 74.5   | 8422               | 96.1   |
| 1999 | 4296.3         | 604.0          | 82.6   | 77.0   | 80.7                              | 75.6   | 81.2               | 75.1   | 7274               | 83.0   |
| 2000 | 4596.5         | 604.0          | 85.9   | 77.7   | 85.3                              | 76.4   | 86.6               | 76.1   | 7584               | 86.3   |
| 2001 | 5018.1         | 604.0          | 95.0   | 79.0   | 93.9                              | 77.8   | 94.8               | 77.5   | 8515               | 97.2   |
| 2002 | 4290.4         | 604.0          | 80.6   | 79.2   | 80.5                              | 77.9   | 81.1               | 77.8   | 7414               | 84.6   |
| 2003 | 4574.5         | 604.0          | 86.5   | 79.6   | 86.0                              | 78.5   | 86.5               | 78.4   | 7595               | 86.7   |
| 2004 | 5247.6         | 604.0          | 98.6   | 80.8   | 98.0                              | 79.7   | 98.9               | 79.7   | 8704               | 99.1   |

**TW-2 CHIN SHAN-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 13 Apr | 31.0  | 28.9    | UF2  | A31  | UNIT SHUTDOWN FOR TURBINE GV-2 (FAILURE CLOSURE) AND BGV-1/2/3 (STUCK OPEN) REPAIR. |
| 24 Aug | 43.0  | 11.2    | XP   | N42  | LOAD RESTRICTION DUE TO TYPHOON.  |
| 25 Oct | 22.0  | 9.1     | XP   | N42  | LOAD RESTRICTION DUE TO TYPHOON.  |
| 06 Dec | 49.0  | 38.3    | UF2  | A33  | UNIT SHUTDOWN FOR CSCW HEAT EXCHANGER SEA WATER PIPING LEAKAGE REPAIR.              |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 80        |          |   | 214       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1087  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 66  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   |           | 1        |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 6        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 7        |
| Subtotal   | 0               | 80        | 0        | 1155  | 225       | 14       |
| Total  |                 | 80        |          |   | 1394      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                                   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 5   |
| 12. Reactor I&C Systems                  |                    | 2   |
| 14. Safety Systems                       |                    | 1   |
| 15. Reactor Cooling Systems              |                    | 73  |
| 21. Fuel Handling and Storage Facilities |                    | 9   |
| 31. Turbine and auxiliaries              | 31                 | 49  |
| 32. Feedwater and Main Steam System      |                    | 20  |
| 33. Circulating Water System             | 49                 | 10  |
| 41. Main Generator Systems               |                    | 28  |
| 42. Electrical Power Supply Systems      |                    | 13  |
| Total                                    | 80                 | 210   |

# TW-3 KUOSHENG-1

**Operator:** TPC (TAI POWER CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 948.0 MW(e)  
**Design Net RUP:** 951.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 6978.5 GW(e).h  
**Energy Availability Factor:** 84.7%  
**Load Factor:** 83.8%  
**Operating Factor:** 85.6%  
**Energy Unavailability Factor:** 15.3%  
**Total Off-line Time:** 1268 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 578.7 | 659.0 | 707.4 | 677.6 | 702.2 | 669.6 | 681.3 | 671.2 | 189.6 | 57.6 | 677.2 | 707.1 | 6978.5 |
| <b>EAF (%)</b>  | 84.3  | 99.3  | 99.8  | 99.3  | 99.9  | 98.9  | 97.7  | 96.6  | 28.9  | 13.5 | 98.8  | 99.4  | 84.7   |
| <b>UCF (%)</b>  | 84.3  | 99.3  | 99.9  | 99.3  | 100.0 | 98.9  | 99.2  | 99.9  | 28.9  | 13.5 | 99.8  | 99.4  | 85.2   |
| <b>LF (%)</b>   | 82.1  | 99.9  | 100.3 | 99.3  | 99.6  | 98.1  | 96.6  | 95.2  | 27.8  | 8.2  | 99.2  | 100.2 | 83.8   |
| <b>OF (%)</b>   | 84.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 28.9  | 13.4 | 100.0 | 100.0 | 85.6   |
| <b>EUF (%)</b>  | 15.7  | 0.7   | 0.2   | 0.7   | 0.1   | 1.1   | 2.3   | 3.4   | 71.1  | 86.5 | 1.2   | 0.6   | 15.3   |
| <b>PUF (%)</b>  | 0.6   | 0.7   | 0.1   | 0.7   | 0.1   | 0.9   | 0.6   | 0.1   | 71.1  | 86.5 | 0.2   | 0.6   | 13.5   |
| <b>UCLF (%)</b> | 15.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.3   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 1.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 1.5   | 3.3   | 0.0   | 0.0  | 0.9   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

IN JULY AND AUGUST REDUCING POWER DUE TO TYPHOON BATTERING

## 5. Historical Summary

**Date of Construction Start:** 19 Nov 1975      **Lifetime Generation:** 146702.2 GW(e).h  
**Date of First Criticality:** 01 Feb 1981      **Cumulative Energy Availability Factor:** 80.5%  
**Date of Grid Connection:** 21 May 1981      **Cumulative Load Factor:** 79.0%  
**Date of Commercial Operation:** 28 Dec 1981      **Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 19.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 5329.1         | 951.0          | 64.9   | 64.9   | 63.0                              | 63.0   | 64.0               | 64.0   | 6447               | 73.6   |
| 1990 | 6898.0         | 918.0          | 87.4   | 76.0   | 86.8                              | 74.7   | 85.8               | 74.7   | 8201               | 93.6   |
| 1991 | 5850.8         | 951.0          | 71.4   | 74.4   | 71.4                              | 73.6   | 70.2               | 73.2   | 6678               | 76.2   |
| 1992 | 6152.4         | 951.0          | 78.4   | 75.4   | 78.4                              | 74.8   | 73.6               | 73.3   | 7126               | 81.1   |
| 1993 | 5679.5         | 951.0          | 71.1   | 74.6   | 71.1                              | 74.0   | 68.2               | 72.3   | 6457               | 73.7   |
| 1994 | 6302.3         | 950.0          | 77.8   | 75.1   | 76.9                              | 74.5   | 75.7               | 72.8   | 7077               | 80.8   |
| 1995 | 6897.9         | 948.0          | 84.7   | 76.5   | 84.6                              | 76.0   | 83.1               | 74.3   | 7734               | 88.3   |
| 1996 | 6950.8         | 948.0          | 84.8   | 77.5   | 84.3                              | 77.0   | 83.5               | 75.5   | 7573               | 86.2   |
| 1997 | 6277.8         | 948.0          | 77.7   | 77.5   | 77.5                              | 77.1   | 75.6               | 75.5   | 6978               | 79.7   |
| 1998 | 6426.0         | 948.0          | 81.2   | 77.9   | 79.7                              | 77.3   | 77.4               | 75.7   | 7209               | 82.3   |
| 1999 | 7686.8         | 948.0          | 95.1   | 79.5   | 93.8                              | 78.8   | 92.6               | 77.2   | 8439               | 96.3   |
| 2000 | 6588.6         | 948.0          | 81.3   | 79.6   | 80.2                              | 78.9   | 79.1               | 77.4   | 7391               | 84.1   |
| 2001 | 6452.3         | 948.0          | 79.4   | 79.6   | 78.8                              | 78.9   | 77.7               | 77.4   | 7070               | 80.7   |
| 2002 | 8068.5         | 948.0          | 98.5   | 81.0   | 98.1                              | 80.3   | 97.2               | 78.8   | 8693               | 99.2   |
| 2003 | 6444.9         | 948.0          | 78.5   | 80.8   | 78.3                              | 80.2   | 77.6               | 78.7   | 6968               | 79.5   |
| 2004 | 6978.5         | 948.0          | 85.2   | 81.1   | 84.7                              | 80.5   | 83.8               | 79.0   | 7516               | 85.6   |

## TW-3 KUOSHENG-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 13 Jan | 112.0  | 106.1   | UF2  | A31  | REACTOR IN COLD SHUTDOWN FOR MAINTENANCE OF HEATER (4A) DUE TO STEAM EXTRACTION LINE LEAKAGE. |
| 09 Sep | 1127.0 | 1107.0  | PF   | B    | RX COLD SHUTDOWN FOR EOC0-17 REFUELING OUTAGE.  |
| 27 Oct | 29.0   | 27.5    | PF   | E31  | RX IN HOT STANDBY FOR TURBINE OVERSPEED TRIP TEST.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 112       |          | 7  | 154       |          |
| B. Refuelling without a maintenance  | 1127            |           |          |  | 15        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1067                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 82                                       |           |          |
| E. Testing of plant systems or components  | 29              |           |          | 8  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 8        |
| L. Human factor related  |                 |           |          |  | 4         |          |
| Subtotal   | 1156            | 112       | 0        | 1164                                     | 173       | 11       |
| Total  |                 | 1268      |          |  | 1348      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1989 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 3  |
| 12. Reactor I&C Systems                  |                 | 7  |
| 13. Reactor Auxiliary Systems            |                 | 4  |
| 15. Reactor Cooling Systems              |                 | 7  |
| 21. Fuel Handling and Storage Facilities |                 | 24                                       |
| 31. Turbine and auxiliaries              | 112             | 23                                       |
| 32. Feedwater and Main Steam System      |                 | 51                                       |
| 33. Circulating Water System             |                 | 13                                       |
| 35. All other I&C Systems                |                 | 2  |
| 41. Main Generator Systems               |                 | 11                                       |
| 42. Electrical Power Supply Systems      |                 | 11                                       |
| Total                                    | 112             | 156                                      |

**TW-4 KUOSHENG-2**

Operator: TPC (TAI POWER CO.)

Contractor: GE (GENERAL ELECTRIC COMPANY (US))

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 948.0 MW(e)  
 Design Net RUP: 951.0 MW(e)  
 Design Discharge Burnup: —

**2. Production Summary 2004**

Energy Production: 6494.0 GW(e).h  
 Energy Availability Factor: 79.8%  
 Load Factor: 78.0%  
 Operating Factor: 83.1%  
 Energy Unavailability Factor: 20.2%  
 Total Off-line Time: 1483 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 649.2 | 644.5 | 369.8 | 0.5  | 573.8 | 662.7 | 674.3 | 563.8 | 658.1 | 626.4 | 669.0 | 401.8 | 6494.0 |
| EAF (%)  | 95.4  | 99.1  | 53.9  | 0.7  | 82.6  | 99.0  | 97.9  | 81.4  | 98.4  | 92.8  | 99.1  | 57.4  | 79.8   |
| UCF (%)  | 95.4  | 99.1  | 54.0  | 0.7  | 82.6  | 99.0  | 99.8  | 89.6  | 98.8  | 99.1  | 99.1  | 58.6  | 81.3   |
| LF (%)   | 92.0  | 97.7  | 52.4  | 0.1  | 81.4  | 97.1  | 95.6  | 79.9  | 96.4  | 88.8  | 98.0  | 57.0  | 78.0   |
| OF (%)   | 97.7  | 100.0 | 54.0  | 0.7  | 88.8  | 100.0 | 100.0 | 97.4  | 100.0 | 94.6  | 100.0 | 64.1  | 83.1   |
| EUF (%)  | 4.6   | 0.9   | 46.1  | 99.3 | 17.4  | 1.0   | 2.1   | 18.6  | 1.6   | 7.2   | 0.9   | 42.6  | 20.2   |
| PUF (%)  | 0.7   | 0.7   | 46.0  | 99.3 | 13.4  | 1.0   | 0.2   | 10.4  | 1.2   | 0.9   | 0.9   | 40.4  | 17.9   |
| UCLF (%) | 4.0   | 0.3   | 0.0   | 0.0  | 4.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.0   | 0.8    |
| XUF (%)  | 0.0   | 0.0   | 0.1   | 0.0  | 0.0   | 0.0   | 1.9   | 8.2   | 0.5   | 6.3   | 0.0   | 1.2   | 1.5    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

FUEL SIPPING AT THE BEGINNING OF YEAR. 17.3.-3.5. REFUELLING OUTAGE. IN JULY POWER REDUCTION DUE TO TYPHOON BATTERING. IN AUGUST AND SEPTEMBER DAMAGE OF MAIN AND OFFSITE TRANSFORMERS BY A TYPHOON.

**5. Historical Summary**

Date of Construction Start: 15 Mar 1976      Lifetime Generation: 136201.5 GW(e).h  
 Date of First Criticality: 26 Mar 1982      Cumulative Energy Availability Factor: 80.2%  
 Date of Grid Connection: 29 Jun 1982      Cumulative Load Factor: 79.0%  
 Date of Commercial Operation: 16 Mar 1983      Cumulative Unit Capability Factor: 78.1%  
    Cumulative Energy Unavailability Factor: 19.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 5227.3         | 951.0          | 65.3   | 65.3   | 61.9                              | 61.9   | 62.7               | 62.7   | 6390               | 72.9   |
| 1990 | 6000.6         | 936.0          | 74.0   | 69.6   | 73.5                              | 67.6   | 73.2               | 67.9   | 6819               | 77.8   |
| 1991 | 7186.3         | 951.0          | 89.3   | 76.2   | 89.3                              | 74.9   | 86.3               | 74.1   | 8101               | 92.5   |
| 1992 | 6176.3         | 951.0          | 76.8   | 76.4   | 76.8                              | 75.4   | 73.9               | 74.0   | 6985               | 79.5   |
| 1993 | 6138.1         | 951.0          | 74.9   | 76.1   | 74.9                              | 75.3   | 73.7               | 74.0   | 6921               | 79.0   |
| 1994 | 6224.1         | 950.0          | 76.0   | 76.1   | 74.8                              | 75.2   | 74.8               | 74.1   | 6868               | 78.4   |
| 1995 | 5999.7         | 948.0          | 72.9   | 75.6   | 72.2                              | 74.8   | 72.2               | 73.8   | 6543               | 74.7   |
| 1996 | 7423.2         | 948.0          | 90.0   | 77.4   | 89.6                              | 76.6   | 89.1               | 75.8   | 7978               | 90.8   |
| 1997 | 7087.2         | 948.0          | 88.7   | 78.7   | 86.1                              | 77.7   | 85.3               | 76.8   | 7745               | 88.4   |
| 1998 | 6549.6         | 948.0          | 80.3   | 78.8   | 79.3                              | 77.8   | 78.9               | 77.0   | 7242               | 82.7   |
| 1999 | 6831.9         | 948.0          | 85.9   | 79.5   | 84.2                              | 78.4   | 82.3               | 77.5   | 7544               | 86.1   |
| 2000 | 7237.6         | 948.0          | 91.5   | 80.5   | 89.3                              | 79.3   | 86.9               | 78.3   | 8234               | 93.7   |
| 2001 | 5976.7         | 948.0          | 74.1   | 80.0   | 72.4                              | 78.8   | 72.0               | 77.8   | 6772               | 77.3   |
| 2002 | 6922.6         | 948.0          | 85.5   | 80.4   | 85.1                              | 79.2   | 83.4               | 78.2   | 7530               | 86.0   |
| 2003 | 7623.1         | 948.0          | 93.7   | 81.3   | 93.5                              | 80.2   | 91.8               | 79.1   | 8427               | 96.2   |
| 2004 | 6494.0         | 948.0          | 81.3   | 81.3   | 79.8                              | 80.2   | 78.0               | 79.0   | 7301               | 83.1   |



## TW-4 KUOSHENG-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 18.0   | 35.1    | UF2  | A21  | RX IN COLD SHUTDOWN FOR INCORE-SIPPING.   |
| 17 Mar | 1106.0 | 1057.1  | PF   | B    | EOC-16 REFUELLING AND TURBINE OVERSPEED TRIP TEST.                                  |
| 03 May | 10.0   | 4.8     | UF2  | A42  | GENERATOR TRIPPED DUE TO THE DIFFERTIAL TRANSFER RELAY.                             |
| 04 May | 18.0   | 17.1    | UF2  | A31  | RX IN HOT STANDBY FOR MAINTENANCE OF PIPING LEAKAGE OF HIGH PRESURE TURBINE.        |
| 15 May | 6.0    | 5.5     | UF2  | A31  | RX IN HOT STANDBY FOR ADJUSTING THE BALANCE OF TURBINE ROTOR.                       |
| 30 Aug | 19.0   | 27.9    | XF2  | N42  | RX IN HOT STANDBY FOR REPAIR OF DAMAGE OF MAIN TRANSFORMER DUE TO TYPHOON INVADING. |
| 25 Oct | 40.0   | 55.7    | XF2  | N42  | RX IN HOT STANDBY FOR REPAIRING THE DAMAGE OF OFFSITE LINE DUE TO TYPHOON INVADING. |
| 12 Dec | 263.0  | 284.8   | PF   | E11  | RX IN COLD SHUTDOWN FOR IN-CORE FUEL SIPPING.                                       |
| 24 Dec | 5.0    | 7.2     | UF2  | A31  | RX IN HOT STANDBY FOR MAINTENANCE OF MSR STEAM EXTRACTING LINE JOINT LEAKAGE.       |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 57        |          |  | 148       |          |
| B. Refuelling without a maintenance  | 1106            |           |          |  | 20        |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 1017                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 110                                      |           |          |
| E. Testing of plant systems or components  | 263             |           |          | 6  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 8         | 4        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 1         | 17       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 59       |  |           |          |
| Subtotal   | 1369            | 57        | 59       | 1133                                     | 177       | 21       |
| Total  |                 | 1485      |          |  | 1331      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1989 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 5  |
| 13. Reactor Auxiliary Systems            |                 | 2  |
| 14. Safety Systems                       |                 | 7  |
| 15. Reactor Cooling Systems              |                 | 24                                       |
| 21. Fuel Handling and Storage Facilities | 18              | 39                                       |
| 31. Turbine and auxiliaries              | 29              | 17                                       |
| 32. Feedwater and Main Steam System      |                 | 27                                       |
| 33. Circulating Water System             |                 | 6  |
| 35. All other I&C Systems                |                 | 12                                       |
| 41. Main Generator Systems               |                 | 0  |
| 42. Electrical Power Supply Systems      | 10              | 5  |
| Total                                    | 57              | 144                                      |

# TW-5 MAANSHAN-1

**Operator:** TPC (TAI POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 890.0 MW(e)  
**Design Net RUP:** 892.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 6793.7 GW(e).h  
**Energy Availability Factor:** 86.8%  
**Load Factor:** 86.9%  
**Operating Factor:** 88.1%  
**Energy Unavailability Factor:** 13.2%  
**Total Off-line Time:** 1042 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 667.7 | 624.4 | 665.7 | 641.3 | 659.6 | 612.4 | 644.9 | 658.1 | 636.2 | 605.3 | 0.0   | 378.1 | 6793.7 |
| <b>EAF (%)</b>  | 99.9  | 99.9  | 99.9  | 99.9  | 99.8  | 95.7  | 97.6  | 99.9  | 99.9  | 91.9  | 0.0   | 56.2  | 86.8   |
| <b>UCF (%)</b>  | 99.9  | 99.9  | 99.9  | 99.9  | 99.8  | 99.9  | 100.0 | 99.9  | 99.9  | 92.8  | 0.0   | 56.2  | 87.4   |
| <b>LF (%)</b>   | 100.8 | 100.8 | 100.5 | 100.2 | 99.6  | 95.6  | 97.4  | 99.4  | 99.3  | 91.3  | 0.0   | 57.1  | 86.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.6  | 0.0   | 63.0  | 88.1   |
| <b>EUF (%)</b>  | 0.1   | 0.1   | 0.1   | 0.1   | 0.2   | 4.3   | 2.4   | 0.1   | 0.1   | 8.1   | 100.0 | 43.8  | 13.2   |
| <b>PUF (%)</b>  | 0.1   | 0.1   | 0.1   | 0.1   | 0.2   | 0.1   | 0.0   | 0.1   | 0.1   | 7.2   | 100.0 | 34.0  | 11.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.8   | 0.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.2   | 2.4   | 0.0   | 0.0   | 0.9   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

UNIT 1 OPERATED AT FULL POWER IN BASE-LOAD OVER THE YEAR EXCEPT UNIT OUTAGE, SURVILLANCE TEST AND SO ON.

## 5. Historical Summary

**Date of Construction Start:** 21 Aug 1978      **Lifetime Generation:** 120650.4 GW(e).h  
**Date of First Criticality:** 30 Mar 1984      **Cumulative Energy Availability Factor:** 81.1%  
**Date of Grid Connection:** 09 May 1984      **Cumulative Load Factor:** 82.6%  
**Date of Commercial Operation:** 27 Jul 1984      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 18.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 5418.4         | 890.0          | 66.3   | 66.3   | 66.0                              | 66.0   | 69.5               | 69.5   | 6305               | 72.0   |
| 1990 | 6098.9         | 894.0          | 77.8   | 72.0   | 76.8                              | 71.4   | 77.9               | 73.7   | 7079               | 80.8   |
| 1991 | 6479.1         | 890.0          | 84.0   | 76.0   | 82.7                              | 75.2   | 83.1               | 76.8   | 7368               | 84.1   |
| 1992 | 6038.8         | 890.0          | 76.8   | 76.2   | 76.2                              | 75.4   | 77.2               | 76.9   | 6826               | 77.7   |
| 1993 | 6258.8         | 890.0          | 78.5   | 76.7   | 78.5                              | 76.0   | 80.3               | 77.6   | 6930               | 79.1   |
| 1994 | 6322.6         | 890.0          | 79.8   | 77.2   | 79.6                              | 76.6   | 81.1               | 78.2   | 7098               | 81.0   |
| 1995 | 6741.1         | 890.0          | 84.5   | 78.2   | 84.4                              | 77.7   | 86.5               | 79.4   | 7495               | 85.6   |
| 1996 | 7537.0         | 890.0          | 95.8   | 80.4   | 93.8                              | 79.7   | 96.4               | 81.5   | 8329               | 94.8   |
| 1997 | 5949.2         | 890.0          | 74.8   | 79.8   | 74.3                              | 79.1   | 76.3               | 80.9   | 6752               | 77.1   |
| 1998 | 5514.5         | 890.0          | 69.2   | 78.7   | 69.2                              | 78.1   | 70.7               | 79.9   | 6101               | 69.6   |
| 1999 | 7392.7         | 890.0          | 96.3   | 80.3   | 92.6                              | 79.5   | 94.8               | 81.3   | 8328               | 95.1   |
| 2000 | 6729.0         | 890.0          | 84.6   | 80.7   | 84.3                              | 79.9   | 86.1               | 81.7   | 7502               | 85.4   |
| 2001 | 5333.3         | 890.0          | 86.1   | 81.1   | 67.6                              | 78.9   | 68.4               | 80.6   | 6046               | 69.0   |
| 2002 | 7800.8         | 890.0          | 98.8   | 82.4   | 98.7                              | 80.3   | 100.1              | 82.0   | 8726               | 99.6   |
| 2003 | 6751.0         | 890.0          | 87.3   | 82.7   | 86.2                              | 80.7   | 86.6               | 82.3   | 7579               | 86.5   |
| 2004 | 6793.7         | 890.0          | 87.4   | 83.0   | 86.8                              | 81.1   | 86.9               | 82.6   | 7742               | 88.1   |

**TW-5 MAANSHAN-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 30 Oct | 1030.0 | 917.1   | PF   | C    | REFUELING OUTAGE.  |
| 12 Dec | 11.0   | 9.8     | PF   | E31  | TURBINE OVERSPEED TEST DURING REACTOR STARTUP AFTER REFUELLING OUTAGE. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 240       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1030            |           |          | 956   | 113       |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 1   |           |          |
| E. Testing of plant systems or components  | 11              |           |          | 9   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 104      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |   |           | 11       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |   |           | 4        |
| Subtotal   | 1041            | 0         | 0        | 966   | 361       | 119      |
| Total  |                 | 1041      |          |   | 1446      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 13  |
| 13. Reactor Auxiliary Systems       |                    | 2   |
| 15. Reactor Cooling Systems         |                    | 29  |
| 16. Steam generation systems        |                    | 22  |
| 31. Turbine and auxiliaries         |                    | 22  |
| 32. Feedwater and Main Steam System |                    | 7   |
| 41. Main Generator Systems          |                    | 98  |
| 42. Electrical Power Supply Systems |                    | 45  |
| Total                               | 0                  | 238   |

# TW-6 MAANSHAN-2

**Operator:** TPC (TAI POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 890.0 MW(e)  
**Design Net RUP:** 892.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 7883.0 GW(e).h  
**Energy Availability Factor:** 99.5%  
**Load Factor:** 100.8%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.5%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 684.7 | 627.3 | 676.2 | 652.0 | 669.4 | 647.3 | 666.3 | 665.5 | 642.8 | 662.0 | 642.2 | 647.3 | 7883.0 |
| <b>EAF (%)</b>  | 100.0 | 98.4  | 99.6  | 100.0 | 99.9  | 99.9  | 99.7  | 99.9  | 100.0 | 99.5  | 99.6  | 97.7  | 99.5   |
| <b>UCF (%)</b>  | 100.0 | 98.4  | 99.6  | 100.0 | 99.9  | 100.0 | 100.0 | 99.9  | 100.0 | 99.5  | 99.6  | 97.8  | 99.6   |
| <b>LF (%)</b>   | 103.4 | 101.3 | 102.1 | 101.7 | 101.1 | 101.0 | 100.6 | 100.5 | 100.3 | 100.0 | 100.2 | 97.8  | 100.8  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 1.6   | 0.4   | 0.0   | 0.1   | 0.1   | 0.3   | 0.1   | 0.0   | 0.5   | 0.4   | 2.3   | 0.5    |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 0.0   | 0.1    |
| <b>UCLF (%)</b> | 0.0   | 1.5   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 0.3   | 2.2   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

UNIT 2 OPERATED AT FULL POWER IN BASE-LOAD OVER THE YEAR EXCEPT UNIT OUTAGE, SURVILLANCE TEST AND SO ON. THERE ARE NO REACTOR TRIP AND OFF-LINE HOURS.

## 5. Historical Summary

**Date of Construction Start:** 21 Feb 1979      **Lifetime Generation:** 117446.6 GW(e).h  
**Date of First Criticality:** 01 Feb 1985      **Cumulative Energy Availability Factor:** 82.3%  
**Date of Grid Connection:** 25 Feb 1985      **Cumulative Load Factor:** 84.3%  
**Date of Commercial Operation:** 18 May 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 17.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 5283.3         | 890.0          | 58.8   | 58.8   | 58.1                              | 58.1   | 67.8               | 67.8   | 6434               | 73.4   |
| 1990 | 6141.3         | 896.0          | 78.8   | 68.9   | 77.3                              | 67.7   | 78.2               | 73.0   | 7143               | 81.5   |
| 1991 | 6187.1         | 890.0          | 80.4   | 72.7   | 78.6                              | 71.3   | 79.4               | 75.1   | 7155               | 81.7   |
| 1992 | 5956.6         | 890.0          | 84.3   | 75.6   | 75.5                              | 72.4   | 76.2               | 75.4   | 7541               | 85.8   |
| 1993 | 6551.0         | 890.0          | 84.1   | 77.3   | 84.1                              | 74.7   | 84.0               | 77.1   | 7442               | 85.0   |
| 1994 | 7006.5         | 890.0          | 93.3   | 80.0   | 88.7                              | 77.0   | 89.9               | 79.2   | 8216               | 93.8   |
| 1995 | 6118.6         | 890.0          | 77.1   | 79.6   | 77.1                              | 77.1   | 78.5               | 79.1   | 6947               | 79.3   |
| 1996 | 6349.8         | 890.0          | 81.0   | 79.7   | 79.8                              | 77.4   | 81.2               | 79.4   | 7091               | 80.7   |
| 1997 | 6415.4         | 890.0          | 81.6   | 79.9   | 81.1                              | 77.8   | 82.3               | 79.7   | 7153               | 81.7   |
| 1998 | 7781.1         | 890.0          | 97.4   | 81.7   | 97.2                              | 79.7   | 99.8               | 81.7   | 8557               | 97.7   |
| 1999 | 6628.4         | 890.0          | 85.3   | 82.0   | 82.7                              | 80.0   | 85.0               | 82.0   | 7427               | 84.8   |
| 2000 | 6618.6         | 890.0          | 84.1   | 82.2   | 82.6                              | 80.2   | 84.7               | 82.2   | 7401               | 84.3   |
| 2001 | 6993.8         | 890.0          | 99.4   | 83.5   | 87.3                              | 80.8   | 89.7               | 82.8   | 7729               | 88.2   |
| 2002 | 6639.8         | 890.0          | 82.4   | 83.4   | 82.4                              | 80.9   | 85.2               | 83.0   | 7507               | 85.7   |
| 2003 | 6737.6         | 890.0          | 86.6   | 83.6   | 85.2                              | 81.2   | 86.4               | 83.2   | 7549               | 86.2   |
| 2004 | 7883.0         | 890.0          | 99.5   | 84.6   | 99.5                              | 82.3   | 100.8              | 84.3   | 8784               | 100.0  |

## TW-6 MAANSHAN-2

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 152       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 1040  | 4         |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 5   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 64       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |   | 2         | 2        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |   |           | 6        |
| Subtotal   | 0               | 0         | 0        | 1045  | 159       | 72       |
| Total  | 0               |           |          | 1276  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|-----------------|---|
| 12. Reactor I&C Systems             |                 | 17  |
| 13. Reactor Auxiliary Systems       |                 | 7   |
| 15. Reactor Cooling Systems         |                 | 37  |
| 16. Steam generation systems        |                 | 2   |
| 31. Turbine and auxiliaries         |                 | 27  |
| 32. Feedwater and Main Steam System |                 | 8   |
| 35. All other I&C Systems           |                 | 7   |
| 41. Main Generator Systems          |                 | 35  |
| 42. Electrical Power Supply Systems |                 | 7   |
| Total                               | 0               | 147   |

# CZ-4 DUKOVANY-1

**Operator:** CEZ (CZECH POWER COMPANY , CEZ a.s.)  
**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 412.0 MW(e)  
**Design Net RUP:** 420.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3035.5 GW(e).h  
**Energy Availability Factor:** 82.9%  
**Load Factor:** 83.9%  
**Operating Factor:** 83.7%  
**Energy Unavailability Factor:** 17.1%  
**Total Off-line Time:** 1435 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 313.4 | 294.1 | 313.5 | 302.4 | 75.3 | 284.1 | 307.2 | 302.3 | 144.3 | 77.4 | 305.3 | 316.1 | 3035.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 99.9  | 24.3 | 99.9  | 99.7  | 98.7  | 49.0  | 25.0 | 100.0 | 100.0 | 82.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 99.9  | 24.3 | 100.0 | 100.0 | 100.0 | 56.2  | 25.0 | 100.0 | 100.0 | 83.7   |
| <b>LF (%)</b>   | 102.2 | 102.6 | 102.3 | 102.0 | 24.6 | 95.8  | 100.2 | 98.6  | 48.7  | 25.3 | 102.9 | 103.1 | 83.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 25.5 | 96.1  | 100.0 | 100.0 | 56.7  | 27.4 | 100.0 | 100.0 | 83.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 75.7 | 0.1   | 0.3   | 1.3   | 51.0  | 75.0 | 0.0   | 0.0   | 17.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 75.7 | 0.0   | 0.0   | 0.0   | 43.8  | 61.2 | 0.0   | 0.0   | 15.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 13.8 | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.1   | 0.3   | 1.3   | 7.2   | 0.0  | 0.0   | 0.0   | 0.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1979  
**Date of First Criticality:** 12 Feb 1985  
**Date of Grid Connection:** 24 Feb 1985  
**Date of Commercial Operation:** 03 May 1985

**Lifetime Generation:** 59202.8 GW(e).h  
**Cumulative Energy Availability Factor:** 81.4%  
**Cumulative Load Factor:** 82.5%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 18.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 1993.9         | 396.0          | 0.0  | 0.0    | 84.1                              | 100.0  | 57.5               | 0.0    | 5418               | 61.9   |
| 1986 | 2658.4         | 403.0          | 76.2   | 76.2   | 76.1                              | 76.1   | 75.3               | 75.3   | 7094               | 81.0   |
| 1987 | 2575.9         | 408.0          | 74.7   | 75.4   | 70.7                              | 73.4   | 72.1               | 73.7   | 6867               | 78.4   |
| 1988 | 2524.0         | 408.0          | 74.2   | 75.0   | 71.5                              | 72.8   | 70.4               | 72.6   | 6996               | 79.6   |
| 1989 | 2940.6         | 408.0          | 82.8   | 77.0   | 82.0                              | 75.1   | 82.3               | 75.0   | 7579               | 86.5   |
| 1990 | 2965.6         | 408.0          | 84.3   | 78.4   | 82.5                              | 76.6   | 83.0               | 76.6   | 7658               | 87.4   |
| 1991 | 2581.1         | 408.0          | 70.7   | 77.1   | 70.5                              | 75.6   | 72.2               | 75.9   | 6751               | 77.1   |
| 1992 | 3172.8         | 408.0          | 80.9   | 77.7   | 80.5                              | 76.3   | 88.5               | 77.7   | 7537               | 85.8   |
| 1993 | 3239.7         | 442.0          | 83.7   | 78.5   | 83.7                              | 77.3   | 83.7               | 78.5   | 7649               | 87.3   |
| 1994 | 3278.5         | 442.0          | 84.6   | 79.2   | 84.6                              | 78.1   | 84.7               | 79.2   | 7656               | 87.4   |
| 1995 | 2966.1         | 442.0          | 76.8   | 79.0   | 76.8                              | 78.0   | 76.6               | 78.9   | 7022               | 80.2   |
| 1996 | 3144.6         | 412.0          | 86.0   | 79.6   | 85.4                              | 78.7   | 86.9               | 79.7   | 7592               | 86.4   |
| 1997 | 3295.6         | 440.0          | 86.8   | 80.2   | 85.3                              | 79.2   | 85.5               | 80.2   | 7678               | 87.6   |
| 1998 | 2973.4         | 412.0          | 85.4   | 80.6   | 82.6                              | 79.5   | 82.4               | 80.3   | 7518               | 85.8   |
| 1999 | 2901.1         | 412.0          | 79.8   | 80.5   | 79.2                              | 79.5   | 80.4               | 80.3   | 7034               | 80.3   |
| 2000 | 3327.9         | 412.0          | 89.8   | 81.2   | 89.7                              | 80.1   | 92.0               | 81.1   | 7934               | 90.3   |
| 2001 | 3328.9         | 412.0          | 90.6   | 81.7   | 90.2                              | 80.8   | 92.2               | 81.8   | 7996               | 91.3   |
| 2002 | 3267.5         | 412.0          | 89.6   | 82.2   | 88.9                              | 81.2   | 90.5               | 82.3   | 7926               | 90.5   |
| 2003 | 3032.0         | 412.0          | 82.9   | 82.2   | 82.6                              | 81.3   | 84.0               | 82.4   | 7261               | 82.9   |
| 2004 | 3035.5         | 412.0          | 83.7   | 82.3   | 82.9                              | 81.4   | 83.9               | 82.5   | 7349               | 83.7   |

# CZ-4 DUKOVANY-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 10.3  | 0.7     | XP   | K    | LOAD FOLLOWING  |
| 02 Jan | 1.6   | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 03 Jan | 9.2   | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 30 Apr | 2.0   | 0.2     | PP   | D    | MAINTENANCE OF EQUIPMENTS COMMON TO THE TWIN UNITS DURING REFUELLING OUTAGE OF THE UNIT 2 |
| 01 May | 562.0 | 231.9   | PF   | D    | MAINTENANCE OF EQUIPMENTS COMMON TO THE TWIN UNITS DURING REFUELLING OUTAGE OF THE UNIT 2 |
| 01 Jun | 720.0 | 0.2     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE   |
| 04 Jun | 35.0  | 14.6    | XF   | J    | PLANNED OUTAGE FOR RECONSTRUCTION OF THE SLAVETICE SWITCHING STATION                      |
| 01 Jul | 720.0 | 0.9     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE   |
| 01 Aug | 744.0 | 1.5     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE   |
| 18 Aug | 288.0 | 2.6     | XP   | S    | FUEL MANAGEMENT LIMITATION - STRECH OUT   |
| 01 Sep | 404.0 | 21.3    | XP   | S    | FUEL MANAGEMENT LIMITATION - STRECH OUT   |
| 18 Sep | 4.0   | 1.3     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE  |
| 18 Sep | 312.0 | 128.5   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE  |
| 01 Oct | 439.0 | 180.9   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE  |
| 19 Oct | 101.9 | 42.0    | UF3  | A42  | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - OUTAGE EXTENSION                               |
| 22 Oct | 59.0  | 6.6     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP                                       |
| 24 Oct | 4.0   | 0.4     | UP   | L    | HUMAN ERROR   |
| 01 Nov | 720.0 | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 02 Nov | 5.0   | 0.0     | PP   | E42  | CERTIFICATION OF THE LOAD FOLLOWING SYSTEM  |
| 01 Dec | 744.0 | 0.2     | XP   | K    | LOAD FOLLOWING  |
| 16 Dec | 2.0   | 0.0     | PP   | E    | CERTIFICATION OF THE LOAD FOLLOWING SYSTEM  |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 101       |          |  | 60        |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 751             |           |          | 1132                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       | 562             |           |          | 108                                      |           |          |
| J. Grid failure or grid unavailability                        |                 |           | 35       |  |           | 4        |
| L. Human factor related                                       |                 |           |          |  | 0         |          |
| Subtotal  | 1313            | 101       | 35       | 1240                                     | 60        | 4        |
| Total   |                 | 1449      |          |  | 1304      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 5  |
| 14. Safety Systems                  |                 | 6  |
| 15. Reactor Cooling Systems         |                 | 24                                       |
| 31. Turbine and auxiliaries         |                 | 4  |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems | 101             | 19                                       |
| Total                               | 101             | 58                                       |

# CZ-5 DUKOVANY-2

**Operator:** CEZ (CZECH POWER COMPANY , CEZ a.s.)  
**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 412.0 MW(e)  
**Design Net RUP:** 420.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3087.7 GW(e).h  
**Energy Availability Factor:** 84.2%  
**Load Factor:** 85.3%  
**Operating Factor:** 84.7%  
**Energy Unavailability Factor:** 15.8%  
**Total Off-line Time:** 1346 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 312.3 | 287.6 | 313.2 | 229.7 | 0.0   | 112.9 | 304.9 | 303.3 | 298.4 | 309.0 | 303.2 | 313.5 | 3087.7 |
| <b>EAF (%)</b>  | 100.0 | 98.0  | 100.0 | 75.7  | 0.0   | 38.5  | 99.3  | 99.0  | 99.9  | 100.0 | 100.0 | 100.0 | 84.2   |
| <b>UCF (%)</b>  | 100.0 | 98.0  | 100.0 | 75.8  | 0.0   | 38.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 84.4   |
| <b>LF (%)</b>   | 101.9 | 100.3 | 102.2 | 77.4  | 0.0   | 38.1  | 99.5  | 98.9  | 100.6 | 100.7 | 102.2 | 102.3 | 85.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 76.0  | 0.0   | 40.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 84.7   |
| <b>EUF (%)</b>  | 0.0   | 2.0   | 0.0   | 24.3  | 100.0 | 61.5  | 0.7   | 1.0   | 0.1   | 0.0   | 0.0   | 0.0   | 15.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 24.2  | 100.0 | 61.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.5   |
| <b>UCLF (%)</b> | 0.0   | 2.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.6   | 1.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1979  
**Date of First Criticality:** 23 Jan 1986  
**Date of Grid Connection:** 30 Jan 1986  
**Date of Commercial Operation:** 21 Mar 1986

**Lifetime Generation:** 57372.0 GW(e).h  
**Cumulative Energy Availability Factor:** 81.6%  
**Cumulative Load Factor:** 83.0%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 18.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 2792.7         | 408.0          | 0.0  | 0.0    | 94.9                              | 100.0  | 83.3               | 0.0    | 7615               | 92.7   |
| 1987 | 2668.6         | 408.0          | 76.6   | 76.6   | 71.6                              | 71.6   | 74.7               | 74.7   | 6997               | 79.9   |
| 1988 | 2771.3         | 408.0          | 74.9   | 75.7   | 74.6                              | 73.1   | 77.3               | 76.0   | 6963               | 79.3   |
| 1989 | 3011.0         | 408.0          | 82.7   | 78.0   | 82.2                              | 76.1   | 84.2               | 78.7   | 7713               | 88.0   |
| 1990 | 2822.7         | 408.0          | 80.1   | 78.5   | 76.5                              | 76.2   | 79.0               | 78.8   | 7566               | 86.4   |
| 1991 | 2901.4         | 408.0          | 81.6   | 79.2   | 81.2                              | 77.2   | 81.2               | 79.3   | 7600               | 86.8   |
| 1992 | 2830.6         | 408.0          | 71.6   | 77.9   | 71.4                              | 76.2   | 79.0               | 79.2   | 6551               | 74.6   |
| 1993 | 3256.9         | 440.0          | 84.2   | 78.8   | 84.2                              | 77.4   | 84.5               | 80.0   | 7496               | 85.6   |
| 1994 | 3094.3         | 440.0          | 80.8   | 79.1   | 79.6                              | 77.7   | 80.3               | 80.1   | 7315               | 83.5   |
| 1995 | 3263.3         | 440.0          | 85.5   | 79.8   | 84.3                              | 78.5   | 84.7               | 80.6   | 7720               | 88.1   |
| 1996 | 2831.0         | 412.0          | 78.3   | 79.7   | 77.3                              | 78.4   | 78.2               | 80.4   | 6917               | 78.7   |
| 1997 | 3144.8         | 440.0          | 81.1   | 79.8   | 81.1                              | 78.6   | 81.6               | 80.5   | 7179               | 82.0   |
| 1998 | 3209.2         | 412.0          | 88.2   | 80.5   | 87.7                              | 79.4   | 88.9               | 81.2   | 7803               | 89.1   |
| 1999 | 3198.1         | 412.0          | 88.4   | 81.1   | 87.8                              | 80.0   | 88.6               | 81.7   | 7812               | 89.2   |
| 2000 | 2954.1         | 412.0          | 81.8   | 81.2   | 81.2                              | 80.1   | 81.6               | 81.7   | 7223               | 82.2   |
| 2001 | 3121.1         | 412.0          | 86.9   | 81.5   | 86.4                              | 80.5   | 86.5               | 82.0   | 7646               | 87.3   |
| 2002 | 3159.6         | 412.0          | 88.3   | 82.0   | 87.8                              | 81.0   | 87.5               | 82.4   | 7716               | 88.1   |
| 2003 | 3252.6         | 412.0          | 89.8   | 82.4   | 89.2                              | 81.4   | 90.1               | 82.8   | 7939               | 90.6   |
| 2004 | 3087.7         | 412.0          | 84.4   | 82.5   | 84.2                              | 81.6   | 85.3               | 83.0   | 7439               | 84.7   |



## CZ-5 DUKOVANY-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 11 Jan | 12.0  | 1.0     | XP   | K    | LOAD FOLLOWING  |
| 07 Feb | 31.3  | 5.8     | UP2  | A31  | TG22 TRIP DUE TO LEAKAGE ON A STEAM EXTRACTION LINE         |
| 18 Apr | 119.5 | 0.3     | XP   | S    | FUEL COASTDOWN EFFECT                                       |
| 23 Apr | 174.0 | 71.7    | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                    |
| 01 May | 744.0 | 305.9   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                    |
| 01 Jun | 428.0 | 176.3   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                    |
| 01 Jun | 720.0 | 0.1     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE           |
| 17 Jun | 87.0  | 5.6     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP         |
| 28 Jun | 6.3   | 0.1     | PP   | E42  | TESTING OF REMOTE CONTROL FOR LOAD FOLLOWING OPERATION      |
| 29 Jun | 3.1   | 0.0     | PP   | E42  | TESTING OF REMOTE CONTROL FOR LOAD FOLLOWING OPERATION      |
| 29 Jun | 2.0   | 0.1     | PP   | E42  | TESTING OF REMOTE CONTROL FOR LOAD FOLLOWING OPERATION      |
| 30 Jun | 9.0   | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 01 Jul | 8.0   | 0.1     | PP   | E    | CERTIFICATION OF THE LOAD FOLLOWING SYSTEM                  |
| 01 Jul | 3.0   | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 01 Jul | 744.0 | 2.0     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS |
| 01 Aug | 744.0 | 3.0     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS |
| 01 Sep | 720.0 | 0.4     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS |
| 01 Oct | 150.0 | 0.0     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 52        |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling | 1346            |           |          | 1091                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 96                                       |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |  | 1         | 3        |
| L. Human factor related                                       |                 |           |          |  | 0         |          |
| Subtotal  | 1346            | 0         | 0        | 1187                                     | 67        | 3        |
| Total   |                 | 1346      |          |  | 1257      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 9  |
| 15. Reactor Cooling Systems                    |                 | 6  |
| 16. Steam generation systems                   |                 | 7  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 1  |
| 32. Feedwater and Main Steam System            |                 | 20                                       |
| 42. Electrical Power Supply Systems            |                 | 4  |
| XX. Miscellaneous Systems                      |                 | 1  |
| Total  | 0               | 49                                       |

## CZ-8 DUKOVANY-3

**Operator:** CEZ (CZECH POWER COMPANY , CEZ a.s.)

**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 412.0 MW(e)  
**Design Net RUP:** 420.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 3302.5 GW(e).h  
**Energy Availability Factor:** 90.2%  
**Load Factor:** 91.2%  
**Operating Factor:** 90.6%  
**Energy Unavailability Factor:** 9.8%  
**Total Off-line Time:** 828 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 312.5 | 293.5 | 115.1 | 140.9 | 309.0 | 297.1 | 305.9 | 305.4 | 296.4 | 309.8 | 302.4 | 314.5 | 3302.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 37.2  | 46.9  | 100.0 | 99.8  | 99.6  | 99.5  | 99.2  | 100.0 | 100.0 | 100.0 | 90.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 37.6  | 46.9  | 100.0 | 100.0 | 100.0 | 99.7  | 99.2  | 100.0 | 100.0 | 100.0 | 90.3   |
| <b>LF (%)</b>   | 101.9 | 102.4 | 37.6  | 47.5  | 100.8 | 100.2 | 99.8  | 99.6  | 99.9  | 100.9 | 101.9 | 102.6 | 91.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 37.9  | 49.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 62.8  | 53.1  | 0.0   | 0.2   | 0.4   | 0.5   | 0.8   | 0.0   | 0.0   | 0.0   | 9.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 62.4  | 53.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.8   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.2   | 0.4   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Mar 1979  
**Date of First Criticality:** 28 Oct 1986  
**Date of Grid Connection:** 14 Nov 1986  
**Date of Commercial Operation:** 20 Dec 1986

**Lifetime Generation:** 55323.5 GW(e).h  
**Cumulative Energy Availability Factor:** 81.7%  
**Cumulative Load Factor:** 83.3%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 18.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 280.2          | 408.0          | 0.0  | 0.0    | 7.9                               | 100.0  | 7.9                | 0.0    | 1356               | 15.7   |
| 1987 | 3109.9         | 408.0          | 86.3   | 86.3   | 84.3                              | 84.3   | 87.0               | 87.0   | 7644               | 87.3   |
| 1988 | 2988.9         | 408.0          | 81.4   | 83.9   | 80.0                              | 82.1   | 83.4               | 85.2   | 7672               | 87.3   |
| 1989 | 2685.7         | 408.0          | 71.4   | 79.7   | 71.0                              | 78.4   | 75.1               | 81.9   | 6678               | 76.2   |
| 1990 | 2982.0         | 408.0          | 85.0   | 81.0   | 80.3                              | 78.9   | 83.4               | 82.2   | 7763               | 88.6   |
| 1991 | 2987.0         | 408.0          | 81.6   | 81.2   | 81.3                              | 79.4   | 83.6               | 82.5   | 7784               | 88.9   |
| 1992 | 2917.9         | 408.0          | 72.6   | 79.7   | 72.3                              | 78.2   | 81.4               | 82.3   | 6678               | 76.0   |
| 1993 | 3190.5         | 452.0          | 80.5   | 79.8   | 80.5                              | 78.6   | 80.6               | 82.1   | 7259               | 82.9   |
| 1994 | 3343.9         | 452.0          | 84.5   | 80.5   | 84.5                              | 79.4   | 84.5               | 82.4   | 7870               | 89.8   |
| 1995 | 2689.6         | 452.0          | 87.4   | 81.3   | 70.2                              | 78.3   | 67.9               | 80.7   | 7788               | 88.9   |
| 1996 | 2871.2         | 412.0          | 80.4   | 81.2   | 78.3                              | 78.3   | 79.3               | 80.5   | 7114               | 81.0   |
| 1997 | 2904.6         | 440.0          | 75.5   | 80.7   | 74.9                              | 77.9   | 75.4               | 80.0   | 6774               | 77.3   |
| 1998 | 3090.1         | 412.0          | 85.7   | 81.1   | 85.0                              | 78.5   | 85.6               | 80.5   | 7564               | 86.3   |
| 1999 | 3246.2         | 412.0          | 89.9   | 81.7   | 89.3                              | 79.3   | 89.9               | 81.2   | 7849               | 89.6   |
| 2000 | 3187.9         | 412.0          | 88.8   | 82.2   | 87.4                              | 79.9   | 88.1               | 81.7   | 7776               | 88.5   |
| 2001 | 3006.0         | 412.0          | 83.8   | 82.3   | 82.7                              | 80.1   | 83.3               | 81.8   | 7309               | 83.4   |
| 2002 | 3259.4         | 412.0          | 89.9   | 82.8   | 89.6                              | 80.7   | 90.3               | 82.3   | 7880               | 90.0   |
| 2003 | 3280.1         | 412.0          | 90.5   | 83.2   | 89.8                              | 81.2   | 90.9               | 82.8   | 7934               | 90.6   |
| 2004 | 3302.5         | 412.0          | 90.3   | 83.6   | 90.2                              | 81.7   | 91.2               | 83.3   | 7957               | 90.6   |

## CZ-8 DUKOVANY-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 9.3   | 0.6     | XP   | K    | LOAD FOLLOWING  |
| 02 Jan | 1.6   | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 03 Jan | 9.2   | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 01 Mar | 318.0 | 1.3     | XP   | S    | FUEL COASTDOWN EFFECT   |
| 09 Mar | 25.0  | 1.3     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - SHUTTING DOWN                            |
| 12 Mar | 461.0 | 189.9   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE  |
| 01 Apr | 366.0 | 150.8   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE  |
| 16 Apr | 31.0  | 6.4     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP                                 |
| 26 Apr | 6.5   | 0.0     | PP   | E42  | TESTING OF REMOTE CONTROL FOR LOAD FOLLOWING OPERATION                              |
| 27 Apr | 2.8   | 0.0     | PP   | E42  | TESTING OF REMOTE CONTROL FOR LOAD FOLLOWING OPERATION                              |
| 28 Apr | 4.4   | 0.0     | PP   | E42  | TESTING OF REMOTE CONTROL FOR LOAD FOLLOWING OPERATION                              |
| 29 Apr | 9.6   | 0.1     | PP   | E42  | TESTING OF REMOTE CONTROL FOR LOAD FOLLOWING OPERATION                              |
| 01 May | 553.0 | 0.1     | PP   | Z    | INTERMITTENT POWER DECREASES DURING UNIT 1 STARTUP AND UNIT2 IN A REFUELLING OUTAGE |
| 01 May | 744.0 | 0.0     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                                   |
| 01 Jun | 720.0 | 0.5     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                                   |
| 01 Jul | 744.0 | 0.5     | XP   | K    | LOAD FOLLOWING  |
| 01 Jul | 744.0 | 1.1     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                                   |
| 20 Jul | 1.0   | 0.0     | PP   | E    | CERTIFICATION OF THE LOAD FOLLOWING SYSTEM  |
| 01 Aug | 744.0 | 0.6     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                                   |
| 31 Aug | 6.0   | 1.0     | UP2  | A41  | POWER REDUCTION DUE TO REPARATION OF THE COLLECTOR RINGS                            |
| 01 Sep | 13.0  | 2.4     | UP2  | A41  | POWER REDUCTION DUE TO REPARATION OF THE COLLECTOR RINGS                            |
| 01 Sep | 720.0 | 0.1     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                                   |
| 01 Oct | 745.0 | 0.0     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                                   |
| 01 Oct | 745.0 | 0.4     | XP   | K    | LOAD FOLLOWING  |
| 01 Dec | 744.0 | 0.2     | XP   | K    | LOAD FOLLOWING  |
| 19 Dec | 10.0  | 0.0     | PP   | E31  | REFERENTIAL MEASUREMENT   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 100       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 827             |           |          | 1078                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 36                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 4        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 10        |          |
| Subtotal   | 827             | 0         | 0        | 1114                                     | 115       | 4        |
| Total  |                 | 827       |          |  | 1233      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 15. Reactor Cooling Systems                    |                 | 42                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 4  |
| 32. Feedwater and Main Steam System            |                 | 3  |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     |                 | 45                                       |
| 42. Electrical Power Supply Systems            |                 | 4  |
| Total  | 0               | 98                                       |

# CZ-9 DUKOVANY-4

**Operator:** CEZ (CZECH POWER COMPANY , CEZ a.s.)

**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 412.0 MW(e)  
**Design Net RUP:** 420.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3335.4 GW(e).h  
**Energy Availability Factor:** 90.9%  
**Load Factor:** 92.2%  
**Operating Factor:** 91.4%  
**Energy Unavailability Factor:** 9.1%  
**Total Off-line Time:** 755 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 314.3 | 293.5 | 312.9 | 301.3 | 312.2 | 298.9 | 307.4 | 307.0 | 301.6 | 275.2 | 3.1  | 307.9 | 3335.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.8  | 99.8  | 100.0 | 89.3  | 1.2  | 99.0  | 90.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.5  | 1.2  | 99.0  | 91.1   |
| <b>LF (%)</b>   | 102.6 | 102.3 | 102.1 | 101.7 | 101.9 | 100.8 | 100.3 | 100.2 | 101.7 | 89.7  | 1.1  | 100.4 | 92.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.8  | 3.6  | 100.0 | 91.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.2   | 0.0   | 10.7  | 98.8 | 1.0   | 9.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5   | 98.8 | 0.3   | 8.8    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.7   | 0.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.2   | 0.0   | 2.2   | 0.0  | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1979  
**Date of First Criticality:** 01 Jun 1987  
**Date of Grid Connection:** 11 Jun 1987  
**Date of Commercial Operation:** 19 Jul 1987

**Lifetime Generation:** 54375.1 GW(e).h  
**Cumulative Energy Availability Factor:** 82.2%  
**Cumulative Load Factor:** 84.5%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 17.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 1624.9         | 408.0          | 0.0  | 0.0    | 99.1                              | 100.0  | 45.5               | 0.0    | 4643               | 53.0   |
| 1988 | 2764.0         | 408.0          | 74.5   | 74.5   | 73.8                              | 73.8   | 77.1               | 77.1   | 7092               | 80.7   |
| 1989 | 2984.5         | 408.0          | 80.8   | 77.6   | 80.4                              | 77.1   | 83.5               | 80.3   | 7314               | 83.5   |
| 1990 | 2995.3         | 408.0          | 82.8   | 79.3   | 80.0                              | 78.0   | 83.8               | 81.5   | 7836               | 89.5   |
| 1991 | 2672.0         | 408.0          | 78.0   | 79.0   | 77.9                              | 78.0   | 74.8               | 79.8   | 7301               | 83.3   |
| 1992 | 3328.4         | 408.0          | 84.5   | 80.1   | 83.7                              | 79.1   | 92.9               | 82.4   | 7614               | 86.7   |
| 1993 | 2939.8         | 448.0          | 62.0   | 76.9   | 62.1                              | 76.1   | 74.9               | 81.1   | 6859               | 78.3   |
| 1994 | 3259.8         | 448.0          | 84.5   | 78.0   | 83.1                              | 77.1   | 83.1               | 81.4   | 7538               | 86.1   |
| 1995 | 3311.1         | 448.0          | 85.5   | 79.0   | 85.4                              | 78.2   | 84.4               | 81.8   | 7712               | 88.0   |
| 1996 | 3202.1         | 412.0          | 88.2   | 80.0   | 87.1                              | 79.2   | 88.5               | 82.5   | 7762               | 88.4   |
| 1997 | 3149.2         | 440.0          | 80.9   | 80.1   | 80.9                              | 79.4   | 81.7               | 82.4   | 7202               | 82.2   |
| 1998 | 3078.6         | 412.0          | 85.7   | 80.6   | 83.8                              | 79.8   | 85.3               | 82.7   | 7536               | 86.0   |
| 1999 | 3179.4         | 412.0          | 88.6   | 81.3   | 86.6                              | 80.3   | 88.1               | 83.1   | 7792               | 88.9   |
| 2000 | 3234.5         | 412.0          | 89.5   | 81.9   | 88.1                              | 80.9   | 89.4               | 83.6   | 7839               | 89.2   |
| 2001 | 3258.1         | 412.0          | 90.4   | 82.5   | 89.2                              | 81.5   | 90.3               | 84.1   | 7946               | 90.7   |
| 2002 | 2748.2         | 412.0          | 77.3   | 82.1   | 75.6                              | 81.1   | 76.1               | 83.5   | 6745               | 77.0   |
| 2003 | 3309.8         | 412.0          | 91.3   | 82.7   | 90.7                              | 81.7   | 91.7               | 84.0   | 8009               | 91.4   |
| 2004 | 3335.4         | 412.0          | 91.1   | 83.2   | 90.9                              | 82.2   | 92.2               | 84.5   | 8029               | 91.4   |

## CZ-9 DUKOVANY-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 30 Apr | 1.0   | 0.0     | PP   | E12  | CONTROL ROD 09-28 TESTING  |
| 01 Jun | 720.0 | 0.1     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                            |
| 01 Jul | 744.0 | 0.6     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                            |
| 01 Aug | 744.0 | 0.6     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                            |
| 01 Sep | 720.0 | 0.0     | XP   | N    | POWER LIMITATION DUE TO COOLING WATER TEMPERATURE                            |
| 01 Oct | 684.0 | 6.8     | XP   | S    | FUEL MANAGEMENT LIMITATION - STRECH OUT                                      |
| 29 Oct | 61.0  | 25.1    | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                                     |
| 29 Oct | 6.0   | 1.0     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                                     |
| 01 Nov | 694.0 | 285.9   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                                     |
| 29 Nov | 25.0  | 7.2     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP                          |
| 01 Dec | 63.0  | 0.9     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP                          |
| 01 Dec | 744.0 | 0.1     | XP   | K    | LOAD FOLLOWING   |
| 19 Dec | 8.0   | 2.1     | UP1  | A41  | TURBINE TRIP DUE TO THE INTERVENTION OF ELECTRIC PROTECTION OF THE GENERATOR |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 27        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 755             |           |          | 927                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 103                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 3         | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 5        |
| Subtotal   | 755             | 0         | 0        | 1030                                     | 31        | 6        |
| Total  |                 | 755       |          |  | 1067      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 7  |
| 15. Reactor Cooling Systems         |                 | 9  |
| 32. Feedwater and Main Steam System |                 | 5  |
| 33. Circulating Water System        |                 | 0  |
| 35. All other I&C Systems           |                 | 2  |
| 42. Electrical Power Supply Systems |                 | 1  |
| Total                               | 0               | 24                                       |

# CZ-23 TEMELIN-1

**Operator:** CEZ (CZECH POWER COMPANY , CEZ a.s.)  
**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 892.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5715.8 GW(e).h  
**Energy Availability Factor:** 68.0%  
**Load Factor:** 68.5%  
**Operating Factor:** 68.6%  
**Energy Unavailability Factor:** 32.0%  
**Total Off-line Time:** 2755 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 709.2 | 667.7 | 713.6 | 359.4 | 0.0   | 0.0   | 364.2 | 629.2 | 431.2 | 558.6 | 696.8 | 586.0 | 5715.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 52.3  | 0.0   | 0.0   | 52.7  | 89.2  | 62.3  | 78.0  | 100.0 | 81.9  | 68.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 53.3  | 0.0   | 0.0   | 52.7  | 89.2  | 62.3  | 78.0  | 100.0 | 81.9  | 68.1   |
| <b>LF (%)</b>   | 100.3 | 101.0 | 101.0 | 52.6  | 0.0   | 0.0   | 51.5  | 89.0  | 63.0  | 78.9  | 101.9 | 82.9  | 68.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 53.4  | 0.0   | 0.0   | 56.0  | 89.9  | 62.6  | 78.9  | 100.0 | 82.9  | 68.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 47.7  | 100.0 | 100.0 | 47.3  | 10.8  | 37.7  | 22.0  | 0.0   | 18.1  | 32.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 46.7  | 100.0 | 100.0 | 45.3  | 0.0   | 0.0   | 0.0   | 0.0   | 17.7  | 25.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0   | 10.8  | 37.7  | 22.0  | 0.0   | 0.4   | 6.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1987  
**Date of First Criticality:** 11 Oct 2000  
**Date of Grid Connection:** 21 Dec 2000  
**Date of Commercial Operation:** 10 Jun 2002

**Lifetime Generation:** 17398.1 GW(e).h  
**Cumulative Energy Availability Factor:** 66.7%  
**Cumulative Load Factor:** 68.4%  
**Cumulative Unit Capability Factor:** 82.9%  
**Cumulative Energy Unavailability Factor:** 33.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2003 | 5455.3         | 912.0          | 65.3   | 65.3   | 65.3                              | 65.3   | 68.3               | 68.3   | 5861               | 66.9   |
| 2004 | 5715.8         | 950.0          | 68.1   | 66.7   | 68.0                              | 66.7   | 68.5               | 68.4   | 6029               | 68.6   |

# CZ-23 TEMELIN-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 8.0    | 0.7     | XP   | K    | LOAD FOLLOWING  |
| 03 Jan | 2.0    | 0.2     | XP   | K    | LOAD FOLLOWING  |
| 04 Jan | 24.0   | 2.7     | XP   | K    | LOAD FOLLOWING  |
| 05 Jan | 1.0    | 0.0     | XP   | K    | LOAD FOLLOWING  |
| 05 Mar | 3.0    | 0.0     | UP2  | A32  | TRIP OF THE LP REGENERATION - TRAIN A                                     |
| 10 Apr | 166.0  | 6.4     | XP   | S    | OPERATION ON COAST DOWN EFFECT  |
| 12 Apr | 2.0    | 0.1     | UP2  | A12  | FAILURE OF THE CRDM   |
| 17 Apr | 2112.0 | 2006.4  | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                                  |
| 14 Jul | 15.0   | 14.3    | UF3  | A11  | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - OUTAGE EXTENSION               |
| 14 Jul | 149.0  | 23.9    | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP                       |
| 18 Jul | 4.0    | 0.2     | XP   | K    | LOAD FOLLOWING  |
| 31 Jul | 3.0    | 0.0     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS               |
| 01 Aug | 669.0  | 0.3     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS               |
| 11 Aug | 4.0    | 0.3     | PP   | E31  | TURBINE TEST  |
| 11 Aug | 5.0    | 4.8     | UF1  | A41  | TURBINE TRIP DUE TO THE INTERVENTION OF THE GENERATOR ELECTRIC PROTECTION |
| 11 Aug | 6.0    | 0.9     | UP1  | A41  | TURBINE TRIP DUE TO THE INTERVENTION OF THE GENERATOR ELECTRIC PROTECTION |
| 12 Aug | 1.0    | 0.4     | UP1  | A41  | TURBINE TRIP DUE TO LEAK OF THE STATOR COOLING WATER - SHUTTING DOWN      |
| 12 Aug | 25.0   | 23.8    | UF1  | A41  | TURBINE TRIP DUE TO LEAK OF THE STATOR COOLING WATER                      |
| 13 Aug | 9.0    | 1.1     | UP1  | A41  | TURBINE TRIP DUE TO LEAK OF THE STATOR COOLING WATER - START-UP           |
| 26 Aug | 2.0    | 0.8     | UP1  | A41  | TURBINE TRIP DUE TO LEAK OF THE STATOR COOLING WATER - SHUTTING DOWN      |
| 26 Aug | 45.0   | 42.8    | UF1  | A41  | TURBINE TRIP DUE TO LEAK OF THE STATOR COOLING WATER                      |
| 27 Aug | 7.0    | 1.7     | UP1  | A41  | TURBINE TRIP DUE TO LEAK OF THE STATOR COOLING WATER - START-UP           |
| 13 Sep | 12.0   | 11.4    | UF1  | A32  | UNPLANNED SHUTDOWN AFTER THE TRIP OF THE CONDENSATE EXTRACTION PUMP       |
| 14 Sep | 6.0    | 1.5     | UP1  | A32  | UNPLANNED SHUTDOWN AFTER THE TRIP OF THE CONDENSATE EXTRACTION PUMP       |
| 20 Sep | 3.0    | 0.7     | UP1  | A41  | TURBINE SHUTDOWN DUE TO LEAK OF H2 TO THE STATOR COOLING WATER            |
| 20 Sep | 257.0  | 244.2   | UF1  | A41  | TURBINE 1 TRIP DUE TO LEAK OF H2 TO THE STATOR COOLING WATER              |
| 01 Oct | 157.0  | 149.2   | UF1  | A41  | TURBINE 1 TRIP DUE TO LEAK OF H2 TO THE STATOR COLING WATER               |
| 07 Oct | 17.0   | 6.3     | UP1  | A41  | TURBINE TRIP DUE TO LEAK OF THE STATOR COOLING WATER - START-UP           |
| 23 Oct | 11.0   | 2.0     | XP   | K    | LOAD FOLLOWING  |
| 31 Oct | 3.0    | 0.1     | XP   | K    | LOAD FOLLOWING  |
| 11 Nov | 20.0   | 0.1     | UP1  | L    | POWER REDUCTION DUE TO FAULTY MANIPULATION                                |
| 01 Dec | 1.0    | 0.0     | XP   | K    | LOAD FOLLOWING  |
| 04 Dec | 5.0    | 2.9     | UP1  | A32  | POWER REDUCTION DUE TO THE TRIP OF THE TURBINE DRIVEN FEEDWATER PUMP      |
| 04 Dec | 7.0    | 1.7     | PP   | E42  | CERTIFICATION OF THE LOAD FOLLOWING SYSTEM                                |
| 24 Dec | 4.0    | 1.7     | PP   | D    | PLANNED OUTAGE - MAINTENANCE OF THE SECONDARY PLANT SYSTEMS               |
| 24 Dec | 127.0  | 120.7   | PF   | D    | PLANNED OUTAGE - MAINTENANCE OF THE SECONDARY PLANT SYSTEMS               |
| 30 Dec | 5.0    | 1.4     | PP   | D    | PLANNED OUTAGE - MAINTENANCE OF THE SECONDARY PLANT SYSTEMS - START-UP    |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2003 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure  |                 | 516       |          |  | 184       |          |
| C. Inspection, maintenance or repair combined with refuelling                                 | 2112            |           |          | 936                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                                       | 127             |           |          | 30                                       |           |          |
| S. Fuel management limitation (including high flux tilt, stretch out or coast-down operation) |                 |           |          | 299                                      |           |          |
| Subtotal  | 2239            | 516       | 0        | 1265                                     | 184       | 0        |
| Total   |                 | 2755      |          |  | 1449      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 2003 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              | 15              |  |
| 12. Reactor I&C Systems                  |                 | 13                                       |
| 15. Reactor Cooling Systems              |                 | 7  |
| 21. Fuel Handling and Storage Facilities |                 | 82                                       |
| 31. Turbine and auxiliaries              |                 | 22                                       |
| 32. Feedwater and Main Steam System      | 12              | 28                                       |
| 33. Circulating Water System             |                 | 19                                       |
| 41. Main Generator Systems               | 489             | 5  |
| 42. Electrical Power Supply Systems      |                 | 6  |
| Total                                    | 516             | 182                                      |

# CZ-24 TEMELIN-2

**Operator:** CEZ (CZECH POWER COMPANY , CEZ a.s.)  
**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 892.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6340.1 GW(e).h  
**Energy Availability Factor:** 75.2%  
**Load Factor:** 76.0%  
**Operating Factor:** 76.0%  
**Energy Unavailability Factor:** 24.8%  
**Total Off-line Time:** 2106 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 704.7 | 135.4 | 0.0   | 440.8 | 636.4 | 293.7 | 711.9 | 713.9 | 673.9 | 719.0 | 697.7 | 612.5 | 6340.1 |
| <b>EAF (%)</b>  | 99.1  | 20.4  | 0.0   | 65.0  | 89.3  | 42.7  | 99.9  | 100.0 | 97.3  | 100.0 | 100.0 | 85.3  | 75.2   |
| <b>UCF (%)</b>  | 99.1  | 20.4  | 0.0   | 65.0  | 89.3  | 42.7  | 99.9  | 100.0 | 97.3  | 100.0 | 100.0 | 85.3  | 75.2   |
| <b>LF (%)</b>   | 99.7  | 20.5  | 0.0   | 64.4  | 90.0  | 42.9  | 100.7 | 101.0 | 98.5  | 101.6 | 102.0 | 86.7  | 76.0   |
| <b>OF (%)</b>   | 100.0 | 21.0  | 0.0   | 70.3  | 90.5  | 43.5  | 100.0 | 100.0 | 97.6  | 100.0 | 100.0 | 86.0  | 76.0   |
| <b>EUF (%)</b>  | 0.9   | 79.6  | 100.0 | 35.0  | 10.7  | 57.3  | 0.1   | 0.0   | 2.7   | 0.0   | 0.0   | 14.7  | 24.8   |
| <b>PUF (%)</b>  | 0.0   | 79.6  | 100.0 | 22.0  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 14.6  | 17.8   |
| <b>UCLF (%)</b> | 0.9   | 0.0   | 0.0   | 13.0  | 10.7  | 57.3  | 0.0   | 0.0   | 2.7   | 0.0   | 0.0   | 0.1   | 7.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1987  
**Date of First Criticality:** 31 May 2002  
**Date of Grid Connection:** 29 Dec 2002  
**Date of Commercial Operation:** 18 Apr 2003

**Lifetime Generation:** 6340.1 GW(e).h  
**Cumulative Energy Availability Factor:** 75.2%  
**Cumulative Load Factor:** 76.0%  
**Cumulative Unit Capability Factor:** 84.2%  
**Cumulative Energy Unavailability Factor:** 24.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 6340.1         | 950.0          | 75.2   | 75.2   | 75.2                              | 75.2   | 76.0               | 76.0   | 6678               | 76.0   |



## CZ-24 TEMELIN-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 7.0    | 0.7     | XP   | K    | LOAD FOLLOWING   |
| 03 Jan | 30.0   | 6.6     | UP2  | A33  | RIP OF A COOLING WATER PUMP (OIL LEAKAGE FROM A MOTOR BEARING)             |
| 06 Feb | 9.0    | 3.8     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - SHUTTING DOWN                   |
| 06 Feb | 1425.0 | 1353.8  | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE                                   |
| 06 Apr | 96.0   | 18.8    | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP                        |
| 10 Apr | 13.5   | 5.7     | UP2  | A31  | POWER REDUCTION DUE TO TURBINE VIBRATION                                   |
| 11 Apr | 67.0   | 63.7    | UF2  | A31  | TURBINE TRIP DUE TO HIGH EXCENTRICITY                                      |
| 14 Apr | 5.0    | 1.6     | UP2  | A31  | UNIT START-UP AFTER TURBINE TRIP DUE TO HIGH EXCENTRICITY                  |
| 14 Apr | 15.0   | 6.0     | PP   | C    | ANNUAL MAINTENANCE AND REFUELLING OUTAGE - START-UP                        |
| 17 Apr | 6.0    | 5.7     | UF2  | A32  | REACTOR SHUTDOWN DUE TO TRIPPING OF THE TURBINE DRIVEN FEEDWATER PUMP      |
| 17 Apr | 3.0    | 1.4     | UP2  | A32  | REACTOR SHUTDOWN DUE TO TRIPPING OF THE TURBINE DRIVEN FEEDWATER PUMP      |
| 24 Apr | 9.0    | 8.6     | UF2  | A31  | TRIP OF THE TURBINE DUE TO HIGH EXCENTRICITY                               |
| 25 Apr | 5.0    | 2.5     | UP2  | A31  | TRIP OF THE TURBINE DUE TO HIGH EXCENTRICITY - START-UP                    |
| 04 May | 6.0    | 5.7     | UF2  | A31  | TRIP OF THE TURBINE DUE TO OIL LEAKAGE                                     |
| 05 May | 11.0   | 3.6     | UP2  | A31  | TURBINE TRIP DUE TO OIL LEAKAGE - START-UP                                 |
| 07 May | 3.0    | 0.8     | UP2  | A31  | POWER REDUCTUIN FOR TURBINE BALANCING                                      |
| 07 May | 45.5   | 43.2    | UF2  | A31  | UNPLANNED SHUTDOWN DUE TO TURBINE BALANCING                                |
| 09 May | 5.0    | 1.8     | UP2  | A31  | UNPLANNED SHUTDOWN DUE TO TURBINE BALANCING - START-UP                     |
| 14 May | 15.0   | 0.2     | UP2  | A31  | POWER REDUCTION DUE TO TURBINE VIBRATION                                   |
| 28 May | 19.5   | 18.5    | UF2  | A31  | TURBINE SHUTDOWN DUE TO TURBINE PROTECTION SYSTEM FAILURE                  |
| 28 May | 8.5    | 1.6     | UP2  | A31  | START-UP AFTER TURBINE SHUTDOWN DUE TO TURBINE PROTECTION SYSTEM FAILURE   |
| 01 Jun | 4.0    | 0.4     | UP2  | A31  | POWER REDUCTION DUE TO TURBINE VIBRATION                                   |
| 02 Jun | 407.0  | 386.7   | UF4  | A42  | REACTOR SCRAM DUE TO MAIN TRANSFORMER PROTECTION ACTUATION ON GROUND FAULT |
| 28 Jun | 12.0   | 4.8     | UP2  | A42  | START-UP AFTER THE REACTOR SCRAM   |
| 03 Jul | 10.0   | 0.3     | PP   | E11  | PLANT SYSTEM TESTING   |
| 05 Jul | 4.0    | 0.0     | UP2  | A31  | POWER REDUCTION DUE TO VIBRATION OF THE TURBINE                            |
| 06 Jul | 4.0    | 0.0     | PP   | E11  | PLANT SYSTEM TESTING   |
| 06 Jul | 3.0    | 0.0     | UP1  | A12  | POWER REDUCTION DUE TO DROP OF THE CLUSTER                                 |
| 08 Jul | 10.0   | 0.1     | UP1  | A31  | POWER REDUCTION DUE TO DEGRADATION OF VACUUM                               |
| 09 Jul | 1.0    | 0.0     | UP2  | A31  | POWER REDUCTION DUE TO DEGRADATION OF VACUUM                               |
| 17 Jul | 30.0   | 0.1     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS                |
| 21 Jul | 15.0   | 0.0     | PP   | E12  | PLANT SYSTEM TESTING   |
| 31 Jul | 2.0    | 0.0     | PP   | E31  | PLANT SYSTEM TESTING   |
| 12 Aug | 7.0    | 0.0     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS                |
| 31 Aug | 1.0    | 0.0     | UP2  | A12  | POWER REDUCTION DUE TO DROP OF THE CLUSTER                                 |
| 04 Sep | 17.0   | 16.2    | UF4  | A32  | REACTOR SHUTDOWN DUE TO TURBINE-DRIVEN FEEDWATER PUMP FAUILURE             |
| 05 Sep | 13.0   | 2.1     | UP1  | A32  | REACTOR SHUTDOWN DUE TO TURBINE-DRIVEN FEEDWATER PUMP FAUILURE - START-UP  |
| 05 Oct | 2.0    | 0.0     | XP   | N    | ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITS                |
| 01 Dec | 2.0    | 0.0     | UP2  | A12  | POWER REDUCTION DUE TO DROP OF THE CLUSTER                                 |
| 15 Dec | 3.0    | 1.0     | PP   | D    | PLANNED OUTAGE - MAINTENANCE OF THE SECONDARY PLANT SYSTEMS                |
| 15 Dec | 104.0  | 98.8    | PF   | D    | PLANNED OUTAGE - MAINTENANCE OF THE SECONDARY PLANT SYSTEMS                |
| 20 Dec | 7.0    | 3.1     | PP   | D    | PLANNED OUTAGE - MAINTENANCE OF THE SECONDARY PLANT SYSTEMS - START-UP     |
| 20 Dec | 4.0    | 0.9     | UP   | A16  | POWER REDUCTION DUE TO UNTIGHTNESS OF THE SEAL                             |
| 30 Dec | 2.0    | 0.1     | UP2  | A31  | POWER REDUCTION DUE TO VIBRATION OF THE TURBINE                            |
| 31 Dec | 2.0    | 0.1     | UP2  | A31  | POWER REDUCTION DUE TO VIBRATION OF THE TURBINE                            |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2004 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 577       |          |  |           |          |
| C. Inspection, maintenance or repair combined with refuelling | 1425            |           |          |  |           |          |
| D. Inspection, maintenance or repair without refuelling       | 104             |           |          |  |           |          |
| Subtotal  | 1529            | 577       | 0        | 0  | 0         | 0        |
| Total   |                 | 2106      |          |  | 0         |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004       | 2004 to 2004                |
|-------------------------------------|------------|-----------------------------|
|                                     | Hours Lost | Average Hours Lost Per Year |
| 31. Turbine and auxiliaries         | 147        |                             |
| 32. Feedwater and Main Steam System | 23         |                             |
| 42. Electrical Power Supply Systems | 407        |                             |
| Total                               | 577        | 0                           |

# FI-1 LOVIISA-1

**Operator:** FORTUMPH (FORTUM POWER AND HEAT OY (former IVO))  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 488.0 MW(e)  
**Design Net RUP:** 420.0 MW(e)  
**Design Discharge Burnup:** 30500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3715.0 GW(e).h  
**Energy Availability Factor:** 86.5%  
**Load Factor:** 86.7%  
**Operating Factor:** 87.0%  
**Energy Unavailability Factor:** 13.5%  
**Total Off-line Time:** 1138 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 367.4 | 344.1 | 367.9 | 356.1 | 365.3 | 346.7 | 249.5 | 0.0  | 227.3 | 367.3 | 354.0 | 369.4 | 3715.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 98.3  | 69.5  | 2.1  | 70.5  | 100.0 | 99.3  | 100.0 | 86.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 98.3  | 74.2  | 2.1  | 70.5  | 100.0 | 99.3  | 100.0 | 86.9   |
| <b>LF (%)</b>   | 101.2 | 101.3 | 101.3 | 101.3 | 100.6 | 98.7  | 68.7  | 0.0  | 64.7  | 101.0 | 100.8 | 101.7 | 86.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 98.9  | 74.7  | 0.0  | 72.6  | 100.0 | 100.0 | 100.0 | 87.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 1.7   | 30.5  | 97.9 | 29.5  | 0.0   | 0.7   | 0.0   | 13.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 25.7  | 97.9 | 13.1  | 0.0   | 0.0   | 0.0   | 11.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 1.7   | 0.1   | 0.0  | 16.3  | 0.0   | 0.7   | 0.0   | 1.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.7   | 0.0  |       | 0.0   | 0.0   | 0.0   | 0.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

PLANNED ENERGY LOSSES: ANNUAL TESTINGS OF MAIN STEAM SAFETY VALVES (20040703), ANNUAL MAINTENANCE AND REFUELLING (20040724-20040909), TESTING OF GENERATOR MAGNETIZATION SYSTEM (20040909-20040911). UNPLANNED ENERGY LOSSES: TRIP OF ONE PCP (20040517), FAULT IN REACTOR PROTECTION SYSTEM (20040618-20040624), REACTOR TRIP (20040629-20040630), TURBINETRIP GASRELAYS FAULTY ACTION OF GENERAL TRANSFORMER (20041109), EXCAHGE OF GASRELAYS FLOATS IN GENERAL TRANSFORMER (20041121). OTHER ENERGY LOSSES: STRETCH-OUT (20040703-20040724).

## 5. Historical Summary

**Date of Construction Start:** 01 May 1971      **Lifetime Generation:** 94262.8 GW(e).h  
**Date of First Criticality:** 21 Jan 1977      **Cumulative Energy Availability Factor:** 86.0%  
**Date of Grid Connection:** 08 Feb 1977      **Cumulative Load Factor:** 85.5%  
**Date of Commercial Operation:** 09 May 1977      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 14.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 3354.6         | 445.0          | 87.0   | 82.0   | 87.0                              | 82.0   | 85.8               | 81.3   | 7678               | 87.4   |
| 1989 | 3575.7         | 445.0          | 92.8   | 82.9   | 92.6                              | 82.9   | 91.7               | 82.2   | 8183               | 93.4   |
| 1990 | 3271.1         | 445.0          | 85.5   | 83.1   | 85.5                              | 83.1   | 83.9               | 82.3   | 7605               | 86.8   |
| 1991 | 3360.9         | 445.0          | 88.8   | 83.5   | 88.6                              | 83.5   | 86.2               | 82.6   | 7927               | 90.5   |
| 1992 | 3108.4         | 445.0          | 80.6   | 83.3   | 80.5                              | 83.3   | 79.5               | 82.4   | 7186               | 81.8   |
| 1993 | 3443.2         | 445.0          | 89.5   | 83.7   | 89.5                              | 83.6   | 88.4               | 82.8   | 8052               | 92.0   |
| 1994 | 3497.6         | 445.0          | 90.8   | 84.1   | 90.7                              | 84.1   | 89.7               | 83.2   | 8017               | 91.5   |
| 1995 | 3389.1         | 445.0          | 88.5   | 84.3   | 87.7                              | 84.3   | 86.9               | 83.4   | 7834               | 89.4   |
| 1996 | 3203.5         | 445.0          | 82.5   | 84.3   | 82.0                              | 84.1   | 82.0               | 83.3   | 7281               | 82.9   |
| 1997 | 3794.8         | 445.0          | 93.9   | 84.7   | 93.0                              | 84.6   | 97.3               | 84.0   | 8309               | 94.9   |
| 1998 | 3852.4         | 488.0          | 93.4   | 85.2   | 91.3                              | 84.9   | 90.1               | 84.3   | 8234               | 94.0   |
| 1999 | 3883.3         | 488.0          | 92.4   | 85.5   | 91.6                              | 85.3   | 90.8               | 84.7   | 8304               | 94.8   |
| 2000 | 3618.0         | 488.0          | 86.5   | 85.6   | 84.9                              | 85.3   | 84.4               | 84.7   | 7720               | 87.9   |
| 2001 | 3921.0         | 488.0          | 93.4   | 86.0   | 92.4                              | 85.6   | 91.7               | 85.0   | 8233               | 94.0   |
| 2002 | 3790.1         | 488.0          | 91.4   | 86.2   | 89.3                              | 85.7   | 88.7               | 85.1   | 8095               | 92.4   |
| 2003 | 3939.0         | 488.0          | 93.2   | 86.5   | 92.4                              | 86.0   | 92.1               | 85.4   | 8194               | 93.5   |
| 2004 | 3715.0         | 488.0          | 86.9   | 86.5   | 86.5                              | 86.0   | 86.7               | 85.5   | 7647               | 87.0   |

# FI-1 LOVIISA-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 17 May | 5.0    | 0.3     | UP2  | A15  | TRIP OF ONE PCP.   |
| 18 Jun | 155.0  | 0.2     | UP2  | A12  | FAULT IN REACTOR PROTECTION SYSTEM.                          |
| 29 Jun | 12.0   | 6.1     | UF4  | A12  | REACTOR TRIP, FAULT IN REACTOR PROTECTION SYSTEM.            |
| 03 Jul | 491.0  | 17.1    | XP   | S    | STRETCH-OUT  |
| 03 Jul | 12.0   | 0.9     | PP   | E32  | ANNUAL TESTINGS OF MAIN STEAM SAFETY VALVES.                 |
| 24 Jul | 1008.0 | 490.9   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.                           |
| 04 Sep | 117.0  | 57.4    | UF3  | Z    | ANNUAL MAINTENANCE AND REFUELLING.                           |
| 09 Sep | 60.0   | 2.9     | PP   | E41  | TESTING OF GENERATOR MAGNETIZATION SYSTEM.                   |
| 09 Nov | 9.0    | 1.4     | UP   | A42  | TURBINE TRIP GASRELAYS FAULTY ACTION OF GENERAL TRANSFORMER. |
| 21 Nov | 7.0    | 1.0     | UP1  | A42  | EXCHANGE OF GASRELAYS FLOATS IN GENERAL TRANSFORMER.         |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 12        |          |  | 244       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1008            |           |          | 721                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 21                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 0  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 1  | 2         | 6        |
| Z. Others  |                 | 117       |          |  |           |          |
| Subtotal   | 1008            | 129       | 0        | 746                                      | 247       | 6        |
| Total  |                 | 1137      |          |  | 999       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        | 12              | 15                                       |
| 14. Safety Systems                             |                 | 5  |
| 15. Reactor Cooling Systems                    |                 | 187                                      |
| 16. Steam generation systems                   |                 | 3  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 20                                       |
| 32. Feedwater and Main Steam System            |                 | 9  |
| 42. Electrical Power Supply Systems            |                 | 1  |
| Total  | 12              | 240                                      |

# FI-2 LOVIISA-2

**Operator:** FORTUMPH (FORTUM POWER AND HEAT OY (former IVO))  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 488.0 MW(e)  
**Design Net RUP:** 420.0 MW(e)  
**Design Discharge Burnup:** 30500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4009.2 GW(e).h  
**Energy Availability Factor:** 93.1%  
**Load Factor:** 93.5%  
**Operating Factor:** 93.7%  
**Energy Unavailability Factor:** 6.9%  
**Total Off-line Time:** 553 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 369.9 | 346.0 | 368.7 | 357.9 | 366.6 | 353.4 | 354.1 | 340.4 | 66.9 | 361.2 | 353.9 | 370.1 | 4009.2 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 99.0  | 96.6  | 23.3 | 98.2  | 99.1  | 100.0 | 93.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 99.8  | 100.0 | 24.8 | 98.2  | 99.1  | 100.0 | 93.6   |
| <b>LF (%)</b>   | 101.9 | 101.9 | 101.5 | 102.0 | 101.0 | 100.6 | 97.5  | 93.8  | 19.0 | 99.4  | 100.7 | 101.9 | 93.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 24.4 | 98.8  | 100.0 | 100.0 | 93.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 1.0   | 3.4   | 76.7 | 1.8   | 0.9   | 0.0   | 6.9    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.0   | 75.2 | 0.0   | 0.0   | 0.0   | 6.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0  | 1.8   | 0.9   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 3.4   | 1.5  | 0.0   | 0.0   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

PLANNED ENERGY LOSSES: ANNUAL TESTINGS OF MAIN STEAM SAFETY VALVES (20040717), ANNUAL MAINTENANCE AND REFUELLING (20040904-20040926), TESTING OF GENERATOR MAGNETIZATION SYSTEM (20040927-20040928). UNPLANNED ENERGY LOSSES: REPAIR OF LEAKAGE IN BACK-PRESSURE VALVE (20041020), EXCHANGE OF GASRELAYS FLOATS IN GENERAL TRANSFORMER (20041121), REPAIR OF A LEAGAGE OF FEEDWATER LINE IMPULSE PIPE (20041129-20041130). OTHER ENERGY LOSSES: HIGH TEMPERATURE OF SEA WATER RESTRICTED (20040801-20040812), STRETCH-OUT (20040813-20040904).

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1972      **Lifetime Generation:** 84460.0 GW(e).h  
**Date of First Criticality:** 17 Oct 1980      **Cumulative Energy Availability Factor:** 88.0%  
**Date of Grid Connection:** 04 Nov 1980      **Cumulative Load Factor:** 87.5%  
**Date of Commercial Operation:** 05 Jan 1981      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 12.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 3602.3         | 445.0          | 94.7   | 86.9   | 94.7                              | 86.9   | 92.2               | 85.9   | 8305               | 94.5   |
| 1989 | 3551.0         | 445.0          | 91.8   | 87.5   | 91.7                              | 87.5   | 91.1               | 86.5   | 8128               | 92.8   |
| 1990 | 3251.1         | 445.0          | 85.3   | 87.3   | 85.3                              | 87.2   | 83.4               | 86.2   | 7584               | 86.6   |
| 1991 | 3442.2         | 445.0          | 89.8   | 87.5   | 89.0                              | 87.4   | 88.3               | 86.4   | 7941               | 90.7   |
| 1992 | 3468.4         | 445.0          | 89.5   | 87.7   | 89.1                              | 87.5   | 88.7               | 86.6   | 7931               | 90.3   |
| 1993 | 3550.8         | 445.0          | 91.3   | 87.9   | 91.2                              | 87.8   | 91.2               | 86.9   | 8050               | 92.0   |
| 1994 | 3124.7         | 445.0          | 81.2   | 87.5   | 80.5                              | 87.3   | 80.2               | 86.4   | 7170               | 81.8   |
| 1995 | 3060.3         | 445.0          | 78.4   | 86.8   | 77.6                              | 86.6   | 78.5               | 85.9   | 7064               | 80.6   |
| 1996 | 3621.3         | 445.0          | 93.1   | 87.2   | 92.7                              | 87.0   | 92.6               | 86.3   | 8227               | 93.7   |
| 1997 | 3804.7         | 445.0          | 92.9   | 87.6   | 92.0                              | 87.3   | 97.6               | 87.0   | 8267               | 94.4   |
| 1998 | 3687.9         | 488.0          | 88.5   | 87.6   | 86.4                              | 87.3   | 86.3               | 86.9   | 7892               | 90.1   |
| 1999 | 3974.3         | 488.0          | 94.2   | 88.0   | 93.5                              | 87.6   | 93.0               | 87.3   | 8281               | 94.5   |
| 2000 | 3885.1         | 488.0          | 94.1   | 88.3   | 90.9                              | 87.8   | 90.6               | 87.5   | 8314               | 94.6   |
| 2001 | 3781.1         | 488.0          | 92.3   | 88.5   | 89.6                              | 87.9   | 88.4               | 87.5   | 8149               | 93.0   |
| 2002 | 3498.7         | 488.0          | 84.5   | 88.3   | 82.6                              | 87.6   | 81.8               | 87.2   | 7463               | 85.2   |
| 2003 | 3736.7         | 488.0          | 90.1   | 88.4   | 90.0                              | 87.7   | 87.4               | 87.3   | 8358               | 95.4   |
| 2004 | 4009.2         | 488.0          | 93.6   | 88.7   | 93.1                              | 88.0   | 93.5               | 87.5   | 8231               | 93.7   |

**FI-2 LOVIISA-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 08 May | 4.0   | 0.4     | UP2  | A31  | TURBINE POWER DECREASE OF FAULT IN ELECTROHYDRAULIC POWER CONTROLLER. |
| 17 Jul | 9.0   | 0.9     | PP   | E32  | ANNUAL TESTINGS OF MAIN STEAM SAFETY VALVES.                          |
| 01 Aug | 264.0 | 2.7     | XP   | N    | HIGH TEMPERATURE OF SEA WATER RESTRICTED.                             |
| 13 Aug | 522.0 | 17.6    | XP   | S    | STRETCH OUT.  |
| 04 Sep | 535.0 | 261.3   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.                                    |
| 27 Sep | 24.0  | 2.8     | PP   | E41  | TESTING OF GENERATOR MAGNETIZATION SYSTEM.                            |
| 20 Oct | 19.0  | 6.4     | UP1  | A32  | REPAIR OF LEAKAGE IN BACK-PRESSURE VALVE.                             |
| 21 Nov | 8.0   | 1.1     | UP1  | A42  | EXCHANGE OF GASRELAYS FLOATS IN GENERAL TRANSFORMER.                  |
| 29 Nov | 12.0  | 2.0     | UP1  | A32  | REPAIR OF A LEAGAGE OF FEEDWATER LINE IMPULSE PIPE.                   |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 107       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 535             |           |          | 660   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 48  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 2   | 2         |          |
| Subtotal   | 535             | 0         | 0        | 710   | 109       | 0        |
| Total  |                 | 535       |          |   | 819       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                                   | 2004<br>Hours Lost | 1980 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                  |                    | 6   |
| 14. Safety Systems                       |                    | 6   |
| 15. Reactor Cooling Systems              |                    | 48  |
| 16. Steam generation systems             |                    | 2   |
| 21. Fuel Handling and Storage Facilities |                    | 15  |
| 31. Turbine and auxiliaries              |                    | 1   |
| 32. Feedwater and Main Steam System      |                    | 18  |
| 41. Main Generator Systems               |                    | 0   |
| XX. Miscellaneous Systems                |                    | 0   |
| Total                                    | 0                  | 96  |

**FI-3 OLKILUOTO-1**

**Operator:** TVO (TEOLLISUUDEN VOIMA OY)  
**Contractor:** ASEASTAL (ASEA-ATOM / STAL-LAVAL)

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 840.0 MW(e)  
**Design Net RUP:** 660.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 7009.0 GW(e).h  
**Energy Availability Factor:** 94.7%  
**Load Factor:** 95.0%  
**Operating Factor:** 94.8%  
**Energy Unavailability Factor:** 5.3%  
**Total Off-line Time:** 455 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 632.7 | 590.8 | 586.7 | 609.5 | 296.0 | 601.8 | 601.9 | 617.8 | 601.1 | 627.8 | 611.3 | 631.8 | 7009.0 |
| <b>EAF (%)</b>  | 100.0 | 99.8  | 92.9  | 100.0 | 47.2  | 100.0 | 98.0  | 100.0 | 100.0 | 99.9  | 100.0 | 99.7  | 94.7   |
| <b>UCF (%)</b>  | 100.0 | 99.8  | 92.9  | 100.0 | 47.2  | 100.0 | 98.0  | 100.0 | 100.0 | 99.9  | 100.0 | 99.7  | 94.7   |
| <b>LF (%)</b>   | 101.2 | 101.0 | 93.9  | 100.8 | 47.4  | 99.5  | 96.3  | 98.9  | 99.4  | 100.4 | 101.1 | 101.1 | 95.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 93.1  | 100.0 | 47.7  | 100.0 | 98.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.8   |
| <b>EUF (%)</b>  | 0.0   | 0.2   | 7.1   | 0.0   | 52.8  | 0.0   | 2.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.3   | 5.3    |
| <b>PUF (%)</b>  | 0.0   | 0.2   | 0.2   | 0.0   | 47.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.3   | 4.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 7.0   | 0.0   | 5.0   | 0.0   | 2.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 01 Feb 1974  
**Date of First Criticality:** 21 Jul 1978  
**Date of Grid Connection:** 02 Sep 1978  
**Date of Commercial Operation:** 10 Oct 1979

**Lifetime Generation:** 152019.2 GW(e).h  
**Cumulative Energy Availability Factor:** 92.0%  
**Cumulative Load Factor:** 91.6%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 8.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4808.3         | 657.0          | 81.9   | 81.4   | 81.9                              | 81.3   | 82.0               | 80.7   | 7651               | 87.3   |
| 1984 | 5505.6         | 678.0          | 91.9   | 83.6   | 91.9                              | 83.5   | 90.3               | 83.1   | 8247               | 93.9   |
| 1985 | 5414.5         | 710.0          | 88.8   | 84.5   | 88.8                              | 84.4   | 87.1               | 83.8   | 8180               | 93.4   |
| 1986 | 5463.2         | 710.0          | 90.1   | 85.3   | 90.1                              | 85.2   | 87.8               | 84.4   | 8008               | 91.4   |
| 1987 | 5636.5         | 710.0          | 92.0   | 86.2   | 92.1                              | 86.1   | 90.6               | 85.2   | 8142               | 92.9   |
| 1988 | 5778.9         | 710.0          | 94.3   | 87.1   | 94.1                              | 87.1   | 92.7               | 86.1   | 8248               | 93.9   |
| 1989 | 5056.2         | 710.0          | 83.2   | 86.7   | 83.2                              | 86.7   | 81.3               | 85.6   | 7278               | 83.1   |
| 1990 | 5857.3         | 710.0          | 95.6   | 87.6   | 95.6                              | 87.5   | 94.2               | 86.4   | 8356               | 95.4   |
| 1991 | 5873.2         | 710.0          | 95.7   | 88.3   | 94.9                              | 88.1   | 94.4               | 87.1   | 8373               | 95.6   |
| 1992 | 5803.0         | 710.0          | 93.7   | 88.7   | 93.2                              | 88.5   | 93.0               | 87.6   | 8251               | 93.9   |
| 1993 | 5944.9         | 710.0          | 95.8   | 89.2   | 95.3                              | 89.0   | 95.6               | 88.2   | 8433               | 96.3   |
| 1994 | 5978.0         | 710.0          | 96.5   | 89.7   | 96.0                              | 89.5   | 96.1               | 88.7   | 8485               | 96.9   |
| 1995 | 5931.5         | 710.0          | 96.1   | 90.1   | 95.5                              | 89.9   | 95.4               | 89.1   | 8427               | 96.2   |
| 1996 | 5938.6         | 710.0          | 92.2   | 90.2   | 92.1                              | 90.0   | 95.2               | 89.5   | 8212               | 93.5   |
| 1997 | 6374.2         | 772.0          | 93.9   | 90.5   | 93.8                              | 90.2   | 94.3               | 89.8   | 8254               | 94.2   |
| 1998 | 6807.0         | 840.0          | 95.6   | 90.8   | 95.0                              | 90.5   | 92.5               | 89.9   | 8384               | 95.7   |
| 1999 | 7111.8         | 840.0          | 97.2   | 91.2   | 96.4                              | 90.9   | 96.6               | 90.3   | 8542               | 97.5   |
| 2000 | 7043.1         | 840.0          | 95.8   | 91.4   | 95.2                              | 91.1   | 95.5               | 90.6   | 8448               | 96.2   |
| 2001 | 7163.8         | 840.0          | 97.6   | 91.7   | 97.2                              | 91.4   | 97.4               | 91.0   | 8561               | 97.7   |
| 2002 | 6997.5         | 840.0          | 95.5   | 91.9   | 95.1                              | 91.6   | 95.1               | 91.2   | 8377               | 95.6   |
| 2003 | 7127.4         | 840.0          | 97.1   | 92.2   | 96.5                              | 91.9   | 96.9               | 91.5   | 8515               | 97.2   |
| 2004 | 7009.0         | 840.0          | 94.7   | 92.3   | 94.7                              | 92.0   | 95.0               | 91.6   | 8329               | 94.8   |

## FI-3 OLKILUOTO-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 06 Mar | 8.0   | 6.9     | UF1  | A15  | HOT SHUT DOWN DUE TO REPAIR OF VALVE IN RELIEF SYSTEM.              |
| 07 Mar | 43.0  | 36.5    | UF4  | A15  | REACTOR SCRAM BACAUSE ONE MAIN STEAM ISOLATION VALVE CLOSED.        |
| 09 May | 352.0 | 295.7   | PF   | C    | REFUELLING OUTAGES  |
| 24 May | 37.0  | 31.1    | UF3  | Z    | EXTENSION OF REFUELLING OUTAGE                                      |
| 07 Jul | 15.0  | 12.7    | UF2  | A41  | TURBINE SCRAM DUE TO LOW LEVEL IN TANK IN GENERATOR COOLING SYSTEM. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1979 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 66        |          |   | 98        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 352             |           |          | 455   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 20  |           |          |
| E. Testing of plant systems or components  |                 |           |          |   | 7         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 4        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 52        | 0        |
| Z. Others  |                 | 37        |          |   | 1         |          |
| Subtotal   | 352             | 103       | 0        | 475   | 158       | 4        |
| Total  |                 | 455       |          |   | 637       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1979 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 8   |
| 12. Reactor I&C Systems             |                    | 1   |
| 14. Safety Systems                  |                    | 5   |
| 15. Reactor Cooling Systems         | 51                 | 11  |
| 31. Turbine and auxiliaries         |                    | 23  |
| 32. Feedwater and Main Steam System |                    | 3   |
| 33. Circulating Water System        |                    | 1   |
| 41. Main Generator Systems          | 15                 | 41  |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 66                 | 93  |

**FI-4 OLKILUOTO-2**

**Operator:** TVO (TEOLLISUUDEN VOIMA OY)  
**Contractor:** ASEASTAL (ASEA-ATOM / STAL-LAVAL)

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 840.0 MW(e)  
**Design Net RUP:** 660.0 MW(e)  
**Design Discharge Burnup:** 35000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 7080.7 GW(e).h  
**Energy Availability Factor:** 95.8%  
**Load Factor:** 96.0%  
**Operating Factor:** 96.6%  
**Energy Unavailability Factor:** 4.2%  
**Total Off-line Time:** 299 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 631.8 | 592.5 | 630.9 | 598.1 | 467.1 | 532.6 | 613.3 | 551.5 | 598.9 | 623.8 | 609.1 | 631.2 | 7080.7 |
| <b>EAF (%)</b>  | 99.8  | 100.0 | 99.8  | 97.9  | 74.6  | 88.7  | 100.0 | 90.0  | 100.0 | 99.6  | 100.0 | 99.7  | 95.8   |
| <b>UCF (%)</b>  | 99.8  | 100.0 | 99.8  | 97.9  | 74.6  | 88.7  | 100.0 | 90.0  | 100.0 | 99.6  | 100.0 | 99.7  | 95.8   |
| <b>LF (%)</b>   | 101.1 | 101.3 | 101.1 | 98.9  | 74.7  | 88.1  | 98.1  | 88.2  | 99.0  | 99.7  | 100.7 | 101.0 | 96.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 78.8  | 90.1  | 100.0 | 90.6  | 100.0 | 100.0 | 100.0 | 100.0 | 96.6   |
| <b>EUF (%)</b>  | 0.2   | 0.0   | 0.2   | 2.1   | 25.4  | 11.3  | 0.0   | 10.0  | 0.0   | 0.4   | 0.0   | 0.3   | 4.2    |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.2   | 0.0   | 23.5  | 6.9   | 0.0   | 0.1   | 0.0   | 0.2   | 0.0   | 0.3   | 2.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 2.1   | 1.9   | 4.4   | 0.0   | 9.9   | 0.0   | 0.2   | 0.0   | 0.0   | 1.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 01 Aug 1975  
**Date of First Criticality:** 13 Oct 1979  
**Date of Grid Connection:** 18 Feb 1980  
**Date of Commercial Operation:** 10 Jul 1982

**Lifetime Generation:** 143203.6 GW(e).h  
**Cumulative Energy Availability Factor:** 93.6%  
**Cumulative Load Factor:** 93.2%  
**Cumulative Unit Capability Factor:** 77.9%  
**Cumulative Energy Unavailability Factor:** 6.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5087.2         | 657.0          | 86.8   | 86.8   | 86.7                              | 86.7   | 88.3               | 88.4   | 8221               | 93.8   |
| 1984 | 5341.3         | 678.0          | 89.6   | 88.2   | 89.6                              | 88.0   | 87.3               | 89.0   | 8031               | 91.4   |
| 1985 | 5415.8         | 710.0          | 88.2   | 88.2   | 88.2                              | 88.1   | 87.1               | 88.4   | 7912               | 90.3   |
| 1986 | 5840.2         | 710.0          | 95.1   | 90.0   | 95.1                              | 89.9   | 93.9               | 89.8   | 8437               | 96.3   |
| 1987 | 5725.0         | 710.0          | 93.7   | 90.7   | 93.7                              | 90.7   | 92.0               | 90.3   | 8379               | 95.7   |
| 1988 | 5713.2         | 710.0          | 92.7   | 91.0   | 92.7                              | 91.0   | 91.6               | 90.5   | 8220               | 93.6   |
| 1989 | 5827.0         | 710.0          | 94.9   | 91.6   | 94.9                              | 91.6   | 93.7               | 90.9   | 8363               | 95.5   |
| 1990 | 5749.9         | 710.0          | 93.8   | 91.9   | 93.8                              | 91.9   | 92.4               | 91.1   | 8265               | 94.3   |
| 1991 | 5731.0         | 710.0          | 93.7   | 92.1   | 93.0                              | 92.0   | 92.1               | 91.3   | 8216               | 93.8   |
| 1992 | 5790.4         | 710.0          | 94.5   | 92.3   | 93.3                              | 92.1   | 92.8               | 91.4   | 8306               | 94.6   |
| 1993 | 5861.6         | 710.0          | 95.1   | 92.6   | 94.4                              | 92.3   | 94.2               | 91.7   | 8327               | 95.1   |
| 1994 | 5732.6         | 710.0          | 93.2   | 92.6   | 92.3                              | 92.3   | 92.2               | 91.7   | 8130               | 92.8   |
| 1995 | 5747.2         | 710.0          | 93.7   | 92.7   | 92.5                              | 92.3   | 92.4               | 91.8   | 8236               | 94.0   |
| 1996 | 5915.4         | 710.0          | 95.3   | 92.9   | 95.0                              | 92.5   | 94.8               | 92.0   | 8413               | 95.8   |
| 1997 | 6077.0         | 736.0          | 94.6   | 93.0   | 93.7                              | 92.6   | 94.3               | 92.1   | 8258               | 94.3   |
| 1998 | 6628.5         | 840.0          | 94.3   | 93.1   | 93.2                              | 92.7   | 90.1               | 92.0   | 8207               | 93.7   |
| 1999 | 7091.2         | 840.0          | 96.9   | 93.4   | 96.4                              | 92.9   | 96.4               | 92.3   | 8505               | 97.1   |
| 2000 | 7028.9         | 840.0          | 95.9   | 93.5   | 95.3                              | 93.1   | 95.3               | 92.5   | 8457               | 96.3   |
| 2001 | 6988.0         | 840.0          | 95.1   | 93.6   | 95.1                              | 93.2   | 95.0               | 92.6   | 8387               | 95.7   |
| 2002 | 7108.5         | 840.0          | 97.0   | 93.8   | 96.8                              | 93.4   | 96.6               | 92.9   | 8472               | 96.7   |
| 2003 | 7026.9         | 840.0          | 95.5   | 93.9   | 95.2                              | 93.5   | 95.5               | 93.0   | 8378               | 95.6   |
| 2004 | 7080.7         | 840.0          | 95.8   | 94.0   | 95.8                              | 93.6   | 96.0               | 93.2   | 8485               | 96.6   |



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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 07 Apr | 1129.0 | 23.8    | UP2  | A33  | POWER REDUCTION TO 96 % DUE TO ONE OF SIX MAIN CIRCULATION PUMP STOP. PUMP REPAIR IN ANNUAL OUTAGES. |
| 05 May | 487.0  | 22.9    | PP   | S    | COAST-DOWN   |
| 25 May | 197.0  | 165.6   | PF   | C    | REFUELLING OUTAGES   |
| 03 Jun | 32.0   | 26.7    | UF3  | Z    | EXTENSION OF REFUELLING OUTAGES  |
| 06 Aug | 70.0   | 58.6    | UF1  | A41  | HOT SHUTDOWN DUE TO REPAIR OF GENERATOR ROTOR COOLING SYSTEM.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 70        |          |  | 375       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 197             |           |          | 392                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 18                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 27                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 14       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         | 5        |
| Z. Others  |                 | 32        |          |  | 0         |          |
| Subtotal   | 197             | 102       | 0        | 437                                      | 390       | 19       |
| Total  |                 | 299       |          |  | 846       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 9  |
| 12. Reactor I&C Systems             |                 | 0  |
| 13. Reactor Auxiliary Systems       |                 | 0  |
| 14. Safety Systems                  |                 | 3  |
| 15. Reactor Cooling Systems         |                 | 13                                       |
| 31. Turbine and auxiliaries         |                 | 2  |
| 32. Feedwater and Main Steam System |                 | 8  |
| 33. Circulating Water System        |                 | 1  |
| 35. All other I&C Systems           |                 | 1  |
| 41. Main Generator Systems          | 70              | 330                                      |
| 42. Electrical Power Supply Systems |                 | 4  |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 70              | 371                                      |

**FR-54 BELLEVILLE-1**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1310.0 MW(e)  
 Design Net RUP: 1310.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 9291.0 GW(e).h  
 Energy Availability Factor: 88.0%  
 Load Factor: 80.7%  
 Operating Factor: 87.0%  
 Energy Unavailability Factor: 12.0%  
 Total Off-line Time: 1140 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 883.4 | 904.6 | 923.2 | 902.4 | 926.5 | 872.7 | 901.0 | 0.0   | 433.7 | 873.3 | 867.5 | 802.8 | 9291.0 |
| EAF (%)  | 95.4  | 100.0 | 96.2  | 99.5  | 99.1  | 98.9  | 93.5  | 0.0   | 75.9  | 100.0 | 100.0 | 99.4  | 88.0   |
| UCF (%)  | 95.4  | 100.0 | 96.2  | 99.9  | 100.0 | 100.0 | 96.9  | 0.0   | 76.2  | 100.0 | 100.0 | 100.0 | 88.6   |
| LF (%)   | 90.6  | 99.2  | 94.7  | 95.7  | 95.1  | 92.5  | 92.4  | 0.0   | 46.0  | 89.5  | 92.0  | 82.4  | 80.7   |
| OF (%)   | 95.4  | 100.0 | 96.0  | 100.0 | 100.0 | 100.0 | 97.2  | 0.0   | 65.3  | 100.0 | 100.0 | 91.8  | 87.0   |
| EUF (%)  | 4.6   | 0.0   | 3.8   | 0.5   | 0.9   | 1.1   | 6.5   | 100.0 | 24.1  | 0.0   | 0.0   | 0.6   | 12.0   |
| PUF (%)  | 4.6   | 0.0   | 3.8   | 0.1   | 0.0   | 0.0   | 3.1   | 100.0 | 23.8  | 0.0   | 0.0   | 0.0   | 11.4   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.4   | 0.9   | 1.1   | 3.4   | 0.0   | 0.3   | 0.0   | 0.0   | 0.6   | 0.6    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 May 1980  
 Date of First Criticality: 09 Sep 1987  
 Date of Grid Connection: 14 Oct 1987  
 Date of Commercial Operation: 01 Jun 1988

Lifetime Generation: 133540.3 GW(e).h  
 Cumulative Energy Availability Factor: 74.7%  
 Cumulative Load Factor: 68.6%  
 Cumulative Unit Capability Factor: 78.8%  
 Cumulative Energy Unavailability Factor: 25.3%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1987 | 622.0             | 1310.0            | 0.0  | 0.0    | 84.1                                 | 100.0  | 5.6                | 0.0    | 1184                  | 14.0   |
| 1988 | 6283.0            | 1310.0            | 0.0  | 0.0    | 68.7                                 | 100.0  | 54.6               | 0.0    | 6478                  | 73.7   |
| 1989 | 5152.6            | 1310.0            | 46.5   | 46.5   | 46.0                                 | 46.0   | 44.9               | 44.9   | 4244                  | 48.4   |
| 1990 | 7914.3            | 1310.0            | 71.4   | 59.0   | 71.2                                 | 58.6   | 69.0               | 56.9   | 6408                  | 73.2   |
| 1991 | 8660.2            | 1310.0            | 80.8   | 66.3   | 79.3                                 | 65.5   | 75.5               | 63.1   | 7092                  | 81.0   |
| 1992 | 8494.3            | 1310.0            | 91.8   | 72.7   | 91.2                                 | 71.9   | 73.8               | 65.8   | 7600                  | 86.5   |
| 1993 | 7921.5            | 1310.0            | 77.5   | 73.6   | 71.3                                 | 71.8   | 69.0               | 66.4   | 6873                  | 78.5   |
| 1994 | 6575.8            | 1310.0            | 65.2   | 72.2   | 64.0                                 | 70.5   | 57.3               | 64.9   | 5848                  | 66.8   |
| 1995 | 7740.9            | 1310.0            | 76.2   | 72.8   | 73.4                                 | 70.9   | 67.5               | 65.3   | 6796                  | 77.6   |
| 1996 | 7365.1            | 1310.0            | 76.8   | 73.3   | 76.5                                 | 71.6   | 64.0               | 65.1   | 6002                  | 68.3   |
| 1997 | 9785.3            | 1310.0            | 93.4   | 75.5   | 93.2                                 | 74.0   | 85.3               | 67.4   | 8294                  | 94.7   |
| 1998 | 5740.9            | 1310.0            | 53.7   | 73.3   | 51.2                                 | 71.7   | 50.0               | 65.6   | 4865                  | 55.5   |
| 1999 | 9580.5            | 1310.0            | 92.0   | 75.0   | 90.4                                 | 73.4   | 83.5               | 67.2   | 7957                  | 90.8   |
| 2000 | 4238.6            | 1310.0            | 38.0   | 71.9   | 37.9                                 | 70.5   | 36.8               | 64.7   | 3459                  | 39.4   |
| 2001 | 9564.5            | 1310.0            | 87.3   | 73.1   | 86.8                                 | 71.7   | 83.3               | 66.1   | 7774                  | 88.7   |
| 2002 | 9567.3            | 1310.0            | 99.5   | 75.0   | 98.9                                 | 73.7   | 83.4               | 67.4   | 8447                  | 96.4   |
| 2003 | 8401.7            | 1310.0            | 77.6   | 75.2   | 75.4                                 | 73.8   | 73.2               | 67.8   | 6871                  | 78.4   |
| 2004 | 9291.0            | 1310.0            | 88.6   | 76.0   | 88.0                                 | 74.7   | 80.7               | 68.6   | 7645                  | 87.0   |

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## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 34.0  | 44.0    | PF   | D    | WORK SCHEDULED FOR 01/01                                 |
| 02 Jan | 149.0 | 20.0    | UP2  | A32  | HIGH-PRESSURE HEATING                                    |
| 11 Jan | 110.0 | 14.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 01 Feb | 51.0  | 4.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 02 Feb | 138.0 | 1.0     | UP2  | A16  | BLOWDOWNS AND MISCELLANEOUS SYSTEM                       |
| 04 Mar | 121.0 | 15.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 20 Mar | 27.0  | 35.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN         |
| 01 Apr | 252.0 | 33.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 01 May | 252.0 | 40.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX  |
| 17 May | 132.0 | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 01 Jun | 279.0 | 41.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 01 Jun | 177.0 | 4.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 21 Jun | 44.0  | 6.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION  |
| 01 Jul | 179.0 | 4.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 01 Jul | 70.0  | 6.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 14 Jul | 396.0 | 30.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                       |
| 31 Jul | 971.0 | 1188.6  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                        |
| 03 Sep | 10.0  | 126.0   | UF1  | A11  | VESSEL AND VESSEL HEAD                                   |
| 07 Sep | 4.0   | 45.0    | UF2  | A11  | VARIOUS, REACTOR   |
| 08 Sep | 6.0   | 62.0    | UF2  | A14  | REFUELLING MACHINE                                       |
| 10 Sep | 6.0   | 73.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                          |
| 10 Sep | 182.0 | 87.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                          |
| 20 Sep | 216.0 | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 26 Sep | 19.0  | 25.0    | UF2  | A    | PARALLEL AND TAPER-SEAT VALVES                           |
| 01 Oct | 260.0 | 88.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                  |
| 01 Oct | 111.0 | 2.0     | UP2  | A31  | MAIN CONDENSER   |
| 01 Nov | 213.0 | 72.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                  |
| 01 Dec | 173.0 | 72.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX  |
| 09 Dec | 21.0  | 27.0    | UF2  | A42  | BACKUP SAFETY SYSTEM                                     |
| 10 Dec | 17.0  | 22.0    | UF2  | A13  | WASTE HANDLING, STORAGE AND TREATMENT FACILITIES         |
| 11 Dec | 23.0  | 31.0    | UF2  | A32  | CHEMICAL CHARACTERISTICS OF THE SECONDARY SYSTEM         |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 100       |          |  | 489       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 22        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 971             |           |          | 1083                                     | 12        |          |
| D. Inspection, maintenance or repair without refuelling                              | 34              |           |          | 8  |           |          |
| E. Testing of plant systems or components  | 33              |           |          | 69                                       | 4         | 0        |
| H. Nuclear regulatory requirements   |                 |           |          |  | 129       |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 97        | 1        |
| Subtotal   | 1038            | 100       | 0        | 1160                                     | 753       | 1        |
| Total  |                 | 1138      |          |  | 1914      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              | 14              | 30                                       |
| 12. Reactor I&C Systems                  |                 | 87                                       |
| 13. Reactor Auxiliary Systems            | 17              | 52                                       |
| 14. Safety Systems                       | 6               | 42                                       |
| 15. Reactor Cooling Systems              |                 | 48                                       |
| 16. Steam generation systems             |                 | 9  |
| 21. Fuel Handling and Storage Facilities |                 | 2  |
| 31. Turbine and auxiliaries              |                 | 12                                       |
| 32. Feedwater and Main Steam System      | 23              | 84                                       |
| 41. Main Generator Systems               |                 | 53                                       |
| 42. Electrical Power Supply Systems      | 21              | 20                                       |
| XX. Miscellaneous Systems                |                 | 3  |
| Total                                    | 81              | 442                                      |

# FR-55 BELLEVILLE-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1310.0 MW(e)  
**Design Net RUP:** 1310.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10202.6 GW(e).h  
**Energy Availability Factor:** 97.1%  
**Load Factor:** 88.7%  
**Operating Factor:** 98.1%  
**Energy Unavailability Factor:** 2.9%  
**Total Off-line Time:** 163 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 834.2 | 836.4 | 900.8 | 840.4 | 878.7 | 742.0 | 859.6 | 840.2 | 853.7 | 745.7 | 937.1 | 933.8 | 10202.6 |
| <b>EAF (%)</b>  | 98.6  | 99.9  | 100.0 | 97.9  | 99.2  | 93.5  | 99.7  | 96.4  | 99.7  | 84.3  | 100.0 | 95.8  | 97.1    |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 100.0 | 99.9  | 99.9  | 99.9  | 99.8  | 96.5  | 100.0 | 84.5  | 100.0 | 96.0  | 98.0    |
| <b>LF (%)</b>   | 85.6  | 91.7  | 92.6  | 89.1  | 90.2  | 78.7  | 88.2  | 86.2  | 90.5  | 76.4  | 99.4  | 95.8  | 88.7    |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.9  | 100.0 | 84.7  | 100.0 | 96.5  | 98.1    |
| <b>EUF (%)</b>  | 1.4   | 0.1   | 0.0   | 2.1   | 0.8   | 6.5   | 0.3   | 3.6   | 0.3   | 15.7  | 0.0   | 4.2   | 2.9     |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.1   | 0.2   | 3.5   | 0.0   | 15.5  | 0.0   | 3.8   | 2.0     |
| <b>XUF (%)</b>  | 1.4   | 0.0   | 0.0   | 2.0   | 0.7   | 6.4   | 0.1   | 0.1   | 0.3   | 0.1   | 0.0   | 0.3   | 1.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1980  
**Date of First Criticality:** 25 May 1988  
**Date of Grid Connection:** 06 Jul 1988  
**Date of Commercial Operation:** 01 Jan 1989

**Lifetime Generation:** 130187.6 GW(e).h  
**Cumulative Energy Availability Factor:** 76.3%  
**Cumulative Load Factor:** 69.8%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 23.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 2087.0         | 1310.0         | 0.0  | 0.0    | 69.6                              | 100.0  | 18.4               | 0.0    | 2477               | 28.6   |
| 1989 | 8505.7         | 1310.0         | 87.0   | 87.0   | 86.6                              | 86.6   | 74.1               | 74.1   | 7419               | 84.7   |
| 1990 | 6324.0         | 1310.0         | 58.4   | 72.7   | 56.9                              | 71.8   | 55.1               | 64.6   | 5350               | 61.1   |
| 1991 | 7876.3         | 1310.0         | 73.3   | 72.9   | 70.3                              | 71.3   | 68.6               | 66.0   | 6578               | 75.1   |
| 1992 | 8262.1         | 1310.0         | 75.9   | 73.7   | 75.3                              | 72.3   | 71.8               | 67.4   | 6904               | 78.6   |
| 1993 | 8871.3         | 1310.0         | 83.4   | 75.6   | 80.1                              | 73.8   | 77.3               | 69.4   | 7435               | 84.9   |
| 1994 | 8241.3         | 1310.0         | 80.4   | 76.4   | 76.9                              | 74.4   | 71.8               | 69.8   | 7122               | 81.3   |
| 1995 | 7960.5         | 1310.0         | 99.3   | 79.7   | 97.5                              | 77.7   | 69.4               | 69.7   | 7438               | 84.9   |
| 1996 | 7229.8         | 1310.0         | 74.5   | 79.0   | 71.2                              | 76.8   | 62.8               | 68.9   | 6666               | 75.9   |
| 1997 | 8508.1         | 1310.0         | 84.9   | 79.7   | 82.0                              | 77.4   | 74.1               | 69.5   | 7339               | 83.8   |
| 1998 | 5068.0         | 1310.0         | 45.0   | 76.2   | 45.0                              | 74.2   | 44.2               | 66.9   | 4239               | 48.4   |
| 1999 | 4899.3         | 1310.0         | 44.8   | 73.3   | 43.3                              | 71.4   | 42.7               | 64.7   | 4040               | 46.1   |
| 2000 | 9882.5         | 1310.0         | 97.4   | 75.4   | 96.7                              | 73.5   | 85.9               | 66.5   | 8271               | 94.2   |
| 2001 | 8458.0         | 1310.0         | 79.2   | 75.7   | 78.6                              | 73.9   | 73.7               | 67.0   | 6935               | 79.2   |
| 2002 | 9378.7         | 1310.0         | 86.2   | 76.4   | 84.3                              | 74.6   | 81.7               | 68.1   | 7687               | 87.8   |
| 2003 | 8624.7         | 1310.0         | 80.4   | 76.7   | 79.4                              | 74.9   | 75.2               | 68.6   | 7135               | 81.4   |
| 2004 | 10202.6        | 1310.0         | 98.0   | 78.0   | 97.1                              | 76.3   | 88.7               | 69.8   | 8621               | 98.1   |

## FR-55 BELLEVILLE-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 280.0 | 128.0   | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 19 Jan | 14.0  | 14.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Feb | 279.0 | 75.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Mar | 258.0 | 76.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Apr | 227.0 | 17.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Apr | 315.0 | 67.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 07 Apr | 23.0  | 19.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 May | 401.0 | 88.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                        |
| 26 May | 13.0  | 7.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Jun | 96.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Jun | 302.0 | 138.0   | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                        |
| 14 Jun | 63.0  | 58.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Jul | 179.0 | 44.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Jul | 70.0  | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 15 Jul | 849.0 | 4.0     | UP2  | A16  | BLOWDOWNS AND MISCELLANEOUS SYSTEM                             |
| 19 Aug | 138.0 | 30.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 19 Aug | 35.0  | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 21 Aug | 23.0  | 30.0    | UF2  | A15  | PRIMARY PUMP   |
| 01 Sep | 344.0 | 74.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 02 Sep | 128.0 | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Oct | 274.0 | 73.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 21 Oct | 37.0  | 49.0    | UF2  | A    | CONTROL AND ISOLATING VALVES                                   |
| 01 Nov | 71.0  | 2.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 02 Nov | 102.0 | 10.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Dec | 54.0  | 5.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 07 Dec | 13.0  | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 21 Dec | 20.0  | 26.0    | UF2  | L    | HUMAN ERROR IN PADLOCKING                                      |
| 21 Dec | 6.0   | 8.0     | UF2  | A41  | HYDROGEN COOLING SYSTEM  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 66        |          |  | 379       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 18        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1035                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          | 47                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 165       |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 82        |          |
| L. Human factor related  |                 | 20        |          |  | 1         |          |
| Z. Others  |                 |           |          |  | 1         |          |
| Subtotal   | 0               | 86        | 0        | 1082                                     | 646       | 0        |
| Total  |                 | 86        |          |  | 1728      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 53                                       |
| 12. Reactor I&C Systems                        |                 | 60                                       |
| 13. Reactor Auxiliary Systems                  |                 | 10                                       |
| 14. Safety Systems                             |                 | 33                                       |
| 15. Reactor Cooling Systems                    | 23              | 58                                       |
| 16. Steam generation systems                   |                 | 41                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 23                                       |
| 32. Feedwater and Main Steam System            |                 | 17                                       |
| 33. Circulating Water System                   |                 | 3  |
| 41. Main Generator Systems                     | 6               | 7  |
| 42. Electrical Power Supply Systems            |                 | 14                                       |
| Total  | 29              | 320                                      |

**FR-32 BLAYAIS-1**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 910.0 MW(e)  
 Design Net RUP: 910.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6144.3 GW(e).h  
 Energy Availability Factor: 79.2%  
 Load Factor: 76.9%  
 Operating Factor: 82.2%  
 Energy Unavailability Factor: 20.8%  
 Total Off-line Time: 1567 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 613.9 | 608.1 | 639.2 | 417.3 | 0.0   | 164.8 | 559.2 | 618.3 | 615.5 | 625.9 | 619.7 | 662.3 | 6144.3 |
| <b>EAF (%)</b>  | 99.8  | 96.4  | 95.0  | 64.3  | 0.0   | 26.6  | 83.1  | 93.5  | 99.0  | 96.6  | 96.6  | 99.9  | 79.2   |
| <b>UCF (%)</b>  | 99.8  | 96.4  | 99.8  | 76.2  | 0.0   | 26.8  | 84.7  | 97.5  | 100.0 | 96.9  | 100.0 | 99.9  | 81.5   |
| <b>LF (%)</b>   | 90.7  | 96.0  | 94.5  | 63.7  | 0.0   | 25.2  | 82.6  | 91.3  | 93.9  | 92.3  | 94.6  | 97.8  | 76.9   |
| <b>OF (%)</b>   | 94.2  | 96.8  | 100.0 | 76.7  | 0.0   | 34.2  | 86.7  | 100.0 | 100.0 | 97.7  | 100.0 | 100.0 | 82.2   |
| <b>EUF (%)</b>  | 0.2   | 3.6   | 5.0   | 35.7  | 100.0 | 73.4  | 16.9  | 6.5   | 1.0   | 3.4   | 3.4   | 0.1   | 20.8   |
| <b>PUF (%)</b>  | 0.2   | 0.1   | 0.1   | 23.7  | 100.0 | 73.1  | 0.3   | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 16.5   |
| <b>UCLF (%)</b> | 0.0   | 3.6   | 0.1   | 0.1   | 0.0   | 0.1   | 15.0  | 2.5   | 0.0   | 2.9   | 0.0   | 0.1   | 2.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 4.8   | 12.0  | 0.0   | 0.3   | 1.6   | 4.0   | 0.9   | 0.3   | 3.4   | 0.0   | 2.3    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Jan 1977  
 Date of First Criticality: 20 May 1981  
 Date of Grid Connection: 12 Jun 1981  
 Date of Commercial Operation: 01 Dec 1981

Lifetime Generation: 129988.2 GW(e).h  
 Cumulative Energy Availability Factor: 75.9%  
 Cumulative Load Factor: 70.0%  
 Cumulative Unit Capability Factor: 77.8%  
 Cumulative Energy Unavailability Factor: 24.1%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 3453.0            | 910.0             | 46.9   | 64.2   | 46.9                                 | 64.2   | 43.3               | 60.1   | 4285                  | 48.9   |
| 1984 | 6509.0            | 910.0             | 85.1   | 71.2   | 84.6                                 | 71.0   | 81.4               | 67.2   | 7536                  | 85.8   |
| 1985 | 6225.2            | 910.0             | 83.0   | 74.1   | 82.8                                 | 73.9   | 78.1               | 69.9   | 7348                  | 83.9   |
| 1986 | 6460.6            | 910.0             | 87.8   | 76.8   | 87.0                                 | 76.5   | 81.0               | 72.2   | 7754                  | 88.5   |
| 1987 | 5586.6            | 910.0             | 78.2   | 77.1   | 76.2                                 | 76.5   | 70.1               | 71.8   | 6793                  | 77.5   |
| 1988 | 5730.0            | 910.0             | 82.1   | 77.8   | 81.3                                 | 77.2   | 71.7               | 71.8   | 7069                  | 80.5   |
| 1989 | 6222.4            | 910.0             | 84.3   | 78.6   | 83.3                                 | 77.9   | 78.1               | 72.6   | 7419                  | 84.7   |
| 1990 | 5822.6            | 910.0             | 77.2   | 78.4   | 76.9                                 | 77.8   | 73.0               | 72.6   | 6834                  | 78.0   |
| 1991 | 6379.0            | 910.0             | 83.8   | 79.0   | 83.3                                 | 78.4   | 80.0               | 73.4   | 7400                  | 84.5   |
| 1992 | 4349.2            | 910.0             | 57.5   | 77.0   | 56.6                                 | 76.4   | 54.4               | 71.6   | 5079                  | 57.8   |
| 1993 | 5979.2            | 910.0             | 83.7   | 77.6   | 78.3                                 | 76.5   | 75.0               | 71.9   | 7253                  | 82.8   |
| 1994 | 3474.9            | 910.0             | 86.6   | 78.3   | 85.8                                 | 77.3   | 43.6               | 69.7   | 5119                  | 58.4   |
| 1995 | 6075.8            | 910.0             | 87.1   | 78.9   | 84.3                                 | 77.8   | 76.2               | 70.2   | 7206                  | 82.3   |
| 1996 | 6639.1            | 910.0             | 88.5   | 79.5   | 85.6                                 | 78.3   | 83.1               | 71.1   | 7798                  | 88.8   |
| 1997 | 6196.6            | 910.0             | 90.1   | 80.2   | 84.6                                 | 78.7   | 77.7               | 71.5   | 7621                  | 87.0   |
| 1998 | 5917.6            | 910.0             | 81.1   | 80.3   | 78.2                                 | 78.6   | 74.2               | 71.6   | 7078                  | 80.8   |
| 1999 | 6046.8            | 910.0             | 80.9   | 80.3   | 77.9                                 | 78.6   | 75.9               | 71.9   | 7082                  | 80.8   |
| 2000 | 2854.1            | 910.0             | 53.4   | 78.9   | 36.6                                 | 76.4   | 35.7               | 70.0   | 3602                  | 41.0   |
| 2001 | 4881.5            | 910.0             | 66.3   | 78.2   | 64.0                                 | 75.8   | 61.2               | 69.5   | 5768                  | 65.8   |
| 2002 | 6861.1            | 910.0             | 95.0   | 79.0   | 93.0                                 | 76.6   | 86.1               | 70.3   | 8251                  | 94.2   |
| 2003 | 4541.7            | 910.0             | 61.8   | 78.3   | 58.1                                 | 75.7   | 57.0               | 69.7   | 5321                  | 60.7   |
| 2004 | 6144.3            | 910.0             | 81.5   | 78.4   | 79.2                                 | 75.9   | 76.9               | 70.0   | 7217                  | 82.2   |

# FR-32 BLAYAIS-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 297.0  | 19.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 02 Feb | 46.0   | 3.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 10 Feb | 22.0   | 20.0    | UF2  | Z    | MALFUNCTION OF REGULATION, CONTROL AND PROTECTION SYSTEM      |
| 01 Mar | 1213.0 | 111.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 02 Mar | 49.0   | 3.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 23 Apr | 1328.0 | 1208.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 20 Jun | 135.0  | 48.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 26 Jun | 99.0   | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Jul | 527.0  | 11.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 11 Jul | 69.0   | 8.0     | UP2  | A42  | EMERGENCY GENERATOR   |
| 11 Jul | 99.0   | 90.0    | UF2  | A42  | EMERGENCY GENERATOR   |
| 01 Aug | 482.0  | 13.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 19 Aug | 93.0   | 9.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 19 Aug | 22.0   | 1.0     | UP2  | A    | RELAYS/SYSTEMS COMMON TO SEVERAL FUNCTIONS                    |
| 19 Aug | 35.0   | 15.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES     |
| 21 Aug | 27.0   | 8.0     | UP2  | A12  | REACTOR CONTROL   |
| 22 Aug | 69.0   | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 29 Aug | 11.0   | 7.0     | UP2  | A    | CONTROL AND ISOLATING VALVES                                  |
| 01 Sep | 334.0  | 6.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Sep | 305.0  | 32.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Oct | 248.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Oct | 234.0  | 19.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Oct | 99.0   | 9.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 11 Oct | 17.0   | 15.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                           |
| 01 Nov | 18.0   | 1.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Nov | 150.0  | 11.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 05 Nov | 59.0   | 22.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES     |
| 01 Dec | 169.0  | 11.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Dec | 84.0   | 5.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 116       |          |  | 446       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1328            |           |          | 1010                                     | 7         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 49                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 87        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 32        | 63       |
| Z. Others  |                 | 22        |          |  |           |          |
| Subtotal   | 1328            | 138       | 0        | 1060                                     | 573       | 63       |
| Total  |                 | 1466      |          |  | 1696      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 34                                       |
| 12. Reactor I&C Systems                        | 17              | 53                                       |
| 13. Reactor Auxiliary Systems                  |                 | 5  |
| 14. Safety Systems                             |                 | 5  |
| 15. Reactor Cooling Systems                    |                 | 84                                       |
| 16. Steam generation systems                   |                 | 4  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 21. Fuel Handling and Storage Facilities       |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 36                                       |
| 32. Feedwater and Main Steam System            |                 | 42                                       |
| 33. Circulating Water System                   |                 | 1  |
| 41. Main Generator Systems                     |                 | 93                                       |
| 42. Electrical Power Supply Systems            | 99              | 13                                       |
| Total  | 116             | 372                                      |

**FR-33 BLAYAIS-2**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 910.0 MW(e)  
 Design Net RUP: 910.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6734.6 GW(e).h  
 Energy Availability Factor: 81.5%  
 Load Factor: 84.3%  
 Operating Factor: 83.6%  
 Energy Unavailability Factor: 18.5%  
 Total Off-line Time: 1438 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 679.5 | 665.8 | 711.4 | 661.8 | 690.3 | 591.8 | 31.9 | 271.4 | 530.9 | 526.0 | 663.4 | 710.3 | 6734.6 |
| EAF (%)  | 95.4  | 99.7  | 99.8  | 96.6  | 99.6  | 90.7  | 5.4  | 40.8  | 79.7  | 75.4  | 97.3  | 99.8  | 81.5   |
| UCF (%)  | 95.4  | 99.7  | 99.8  | 96.9  | 99.9  | 99.7  | 6.4  | 40.8  | 79.7  | 75.4  | 100.0 | 99.8  | 82.6   |
| LF (%)   | 100.4 | 105.1 | 105.1 | 101.0 | 102.0 | 90.3  | 4.7  | 40.1  | 81.0  | 77.7  | 101.3 | 104.9 | 84.3   |
| OF (%)   | 96.5  | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 6.5  | 46.4  | 80.0  | 76.9  | 100.0 | 100.0 | 83.6   |
| EUF (%)  | 4.6   | 0.3   | 0.2   | 3.4   | 0.4   | 9.3   | 94.6 | 59.2  | 20.3  | 24.6  | 2.7   | 0.2   | 18.5   |
| PUF (%)  | 0.1   | 0.3   | 0.1   | 0.0   | 0.0   | 0.0   | 93.6 | 43.0  | 0.2   | 0.0   | 0.0   | 0.2   | 11.6   |
| UCLF (%) | 4.6   | 0.1   | 0.1   | 3.1   | 0.1   | 0.3   | 0.0  | 16.2  | 20.1  | 24.6  | 0.0   | 0.0   | 5.8    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.2   | 0.4   | 9.1   | 1.0  | 0.0   | 0.0   | 0.0   | 2.7   | 0.0   | 1.1    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Jan 1977      Lifetime Generation: 133162.6 GW(e).h  
 Date of First Criticality: 28 Jun 1982      Cumulative Energy Availability Factor: 80.7%  
 Date of Grid Connection: 17 Jul 1982      Cumulative Load Factor: 75.5%  
 Date of Commercial Operation: 01 Feb 1983      Cumulative Unit Capability Factor: 78.1%  
    Cumulative Energy Unavailability Factor: 19.3%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 5094.0            | 910.0             | 0.0  | 0.0    | 64.6                                 | 100.0  | 63.9               | 0.0    | 5817                  | 66.4   |
| 1984 | 6645.0            | 910.0             | 86.5   | 86.5   | 85.5                                 | 85.5   | 83.1               | 83.1   | 7716                  | 87.8   |
| 1985 | 6819.7            | 910.0             | 90.0   | 88.3   | 89.9                                 | 87.7   | 85.5               | 84.3   | 7937                  | 90.6   |
| 1986 | 6048.4            | 910.0             | 83.2   | 86.6   | 82.9                                 | 86.1   | 75.9               | 81.5   | 7142                  | 81.5   |
| 1987 | 5987.1            | 910.0             | 84.8   | 86.1   | 84.2                                 | 85.6   | 75.1               | 79.9   | 7218                  | 82.4   |
| 1988 | 4162.0            | 910.0             | 91.2   | 87.2   | 90.8                                 | 86.7   | 52.1               | 74.3   | 5718                  | 65.1   |
| 1989 | 5561.0            | 910.0             | 77.0   | 85.5   | 73.4                                 | 84.5   | 69.8               | 73.6   | 6720                  | 76.7   |
| 1990 | 5656.4            | 910.0             | 87.4   | 85.7   | 85.7                                 | 84.6   | 71.0               | 73.2   | 7381                  | 84.3   |
| 1991 | 5326.5            | 910.0             | 78.3   | 84.8   | 75.1                                 | 83.4   | 66.8               | 72.4   | 6789                  | 77.5   |
| 1992 | 5953.3            | 910.0             | 86.9   | 85.0   | 83.7                                 | 83.5   | 74.5               | 72.6   | 7505                  | 85.4   |
| 1993 | 5253.2            | 910.0             | 71.0   | 83.6   | 67.0                                 | 81.8   | 65.9               | 72.0   | 6203                  | 70.8   |
| 1994 | 6692.6            | 910.0             | 88.7   | 84.1   | 88.1                                 | 82.4   | 84.0               | 73.1   | 7658                  | 87.4   |
| 1995 | 6725.5            | 910.0             | 87.9   | 84.4   | 85.6                                 | 82.7   | 84.4               | 74.0   | 7775                  | 88.8   |
| 1996 | 6709.8            | 910.0             | 87.4   | 84.7   | 85.0                                 | 82.9   | 83.9               | 74.8   | 7587                  | 86.4   |
| 1997 | 6769.9            | 910.0             | 88.7   | 84.9   | 84.8                                 | 83.0   | 84.9               | 75.5   | 7681                  | 87.7   |
| 1998 | 6974.3            | 910.0             | 90.0   | 85.3   | 87.2                                 | 83.3   | 87.5               | 76.3   | 7883                  | 90.0   |
| 1999 | 5836.2            | 910.0             | 75.1   | 84.6   | 73.1                                 | 82.6   | 73.2               | 76.1   | 6544                  | 74.7   |
| 2000 | 4941.1            | 910.0             | 75.2   | 84.1   | 63.0                                 | 81.5   | 61.8               | 75.3   | 5592                  | 63.7   |
| 2001 | 6548.0            | 910.0             | 83.6   | 84.0   | 81.9                                 | 81.5   | 82.1               | 75.6   | 7358                  | 84.0   |
| 2002 | 5972.0            | 910.0             | 84.3   | 84.1   | 82.7                                 | 81.6   | 74.9               | 75.6   | 7357                  | 84.0   |
| 2003 | 5181.2            | 910.0             | 66.0   | 83.2   | 63.7                                 | 80.7   | 65.0               | 75.1   | 5784                  | 66.0   |
| 2004 | 6734.6            | 910.0             | 82.6   | 83.1   | 81.5                                 | 80.7   | 84.3               | 75.5   | 7346                  | 83.6   |



## FR-33 BLAYAIS-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 03 Jan | 24.0  | 6.0     | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT |
| 03 Jan | 26.0  | 24.0    | UF2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT |
| 16 Jan | 4.0   | 1.0     | UP2  | A    | VARIOUS, PRIMARY CIRCUIT (SOME NOT EXPLAINED)              |
| 01 Feb | 4.0   | 2.0     | PP   | E    | TEST OF HOUSE LOAD OPERATION                               |
| 05 Apr | 51.0  | 20.0    | UP2  | A32  | CHEMICAL CHARACTERISTICS OF THE SECONDARY SYSTEM           |
| 07 Apr | 27.0  | 1.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 25 May | 155.0 | 2.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 01 Jun | 687.0 | 59.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 01 Jun | 33.0  | 2.0     | UP2  | A    | RELAYS/SYSTEMS COMMON TO SEVERAL FUNCTIONS                 |
| 01 Jul | 47.0  | 7.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 02 Jul | 696.0 | 634.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 01 Aug | 168.0 | 153.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 08 Aug | 24.0  | 22.0    | PF   | C    | REFUELLING AND INSPECTION                                  |
| 09 Aug | 120.0 | 109.0   | UF2  | A    | NON-RETURN AND STOP VALVES                                 |
| 14 Aug | 87.0  | 80.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                            |
| 14 Aug | 121.0 | 37.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 10 Sep | 5.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 24 Sep | 144.0 | 131.0   | UF2  | A11  | VESSEL AND VESSEL HEAD                                     |
| 01 Oct | 173.0 | 158.0   | UF2  | A11  | VESSEL AND VESSEL HEAD                                     |
| 01 Oct | 9.0   | 4.0     | UP2  | A11  | VESSEL AND VESSEL HEAD                                     |
| 08 Oct | 75.0  | 5.0     | UP2  | A    | VARIOUS, PRIMARY CIRCUIT (SOME NOT EXPLAINED)              |
| 05 Nov | 48.0  | 17.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES  |
| 06 Nov | 7.0   | 3.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 10 Dec | 5.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 463       |          |  | 160       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 888             |           |          | 1128                                     |           | 3        |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 29                                       |           |          |
| E. Testing of plant systems or components  | 87              |           |          | 84                                       | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 16        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 12        | 61       |
| Subtotal   | 975             | 463       | 0        | 1241                                     | 193       | 66       |
| Total  |                 | 1438      |          |  | 1500      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         | 317             | 15                                       |
| 12. Reactor I&C Systems             |                 | 7  |
| 13. Reactor Auxiliary Systems       |                 | 9  |
| 14. Safety Systems                  |                 | 16                                       |
| 15. Reactor Cooling Systems         |                 | 33                                       |
| 16. Steam generation systems        |                 | 4  |
| 31. Turbine and auxiliaries         | 26              | 19                                       |
| 32. Feedwater and Main Steam System |                 | 14                                       |
| 33. Circulating Water System        |                 | 6  |
| 41. Main Generator Systems          |                 | 6  |
| 42. Electrical Power Supply Systems |                 | 6  |
| Total                               | 343             | 135                                      |

# FR-34 BLAYAIS-3

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 910.0 MW(e)  
**Design Net RUP:** 910.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5822.8 GW(e).h  
**Energy Availability Factor:** 72.5%  
**Load Factor:** 72.8%  
**Operating Factor:** 76.3%  
**Energy Unavailability Factor:** 27.5%  
**Total Off-line Time:** 2085 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 657.1 | 641.9 | 685.2 | 632.3 | 680.3 | 620.1 | 649.5 | 560.0 | 151.0 | 0.0   | 0.0   | 545.6 | 5822.8 |
| <b>EAF (%)</b>  | 96.2  | 100.0 | 99.9  | 95.5  | 99.9  | 94.8  | 95.9  | 82.7  | 23.6  | 0.0   | 0.0   | 80.5  | 72.5   |
| <b>UCF (%)</b>  | 96.2  | 100.0 | 99.9  | 95.5  | 100.0 | 96.1  | 100.0 | 100.0 | 33.5  | 0.0   | 0.0   | 80.5  | 75.2   |
| <b>LF (%)</b>   | 97.1  | 101.3 | 101.3 | 96.5  | 100.5 | 94.6  | 95.9  | 82.7  | 23.0  | 0.0   | 0.0   | 80.6  | 72.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 96.7  | 100.0 | 96.7  | 100.0 | 100.0 | 33.6  | 0.0   | 0.0   | 87.4  | 76.3   |
| <b>EUF (%)</b>  | 3.8   | 0.0   | 0.1   | 4.5   | 0.1   | 5.2   | 4.1   | 17.3  | 76.4  | 100.0 | 100.0 | 19.5  | 27.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.1   | 0.0   | 0.2   | 0.0   | 0.0   | 66.5  | 100.0 | 100.0 | 17.5  | 23.6   |
| <b>UCLF (%)</b> | 3.8   | 0.0   | 0.0   | 4.4   | 0.0   | 3.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 1.3   | 4.1   | 17.3  | 10.0  | 0.0   | 0.0   | 0.0   | 2.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|                                      |             |   |                  |
|--------------------------------------|-------------|---|------------------|
| <b>Date of Construction Start:</b>   | 01 Apr 1978 | <b>Lifetime Generation:</b>                     | 128033.2 GW(e).h |
| <b>Date of First Criticality:</b>    | 29 Jul 1983 | <b>Cumulative Energy Availability Factor:</b>   | 80.0%            |
| <b>Date of Grid Connection:</b>      | 17 Aug 1983 | <b>Cumulative Load Factor:</b>                  | 75.3%            |
| <b>Date of Commercial Operation:</b> | 14 Nov 1983 | <b>Cumulative Unit Capability Factor:</b>       | 78.1%            |
|                                      |             | <b>Cumulative Energy Unavailability Factor:</b> | 20.0%            |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1912.0         | 910.0          | 0.0  | 0.0    | 85.8                              | 100.0  | 25.1               | 0.0    | 2739               | 32.7   |
| 1984 | 5944.0         | 910.0          | 80.3   | 80.3   | 80.3                              | 80.3   | 74.4               | 74.4   | 7055               | 80.3   |
| 1985 | 6568.9         | 910.0          | 87.0   | 83.7   | 86.6                              | 83.5   | 82.4               | 78.4   | 7729               | 88.2   |
| 1986 | 6504.9         | 910.0          | 88.3   | 85.2   | 88.1                              | 85.0   | 81.6               | 79.5   | 7759               | 88.6   |
| 1987 | 4304.7         | 910.0          | 93.9   | 87.4   | 93.5                              | 87.1   | 54.0               | 73.1   | 5473               | 62.5   |
| 1988 | 5287.0         | 910.0          | 82.8   | 86.4   | 81.6                              | 86.0   | 66.1               | 71.7   | 6708               | 76.4   |
| 1989 | 6086.4         | 910.0          | 82.7   | 85.8   | 78.5                              | 84.8   | 76.4               | 72.5   | 7292               | 83.2   |
| 1990 | 4871.2         | 910.0          | 64.3   | 82.7   | 62.8                              | 81.6   | 61.1               | 70.9   | 5673               | 64.8   |
| 1991 | 6372.3         | 910.0          | 84.6   | 83.0   | 84.0                              | 81.9   | 79.9               | 72.0   | 7448               | 85.0   |
| 1992 | 5967.9         | 910.0          | 83.0   | 83.0   | 81.8                              | 81.9   | 74.7               | 72.3   | 7220               | 82.2   |
| 1993 | 6285.3         | 910.0          | 87.7   | 83.5   | 79.8                              | 81.7   | 78.8               | 72.9   | 7728               | 88.2   |
| 1994 | 4212.8         | 910.0          | 57.8   | 81.1   | 57.7                              | 79.5   | 52.8               | 71.1   | 4979               | 56.8   |
| 1995 | 6739.6         | 910.0          | 85.9   | 81.5   | 85.4                              | 80.0   | 84.5               | 72.2   | 7525               | 85.9   |
| 1996 | 6924.1         | 910.0          | 87.2   | 82.0   | 86.8                              | 80.5   | 86.6               | 73.3   | 7744               | 88.2   |
| 1997 | 6614.1         | 910.0          | 86.4   | 82.3   | 86.4                              | 80.9   | 83.0               | 74.0   | 7659               | 87.4   |
| 1998 | 6970.2         | 910.0          | 90.1   | 82.8   | 87.8                              | 81.4   | 87.4               | 74.9   | 7954               | 90.8   |
| 1999 | 5123.0         | 910.0          | 66.8   | 81.8   | 64.2                              | 80.3   | 64.3               | 74.3   | 5861               | 66.9   |
| 2000 | 6183.6         | 910.0          | 80.3   | 81.7   | 78.2                              | 80.2   | 77.4               | 74.4   | 7143               | 81.3   |
| 2001 | 6707.1         | 910.0          | 85.4   | 81.9   | 84.2                              | 80.4   | 84.1               | 75.0   | 7540               | 86.1   |
| 2002 | 6882.0         | 910.0          | 87.5   | 82.2   | 86.4                              | 80.7   | 86.3               | 75.6   | 7682               | 87.7   |
| 2003 | 5844.9         | 910.0          | 86.5   | 82.4   | 73.6                              | 80.4   | 73.3               | 75.5   | 6725               | 76.8   |
| 2004 | 5822.8         | 910.0          | 75.2   | 82.1   | 72.5                              | 80.0   | 72.8               | 75.3   | 6699               | 76.3   |

## FR-34 BLAYAIS-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 23 Jan | 70.0  | 25.0    | UP2  | A33  | VARIOUS, PUMPHOUSE-CIRCULATING WATER                       |
| 11 Apr | 24.0  | 22.0    | UF2  | A15  | PRIMARY PUMP   |
| 11 Apr | 7.0   | 2.0     | UP2  | A15  | PRIMARY PUMP   |
| 24 Apr | 9.0   | 5.0     | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT |
| 01 Jun | 558.0 | 8.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 22 Jun | 63.0  | 2.0     | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                        |
| 22 Jun | 24.0  | 22.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                        |
| 01 Jul | 192.0 | 4.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 09 Jul | 552.0 | 24.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 01 Aug | 500.0 | 17.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 01 Sep | 241.0 | 65.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 11 Sep | 478.0 | 435.0   | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                        |
| 01 Oct | 744.0 | 677.0   | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                        |
| 01 Nov | 719.0 | 655.0   | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                        |
| 01 Dec | 94.0  | 85.0    | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                        |
| 04 Dec | 94.0  | 33.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 06 Dec | 14.0  | 6.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 06 Dec | 11.0  | 6.0     | UP2  | A42  | EMERGENCY GENERATOR  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 48        |          |  | 265       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 2035            |           |          | 939                                      | 7         |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 32                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 35        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 63        | 17       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 27       |
| Subtotal   | 2035            | 48        | 0        | 973                                      | 371       | 44       |
| Total  |                 | 2083      |          |  | 1388      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 16                                       |
| 12. Reactor I&C Systems             | 24              | 14                                       |
| 13. Reactor Auxiliary Systems       |                 | 44                                       |
| 14. Safety Systems                  |                 | 7  |
| 15. Reactor Cooling Systems         | 24              | 13                                       |
| 16. Steam generation systems        |                 | 57                                       |
| 31. Turbine and auxiliaries         |                 | 7  |
| 32. Feedwater and Main Steam System |                 | 4  |
| 33. Circulating Water System        |                 | 1  |
| 41. Main Generator Systems          |                 | 13                                       |
| 42. Electrical Power Supply Systems |                 | 17                                       |
| Total                               | 48              | 193                                      |

## FR-35 BLAYAIS-4

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

### 1. Station Details

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 910.0 MW(e)  
 Design Net RUP: 910.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

### 2. Production Summary 2004

Energy Production: 6560.3 GW(e).h  
 Energy Availability Factor: 84.6%  
 Load Factor: 82.1%  
 Operating Factor: 88.2%  
 Energy Unavailability Factor: 15.4%  
 Total Off-line Time: 1035 hours

### 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 651.7 | 619.5 | 600.8 | 633.0 | 583.6 | 0.0   | 503.5 | 525.9 | 548.2 | 638.8 | 634.8 | 620.6 | 6560.3 |
| EAFF (%) | 99.6  | 99.8  | 91.0  | 99.1  | 90.4  | 0.0   | 75.5  | 83.0  | 85.2  | 96.6  | 99.2  | 94.9  | 84.6   |
| UCF (%)  | 100.0 | 99.8  | 100.0 | 100.0 | 90.5  | 0.0   | 76.9  | 99.9  | 97.8  | 99.8  | 99.2  | 94.9  | 88.3   |
| LF (%)   | 96.3  | 97.8  | 88.9  | 96.6  | 86.2  | 0.0   | 74.4  | 77.7  | 83.7  | 94.2  | 96.9  | 91.7  | 82.1   |
| OF (%)   | 100.0 | 100.0 | 91.5  | 100.0 | 90.6  | 0.0   | 82.1  | 100.0 | 98.1  | 100.0 | 100.0 | 95.3  | 88.2   |
| EUF (%)  | 0.4   | 0.2   | 9.0   | 0.9   | 9.6   | 100.0 | 24.5  | 17.0  | 14.8  | 3.4   | 0.8   | 5.1   | 15.4   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 9.5   | 90.3  | 5.2   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 8.7    |
| UCLF (%) | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 9.7   | 17.8  | 0.1   | 2.2   | 0.1   | 0.8   | 5.1   | 3.0    |
| XUF (%)  | 0.4   | 0.0   | 9.0   | 0.9   | 0.1   | 0.0   | 1.5   | 17.0  | 12.6  | 3.2   | 0.0   | 0.0   | 3.7    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

Date of Construction Start: 01 Apr 1978  
 Date of First Criticality: 01 May 1983  
 Date of Grid Connection: 16 May 1983  
 Date of Commercial Operation: 01 Oct 1983

Lifetime Generation: 127843.2 GW(e).h  
 Cumulative Energy Availability Factor: 79.7%  
 Cumulative Load Factor: 74.4%  
 Cumulative Unit Capability Factor: 78.1%  
 Cumulative Energy Unavailability Factor: 20.3%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 3356.0            | 910.0             | 0.0  | 0.0    | 78.3                                 | 100.0  | 44.0               | 0.0    | 4418                  | 52.7   |
| 1984 | 6012.0            | 910.0             | 76.3   | 76.3   | 76.0                                 | 76.0   | 75.2               | 75.2   | 6780                  | 77.2   |
| 1985 | 5972.6            | 910.0             | 78.8   | 77.5   | 78.7                                 | 77.4   | 74.9               | 75.1   | 7024                  | 80.2   |
| 1986 | 6278.1            | 910.0             | 82.5   | 79.2   | 81.9                                 | 78.9   | 78.8               | 76.3   | 7412                  | 84.6   |
| 1987 | 6104.6            | 910.0             | 85.6   | 80.8   | 83.9                                 | 80.1   | 76.6               | 76.4   | 7437                  | 84.9   |
| 1988 | 4337.0            | 910.0             | 71.5   | 78.9   | 70.2                                 | 78.1   | 54.3               | 71.9   | 5662                  | 64.5   |
| 1989 | 5816.3            | 910.0             | 89.4   | 80.7   | 87.5                                 | 79.7   | 73.0               | 72.1   | 7250                  | 82.8   |
| 1990 | 5912.3            | 910.0             | 83.4   | 81.1   | 78.2                                 | 79.5   | 74.2               | 72.4   | 7347                  | 83.9   |
| 1991 | 5467.7            | 910.0             | 73.5   | 80.1   | 73.1                                 | 78.7   | 68.6               | 71.9   | 6496                  | 74.2   |
| 1992 | 6120.6            | 910.0             | 84.1   | 80.6   | 83.5                                 | 79.2   | 76.6               | 72.4   | 7430                  | 84.6   |
| 1993 | 5096.4            | 910.0             | 85.3   | 81.0   | 72.9                                 | 78.6   | 63.9               | 71.6   | 6854                  | 78.2   |
| 1994 | 5897.1            | 910.0             | 82.6   | 81.2   | 81.8                                 | 78.9   | 74.0               | 71.8   | 7308                  | 83.4   |
| 1995 | 5342.4            | 910.0             | 75.2   | 80.7   | 71.5                                 | 78.3   | 67.0               | 71.4   | 6198                  | 70.8   |
| 1996 | 6719.6            | 910.0             | 88.2   | 81.3   | 86.9                                 | 78.9   | 84.1               | 72.4   | 7761                  | 88.4   |
| 1997 | 6497.2            | 910.0             | 89.1   | 81.8   | 86.6                                 | 79.5   | 81.5               | 73.0   | 7705                  | 88.0   |
| 1998 | 6692.6            | 910.0             | 90.3   | 82.4   | 87.9                                 | 80.0   | 84.0               | 73.8   | 7930                  | 90.5   |
| 1999 | 6161.2            | 910.0             | 83.3   | 82.5   | 80.2                                 | 80.0   | 77.3               | 74.0   | 7369                  | 84.1   |
| 2000 | 5467.5            | 910.0             | 75.0   | 82.0   | 72.5                                 | 79.6   | 68.4               | 73.7   | 6559                  | 74.7   |
| 2001 | 6370.0            | 910.0             | 82.4   | 82.0   | 82.1                                 | 79.7   | 79.9               | 74.0   | 7297                  | 83.3   |
| 2002 | 6462.2            | 910.0             | 86.2   | 82.3   | 85.1                                 | 80.0   | 81.1               | 74.4   | 7623                  | 87.0   |
| 2003 | 5311.1            | 910.0             | 72.9   | 81.8   | 68.4                                 | 79.4   | 66.6               | 74.0   | 6292                  | 71.8   |
| 2004 | 6560.3            | 910.0             | 88.3   | 82.1   | 84.6                                 | 79.7   | 82.1               | 74.4   | 7749                  | 88.2   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 320.0 | 24.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Feb | 195.0 | 15.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Mar | 196.0 | 14.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 19 Mar | 73.0  | 61.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Apr | 214.0 | 17.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 08 Apr | 19.0  | 6.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 May | 180.0 | 27.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 29 May | 690.0 | 627.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 28 Jun | 93.0  | 84.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                           |
| 06 Jul | 131.0 | 34.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 12 Jul | 417.0 | 9.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 29 Jul | 243.0 | 38.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 10 Aug | 112.0 | 3.0     | XP   | K    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Sep | 156.0 | 74.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES     |
| 07 Sep | 392.0 | 8.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 17 Sep | 95.0  | 9.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 25 Sep | 14.0  | 13.0    | UF2  | L    | HUMAN ERROR IN PADLOCKING                                     |
| 01 Oct | 325.0 | 16.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 29 Oct | 69.0  | 22.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES     |
| 01 Nov | 202.0 | 16.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 15 Nov | 13.0  | 4.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)      |
| 01 Dec | 237.0 | 20.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 21 Dec | 35.0  | 32.0    | UF2  | A41  | ALTERNATOR BEARINGS AND SHAFT LINE                            |
| 22 Dec | 13.0  | 1.0     | UP2  | A12  | REACTOR CONTROL   |
| 28 Dec | 31.0  | 2.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 35        |          |  | 314       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 690             |           |          | 967                                      | 40        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 9  | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 1  | 0         |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling  |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 15        | 26       |
| L. Human factor related  |                 | 14        |          |  |           |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 7        |
| Z. Others  |                 | 93        |          |  | 5         |          |
| Subtotal   | 690             | 142       | 0        | 977                                      | 376       | 35       |
| Total  |                 | 832       |          |  | 1388      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 2  |
| 12. Reactor I&C Systems             |                 | 57                                       |
| 13. Reactor Auxiliary Systems       |                 | 15                                       |
| 15. Reactor Cooling Systems         |                 | 6  |
| 16. Steam generation systems        |                 | 22                                       |
| 31. Turbine and auxiliaries         |                 | 56                                       |
| 32. Feedwater and Main Steam System |                 | 4  |
| 33. Circulating Water System        |                 | 10                                       |
| 41. Main Generator Systems          | 35              | 52                                       |
| 42. Electrical Power Supply Systems |                 | 16                                       |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 35              | 240                                      |

# FR-13 BUGEY-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 910.0 MW(e)  
**Design Net RUP:** 920.0 MW(e)  
**Design Discharge Burnup:** 33700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7593.4 GW(e).h  
**Energy Availability Factor:** 96.0%  
**Load Factor:** 95.0%  
**Operating Factor:** 97.6%  
**Energy Unavailability Factor:** 4.0%  
**Total Off-line Time:** 213 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 634.7 | 631.5 | 675.5 | 617.1 | 623.0 | 619.0 | 575.7 | 633.6 | 628.2 | 630.0 | 653.7 | 671.3 | 7593.4 |
| <b>EAF (%)</b>  | 94.3  | 100.0 | 100.0 | 94.8  | 93.0  | 96.5  | 87.7  | 95.3  | 97.5  | 93.8  | 99.7  | 99.3  | 96.0   |
| <b>UCF (%)</b>  | 96.3  | 100.0 | 100.0 | 94.8  | 94.8  | 100.0 | 88.2  | 100.0 | 98.0  | 93.9  | 99.9  | 100.0 | 97.1   |
| <b>LF (%)</b>   | 93.8  | 99.7  | 99.9  | 94.2  | 92.0  | 94.5  | 85.0  | 93.6  | 95.9  | 92.9  | 99.8  | 99.2  | 95.0   |
| <b>OF (%)</b>   | 96.5  | 100.0 | 100.0 | 95.8  | 95.2  | 100.0 | 89.0  | 100.0 | 98.8  | 96.0  | 100.0 | 100.0 | 97.6   |
| <b>EUF (%)</b>  | 5.7   | 0.0   | 0.0   | 5.2   | 7.0   | 3.5   | 12.3  | 4.7   | 2.5   | 6.2   | 0.3   | 0.7   | 4.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 4.7   | 0.0   | 0.0   | 3.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7    |
| <b>UCLF (%)</b> | 3.7   | 0.0   | 0.0   | 0.5   | 5.2   | 0.0   | 7.9   | 0.0   | 2.0   | 6.2   | 0.1   | 0.0   | 2.2    |
| <b>XUF (%)</b>  | 1.9   | 0.0   | 0.0   | 0.0   | 1.8   | 3.5   | 0.5   | 4.7   | 0.4   | 0.0   | 0.2   | 0.7   | 1.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1972      **Lifetime Generation:** 136940.2 GW(e).h  
**Date of First Criticality:** 20 Apr 1978      **Cumulative Energy Availability Factor:** 71.5%  
**Date of Grid Connection:** 10 May 1978      **Cumulative Load Factor:** 65.9%  
**Date of Commercial Operation:** 01 Mar 1979      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 28.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6725.0         | 920.0          | 85.3   | 62.0   | 85.3                              | 62.0   | 83.4               | 61.2   | 7689               | 87.8   |
| 1984 | 5748.0         | 920.0          | 88.0   | 67.2   | 87.9                              | 67.2   | 71.1               | 63.2   | 6580               | 74.9   |
| 1985 | 5948.8         | 920.0          | 79.7   | 69.3   | 76.0                              | 68.6   | 73.8               | 64.9   | 7118               | 81.3   |
| 1986 | 5945.6         | 920.0          | 86.4   | 71.7   | 84.5                              | 70.9   | 73.8               | 66.2   | 7515               | 85.8   |
| 1987 | 3581.1         | 920.0          | 53.4   | 69.4   | 51.6                              | 68.5   | 44.4               | 63.5   | 4729               | 54.0   |
| 1988 | 4495.0         | 920.0          | 67.0   | 69.1   | 63.1                              | 67.9   | 55.6               | 62.6   | 5718               | 65.1   |
| 1989 | 4700.8         | 920.0          | 64.7   | 68.7   | 61.1                              | 67.2   | 58.3               | 62.2   | 5721               | 65.3   |
| 1990 | 4878.7         | 920.0          | 69.7   | 68.8   | 69.3                              | 67.4   | 60.5               | 62.0   | 6213               | 70.9   |
| 1991 | 4927.2         | 920.0          | 66.7   | 68.6   | 64.4                              | 67.2   | 61.1               | 62.0   | 6001               | 68.5   |
| 1992 | 3918.3         | 910.0          | 53.9   | 67.5   | 50.2                              | 65.9   | 49.0               | 61.0   | 4781               | 54.4   |
| 1993 | 4509.9         | 910.0          | 99.2   | 69.7   | 94.2                              | 67.9   | 56.6               | 60.7   | 5718               | 65.3   |
| 1994 | 5782.2         | 910.0          | 77.7   | 70.3   | 76.5                              | 68.4   | 72.5               | 61.4   | 6811               | 77.8   |
| 1995 | 6045.7         | 910.0          | 79.7   | 70.8   | 78.1                              | 69.0   | 75.8               | 62.3   | 7051               | 80.5   |
| 1996 | 5533.9         | 910.0          | 78.7   | 71.3   | 75.4                              | 69.4   | 69.2               | 62.7   | 6863               | 78.1   |
| 1997 | 5477.7         | 910.0          | 84.4   | 72.0   | 81.0                              | 70.1   | 68.7               | 63.1   | 6815               | 77.8   |
| 1998 | 5379.4         | 910.0          | 77.6   | 72.3   | 72.9                              | 70.2   | 67.5               | 63.3   | 6605               | 75.4   |
| 1999 | 5960.3         | 910.0          | 78.9   | 72.6   | 77.5                              | 70.6   | 74.8               | 63.9   | 7050               | 80.5   |
| 2000 | 5183.5         | 910.0          | 68.5   | 72.5   | 66.3                              | 70.4   | 64.8               | 63.9   | 6025               | 68.6   |
| 2001 | 5685.9         | 910.0          | 72.3   | 72.4   | 72.2                              | 70.4   | 71.3               | 64.2   | 6493               | 74.1   |
| 2002 | 5542.3         | 910.0          | 70.2   | 72.3   | 69.9                              | 70.4   | 69.5               | 64.5   | 6212               | 70.9   |
| 2003 | 5521.7         | 910.0          | 74.8   | 72.4   | 71.0                              | 70.4   | 69.3               | 64.7   | 6579               | 75.1   |
| 2004 | 7593.4         | 910.0          | 97.1   | 73.4   | 96.0                              | 71.5   | 95.0               | 65.9   | 8571               | 97.6   |

## FR-13 BUGEY-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 627.0 | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 19 Jan | 24.0  | 13.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 30 Jan | 26.0  | 24.0    | UF2  | L    | HUMAN ERRORS DURING TESTING                                |
| 01 Feb | 515.0 | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 02 Mar | 403.0 | 1.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Apr | 539.0 | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 11 Apr | 30.0  | 27.0    | PF   | D    | WORK PLANNED TO BE DONE DURING THE YEAR                    |
| 12 Apr | 8.0   | 3.0     | UP2  | A31  | STEAM VALVES   |
| 01 May | 650.0 | 6.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 14 May | 36.0  | 33.0    | UF2  | A15  | PRIMARY PUMP   |
| 27 May | 22.0  | 12.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 01 Jun | 603.0 | 9.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 14 Jun | 49.0  | 23.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 01 Jul | 609.0 | 16.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 16 Jul | 27.0  | 25.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 24 Jul | 19.0  | 17.0    | UF2  | A32  | CHEMICAL CHARACTERISTICS OF THE SECONDARY SYSTEM           |
| 27 Jul | 36.0  | 33.0    | UF2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)    |
| 01 Aug | 593.0 | 10.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 03 Aug | 104.0 | 31.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES  |
| 01 Sep | 632.0 | 10.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 22 Sep | 9.0   | 8.0     | UF2  | A31  | STEAM VALVES   |
| 24 Sep | 13.0  | 3.0     | UP2  | A12  | REACTOR CONTROL  |
| 01 Oct | 510.0 | 5.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Oct | 192.0 | 13.0    | UP2  | A31  | STEAM VALVES   |
| 16 Oct | 30.0  | 27.0    | UF2  | A15  | PRIMARY PUMP   |
| 01 Nov | 358.0 | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 14 Dec | 344.0 | 4.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 94        |          |  | 599       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1219                                     | 49        |          |
| D. Inspection, maintenance or repair without refuelling                              | 30              |           |          | 138                                      |           |          |
| E. Testing of plant systems or components  | 27              |           |          | 10                                       | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 48                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 3  | 60        | 16       |
| L. Human factor related  |                 | 26        |          |  |           |          |
| Z. Others  |                 | 36        |          |  | 9         |          |
| Subtotal   | 57              | 156       | 0        | 1418                                     | 718       | 16       |
| Total  |                 | 213       |          |  | 2152      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 198                                      |
| 12. Reactor I&C Systems                  |                 | 24                                       |
| 13. Reactor Auxiliary Systems            |                 | 7  |
| 14. Safety Systems                       |                 | 77                                       |
| 15. Reactor Cooling Systems              | 66              | 36                                       |
| 16. Steam generation systems             |                 | 19                                       |
| 21. Fuel Handling and Storage Facilities |                 | 71                                       |
| 31. Turbine and auxiliaries              | 9               | 27                                       |
| 32. Feedwater and Main Steam System      | 19              | 24                                       |
| 33. Circulating Water System             |                 | 1  |
| 41. Main Generator Systems               |                 | 78                                       |
| 42. Electrical Power Supply Systems      |                 | 4  |
| XX. Miscellaneous Systems                |                 | 0  |
| Total                                    | 94              | 566                                      |

**FR-14 BUGEY-3**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 910.0 MW(e)  
 Design Net RUP: 920.0 MW(e)  
 Design Discharge Burnup: 33700 MW.d/t

**2. Production Summary 2004**

Energy Production: 6447.3 GW(e).h  
 Energy Availability Factor: 87.9%  
 Load Factor: 80.7%  
 Operating Factor: 84.9%  
 Energy Unavailability Factor: 12.1%  
 Total Off-line Time: 1323 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 413.4 | 648.2 | 620.2 | 628.7 | 610.9 | 597.5 | 579.8 | 506.5 | 574.3 | 620.4 | 647.5 | 6447.3 |
| EAF (%)  | 0.0   | 66.0  | 100.0 | 99.2  | 98.0  | 98.7  | 99.7  | 99.2  | 93.5  | 100.0 | 100.0 | 100.0 | 87.9   |
| UCF (%)  | 0.0   | 66.0  | 100.0 | 99.8  | 100.0 | 99.7  | 99.7  | 100.0 | 93.5  | 100.0 | 100.0 | 100.0 | 88.2   |
| LF (%)   | 0.0   | 65.3  | 95.9  | 94.7  | 92.9  | 93.2  | 88.3  | 85.6  | 77.3  | 84.7  | 94.7  | 95.6  | 80.7   |
| OF (%)   | 0.0   | 74.6  | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 90.3  | 81.5  | 87.4  | 96.1  | 96.8  | 84.9   |
| EUF (%)  | 100.0 | 34.0  | 0.0   | 0.8   | 2.0   | 1.3   | 0.3   | 0.8   | 6.5   | 0.0   | 0.0   | 0.0   | 12.1   |
| PUF (%)  | 100.0 | 8.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.2    |
| UCLF (%) | 0.0   | 25.5  | 0.0   | 0.2   | 0.0   | 0.3   | 0.3   | 0.0   | 6.6   | 0.0   | 0.0   | 0.0   | 2.6    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.6   | 2.0   | 1.0   | 0.0   | 0.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Sep 1973      Lifetime Generation: 136957.9 GW(e).h  
 Date of First Criticality: 31 Aug 1978      Cumulative Energy Availability Factor: 73.4%  
 Date of Grid Connection: 21 Sep 1978      Cumulative Load Factor: 66.7%  
 Date of Commercial Operation: 01 Mar 1979      Cumulative Unit Capability Factor: 77.6%  
    Cumulative Energy Unavailability Factor: 26.6%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 5525.0            | 920.0             | 74.2   | 73.6   | 74.2                                 | 73.6   | 68.6               | 69.2   | 6556                  | 74.8   |
| 1984 | 5793.0            | 920.0             | 78.0   | 74.4   | 78.0                                 | 74.4   | 71.7               | 69.7   | 6905                  | 78.6   |
| 1985 | 4571.1            | 920.0             | 58.7   | 71.8   | 57.2                                 | 71.6   | 56.7               | 67.6   | 5235                  | 59.8   |
| 1986 | 6558.1            | 920.0             | 87.7   | 74.1   | 87.1                                 | 73.8   | 81.4               | 69.5   | 7634                  | 87.1   |
| 1987 | 5482.5            | 920.0             | 78.4   | 74.6   | 76.4                                 | 74.1   | 68.0               | 69.3   | 6637                  | 75.8   |
| 1988 | 3812.0            | 920.0             | 64.7   | 73.5   | 62.4                                 | 72.8   | 47.2               | 66.9   | 4935                  | 56.2   |
| 1989 | 4914.3            | 920.0             | 88.7   | 75.0   | 87.4                                 | 74.3   | 61.0               | 66.3   | 6467                  | 73.8   |
| 1990 | 4538.6            | 920.0             | 68.0   | 74.4   | 62.9                                 | 73.2   | 56.3               | 65.4   | 5474                  | 62.5   |
| 1991 | 3442.8            | 920.0             | 55.7   | 72.8   | 51.7                                 | 71.4   | 42.7               | 63.5   | 4168                  | 47.6   |
| 1992 | 2490.0            | 910.0             | 32.5   | 69.8   | 32.2                                 | 68.4   | 31.2               | 61.0   | 2879                  | 32.8   |
| 1993 | 5954.4            | 910.0             | 80.2   | 70.5   | 76.1                                 | 69.0   | 74.7               | 62.0   | 7117                  | 81.2   |
| 1994 | 4717.7            | 910.0             | 70.0   | 70.5   | 65.2                                 | 68.7   | 59.2               | 61.8   | 5872                  | 67.0   |
| 1995 | 5535.7            | 910.0             | 95.9   | 72.0   | 95.2                                 | 70.4   | 69.4               | 62.3   | 6564                  | 74.9   |
| 1996 | 5652.9            | 910.0             | 78.7   | 72.4   | 76.4                                 | 70.7   | 70.7               | 62.8   | 7012                  | 79.8   |
| 1997 | 5596.6            | 910.0             | 75.0   | 72.6   | 74.9                                 | 71.0   | 70.2               | 63.2   | 6561                  | 74.9   |
| 1998 | 6680.4            | 910.0             | 89.1   | 73.4   | 89.0                                 | 71.9   | 83.8               | 64.3   | 7875                  | 89.9   |
| 1999 | 5786.6            | 910.0             | 77.6   | 73.6   | 77.3                                 | 72.2   | 72.6               | 64.7   | 7001                  | 79.9   |
| 2000 | 5745.1            | 910.0             | 75.7   | 73.7   | 74.7                                 | 72.3   | 71.9               | 65.0   | 6765                  | 77.0   |
| 2001 | 6230.6            | 910.0             | 81.8   | 74.1   | 81.2                                 | 72.7   | 78.2               | 65.6   | 7129                  | 81.4   |
| 2002 | 4634.7            | 880.0             | 65.3   | 73.7   | 62.7                                 | 72.3   | 60.1               | 65.4   | 5654                  | 64.5   |
| 2003 | 6646.1            | 910.0             | 97.2   | 74.7   | 85.2                                 | 72.8   | 83.4               | 66.1   | 7924                  | 90.5   |
| 2004 | 6447.3            | 910.0             | 88.2   | 75.3   | 87.9                                 | 73.4   | 80.7               | 66.7   | 7461                  | 84.9   |



# FR-14 BUGEY-3

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 802.0 | 730.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                              |
| 31 Jan | 91.0  | 83.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                            |
| 08 Feb | 141.0 | 54.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 01 Mar | 620.0 | 29.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Apr | 507.0 | 29.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 04 Apr | 132.0 | 1.0     | UP2  | A31  | STEAM VALVES   |
| 01 May | 640.0 | 31.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                        |
| 20 May | 22.0  | 16.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 Jun | 480.0 | 36.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 07 Jun | 37.0  | 2.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                 |
| 14 Jun | 27.0  | 6.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Jul | 616.0 | 27.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 13 Jul | 22.0  | 2.0     | UP2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                    |
| 31 Jul | 103.0 | 88.0    | XP   | K    | LOAD LIMITATION OR SHUTDOWN TO OPTIMIZE SHUTDOWN               |
| 02 Aug | 652.0 | 19.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 02 Aug | 10.0  | 6.0     | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES      |
| 01 Sep | 569.0 | 100.0   | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 20 Sep | 45.0  | 41.0    | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                                 |
| 01 Oct | 634.0 | 11.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 23 Oct | 142.0 | 118.0   | XP   | K    | LOAD LIMITATION OR SHUTDOWN TO OPTIMIZE SHUTDOWN               |
| 02 Nov | 667.0 | 6.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Dec | 698.0 | 4.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 18 Dec | 34.0  | 25.0    | XP   | K    | LOAD LIMITATION OR SHUTDOWN TO OPTIMIZE SHUTDOWN               |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 45        |          |  | 561       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 802             |           |          | 1006                                     | 47        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 85                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 53                                       | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 3        |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 73        | 66       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 22       |
| Z. Others  |                 | 91        |          |  |           |          |
| Subtotal   | 802             | 136       | 0        | 1144                                     | 686       | 91       |
| Total  |                 | 938       |          |  | 1921      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 239                                      |
| 12. Reactor I&C Systems                        |                 | 8  |
| 13. Reactor Auxiliary Systems                  |                 | 15                                       |
| 14. Safety Systems                             |                 | 24                                       |
| 15. Reactor Cooling Systems                    |                 | 48                                       |
| 16. Steam generation systems                   |                 | 24                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    | 45              | 41                                       |
| 32. Feedwater and Main Steam System            |                 | 18                                       |
| 33. Circulating Water System                   |                 | 1  |
| 41. Main Generator Systems                     |                 | 116                                      |
| 42. Electrical Power Supply Systems            |                 | 15                                       |
| Total  | 45              | 549                                      |

# FR-15 BUGEY-4

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 880.0 MW(e)  
**Design Net RUP:** 900.0 MW(e)  
**Design Discharge Burnup:** 33700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6098.3 GW(e).h  
**Energy Availability Factor:** 81.3%  
**Load Factor:** 78.9%  
**Operating Factor:** 83.9%  
**Energy Unavailability Factor:** 18.7%  
**Total Off-line Time:** 1417 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 636.8 | 600.7 | 643.9 | 559.6 | 112.3 | 0.0   | 531.6 | 603.1 | 596.0 | 578.6 | 604.0 | 631.7 | 6098.3 |
| <b>EAF (%)</b>  | 99.8  | 99.9  | 98.4  | 88.3  | 17.6  | 0.0   | 87.8  | 98.5  | 98.7  | 91.6  | 97.0  | 98.0  | 81.3   |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 99.8  | 100.0 | 23.0  | 0.0   | 87.8  | 98.5  | 98.7  | 91.6  | 98.3  | 98.0  | 83.0   |
| <b>LF (%)</b>   | 97.3  | 98.1  | 98.5  | 88.3  | 17.2  | 0.0   | 81.2  | 92.1  | 94.1  | 88.3  | 95.3  | 96.5  | 78.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 23.0  | 0.0   | 94.9  | 99.3  | 100.0 | 92.3  | 98.5  | 98.3  | 83.9   |
| <b>EUF (%)</b>  | 0.2   | 0.1   | 1.6   | 11.7  | 82.4  | 100.0 | 12.2  | 1.5   | 1.3   | 8.4   | 3.0   | 2.0   | 18.7   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.1   | 0.0   | 77.0  | 95.6  | 7.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 4.4   | 5.1   | 1.5   | 1.3   | 8.3   | 1.7   | 2.0   | 2.1    |
| <b>XUF (%)</b>  | 0.2   | 0.0   | 1.4   | 11.7  | 5.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.4   | 0.0   | 1.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1974  
**Date of First Criticality:** 17 Feb 1979  
**Date of Grid Connection:** 08 Mar 1979  
**Date of Commercial Operation:** 01 Jul 1979

**Lifetime Generation:** 132450.1 GW(e).h  
**Cumulative Energy Availability Factor:** 72.5%  
**Cumulative Load Factor:** 66.3%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 27.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6329.0         | 900.0          | 84.6   | 74.0   | 84.6                              | 74.0   | 80.3               | 71.4   | 7389               | 84.3   |
| 1984 | 5882.0         | 900.0          | 75.8   | 74.3   | 75.8                              | 74.3   | 74.4               | 72.0   | 6896               | 78.5   |
| 1985 | 6224.4         | 900.0          | 87.2   | 76.5   | 86.7                              | 76.4   | 78.9               | 73.2   | 7696               | 87.9   |
| 1986 | 5312.7         | 900.0          | 78.7   | 76.8   | 76.1                              | 76.4   | 67.4               | 72.3   | 6622               | 75.6   |
| 1987 | 4670.9         | 900.0          | 79.8   | 77.2   | 78.2                              | 76.6   | 59.2               | 70.7   | 6180               | 70.5   |
| 1988 | 3323.0         | 900.0          | 67.3   | 76.1   | 51.5                              | 73.8   | 42.0               | 67.5   | 4524               | 51.5   |
| 1989 | 5541.3         | 900.0          | 76.7   | 76.1   | 76.2                              | 74.0   | 70.3               | 67.8   | 6846               | 78.2   |
| 1990 | 3186.6         | 880.0          | 56.7   | 74.4   | 53.5                              | 72.2   | 41.3               | 65.4   | 4312               | 49.2   |
| 1991 | 4984.9         | 880.0          | 71.8   | 74.2   | 69.3                              | 72.0   | 64.7               | 65.4   | 6317               | 72.1   |
| 1992 | 1649.1         | 880.0          | 22.3   | 70.3   | 22.2                              | 68.2   | 21.3               | 62.0   | 2012               | 22.9   |
| 1993 | 5748.6         | 880.0          | 82.2   | 71.1   | 74.2                              | 68.6   | 74.6               | 62.9   | 7506               | 85.7   |
| 1994 | 5209.3         | 880.0          | 83.5   | 71.9   | 82.2                              | 69.5   | 67.6               | 63.2   | 6619               | 75.6   |
| 1995 | 3989.9         | 880.0          | 64.3   | 71.4   | 59.1                              | 68.9   | 51.8               | 62.5   | 4843               | 55.3   |
| 1996 | 4188.1         | 880.0          | 62.6   | 70.9   | 62.4                              | 68.5   | 54.2               | 62.0   | 5333               | 60.7   |
| 1997 | 5652.5         | 880.0          | 83.6   | 71.6   | 80.7                              | 69.2   | 73.3               | 62.7   | 7420               | 84.7   |
| 1998 | 6304.0         | 880.0          | 88.3   | 72.5   | 86.3                              | 70.1   | 81.8               | 63.6   | 7791               | 88.9   |
| 1999 | 5591.3         | 880.0          | 81.5   | 72.9   | 77.5                              | 70.4   | 72.5               | 64.1   | 7231               | 82.5   |
| 2000 | 5988.0         | 880.0          | 85.1   | 73.5   | 82.6                              | 71.0   | 77.5               | 64.7   | 7544               | 85.9   |
| 2001 | 4746.0         | 880.0          | 65.8   | 73.2   | 63.4                              | 70.7   | 61.6               | 64.6   | 5921               | 67.6   |
| 2002 | 5590.8         | 880.0          | 83.5   | 73.6   | 83.4                              | 71.2   | 72.5               | 64.9   | 7130               | 81.4   |
| 2003 | 6645.3         | 880.0          | 95.6   | 74.5   | 94.2                              | 72.2   | 86.2               | 65.8   | 8192               | 93.5   |
| 2004 | 6098.3         | 880.0          | 83.0   | 74.8   | 81.3                              | 72.5   | 78.9               | 66.3   | 7367               | 83.9   |

# FR-15 BUGEY-4

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 309.0  | 14.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 11 Jan | 49.0   | 7.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 20 Jan | 7.0    | 1.0     | XP   | K    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Feb | 276.0  | 14.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Feb | 38.0   | 1.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 02 Mar | 51.0   | 2.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 12 Mar | 1265.0 | 118.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 08 May | 1252.0 | 1109.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                              |
| 29 Jun | 70.0   | 61.0    | UF3  | Z    | INDUSTRIAL ACTION DURING PROGRAMMED OUTAGE, EXTENSION          |
| 02 Jul | 186.0  | 47.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 10 Jul | 351.0  | 40.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Aug | 502.0  | 34.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 05 Aug | 63.0   | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 11 Aug | 5.0    | 4.0     | UF2  | A31  | STEAM VALVES   |
| 20 Aug | 27.0   | 3.0     | UP2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                    |
| 01 Sep | 72.0   | 7.0     | UP2  | A32  | HP WATER CIRCUIT   |
| 03 Sep | 508.0  | 25.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Oct | 500.0  | 20.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 16 Oct | 57.0   | 51.0    | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                    |
| 21 Oct | 50.0   | 1.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                 |
| 01 Nov | 397.0  | 10.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 05 Nov | 11.0   | 10.0    | UF2  | L    | HUMAN OPERATING ERRORS   |
| 30 Nov | 16.0   | 9.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Dec | 429.0  | 7.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 07 Dec | 13.0   | 11.0    | UF2  | L    | HUMAN ERROR DURING MAINTENANCE                                 |
| 08 Dec | 14.0   | 1.0     | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 19 Dec | 47.0   | 3.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1979 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 62        |          |  | 653       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1252            |           |          | 1104                                     | 24        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 121                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 10                                       | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 10        | 36       |
| L. Human factor related  |                 | 24        |          |  |           |          |
| Z. Others  |                 | 70        |          |  |           |          |
| Subtotal   | 1252            | 156       | 0        | 1235                                     | 696       | 37       |
| Total  |                 | 1408      |          |  | 1968      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1979 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 315                                      |
| 12. Reactor I&C Systems                        | 57              | 23                                       |
| 13. Reactor Auxiliary Systems                  |                 | 4  |
| 14. Safety Systems                             |                 | 13                                       |
| 15. Reactor Cooling Systems                    |                 | 28                                       |
| 16. Steam generation systems                   |                 | 36                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 21. Fuel Handling and Storage Facilities       |                 | 3  |
| 31. Turbine and auxiliaries                    | 5               | 37                                       |
| 32. Feedwater and Main Steam System            |                 | 9  |
| 33. Circulating Water System                   |                 | 3  |
| 41. Main Generator Systems                     |                 | 35                                       |
| 42. Electrical Power Supply Systems            |                 | 141                                      |
| XX. Miscellaneous Systems                      |                 | 0  |
| Total  | 62              | 647                                      |

# FR-16 BUGEY-5

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 880.0 MW(e)  
**Design Net RUP:** 900.0 MW(e)  
**Design Discharge Burnup:** 33700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5256.1 GW(e).h  
**Energy Availability Factor:** 71.4%  
**Load Factor:** 68.0%  
**Operating Factor:** 73.3%  
**Energy Unavailability Factor:** 28.6%  
**Total Off-line Time:** 2346 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 604.0 | 556.5 | 630.9 | 591.1 | 607.0 | 584.3 | 611.1 | 370.7 | 0.0   | 0.0   | 67.8 | 632.7 | 5256.1 |
| <b>EAF (%)</b>  | 97.8  | 94.7  | 99.9  | 99.6  | 99.3  | 99.9  | 95.9  | 57.0  | 0.0   | 0.0   | 12.5 | 99.8  | 71.4   |
| <b>UCF (%)</b>  | 100.0 | 94.8  | 99.9  | 100.0 | 99.9  | 99.9  | 99.9  | 64.9  | 0.0   | 0.0   | 12.5 | 99.8  | 72.7   |
| <b>LF (%)</b>   | 92.3  | 90.9  | 96.5  | 93.3  | 92.7  | 92.2  | 93.3  | 56.6  | 0.0   | 0.0   | 10.7 | 96.6  | 68.0   |
| <b>OF (%)</b>   | 100.0 | 95.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 64.9  | 0.0   | 0.0   | 18.5 | 100.0 | 73.3   |
| <b>EUF (%)</b>  | 2.2   | 5.3   | 0.1   | 0.4   | 0.7   | 0.1   | 4.1   | 43.0  | 100.0 | 100.0 | 87.5 | 0.2   | 28.6   |
| <b>PUF (%)</b>  | 0.0   | 5.3   | 0.1   | 0.0   | 0.1   | 0.1   | 0.1   | 35.1  | 100.0 | 34.2  | 5.9  | 0.0   | 15.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 65.8  | 81.6 | 0.2   | 12.3   |
| <b>XUF (%)</b>  | 2.2   | 0.0   | 0.0   | 0.4   | 0.6   | 0.0   | 4.0   | 7.9   | 0.0   | 0.0   | 0.0  | 0.0   | 1.3    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1974      **Lifetime Generation:** 133104.1 GW(e).h  
**Date of First Criticality:** 15 Jul 1979      **Cumulative Energy Availability Factor:** 74.0%  
**Date of Grid Connection:** 31 Jul 1979      **Cumulative Load Factor:** 67.8%  
**Date of Commercial Operation:** 03 Jan 1980      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 26.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5578.0         | 900.0          | 73.9   | 78.3   | 73.9                              | 74.4   | 70.8               | 72.2   | 6649               | 75.9   |
| 1984 | 5778.0         | 900.0          | 74.1   | 77.4   | 74.1                              | 74.3   | 73.1               | 72.4   | 6884               | 78.4   |
| 1985 | 6079.7         | 900.0          | 84.6   | 78.6   | 80.5                              | 75.4   | 77.1               | 73.1   | 7314               | 83.5   |
| 1986 | 5465.5         | 900.0          | 75.7   | 78.2   | 75.5                              | 75.4   | 69.3               | 72.6   | 6493               | 74.1   |
| 1987 | 5015.9         | 900.0          | 67.8   | 76.9   | 66.6                              | 74.3   | 63.6               | 71.5   | 6044               | 69.0   |
| 1988 | 5466.0         | 900.0          | 89.7   | 78.3   | 84.6                              | 75.4   | 69.1               | 71.2   | 6465               | 73.6   |
| 1989 | 4758.0         | 900.0          | 68.8   | 77.4   | 64.7                              | 74.4   | 60.3               | 70.1   | 6185               | 70.6   |
| 1990 | 5586.0         | 880.0          | 80.7   | 77.7   | 74.9                              | 74.4   | 72.5               | 70.3   | 7156               | 81.7   |
| 1991 | 3358.4         | 880.0          | 47.9   | 75.2   | 44.0                              | 71.9   | 43.6               | 68.2   | 4258               | 48.6   |
| 1992 | 4035.0         | 880.0          | 56.4   | 73.8   | 52.5                              | 70.5   | 52.2               | 66.9   | 5003               | 57.0   |
| 1993 | 4416.6         | 880.0          | 60.5   | 72.9   | 57.4                              | 69.5   | 57.3               | 66.3   | 5329               | 60.8   |
| 1994 | 4487.3         | 880.0          | 85.9   | 73.7   | 85.7                              | 70.6   | 58.2               | 65.7   | 6311               | 72.0   |
| 1995 | 5582.8         | 880.0          | 79.9   | 74.1   | 78.0                              | 71.1   | 72.4               | 66.1   | 7060               | 80.6   |
| 1996 | 5361.4         | 880.0          | 79.0   | 74.4   | 77.5                              | 71.4   | 69.4               | 66.3   | 6844               | 77.9   |
| 1997 | 5592.9         | 880.0          | 88.0   | 75.1   | 84.3                              | 72.1   | 72.6               | 66.7   | 7302               | 83.4   |
| 1998 | 5320.4         | 880.0          | 83.9   | 75.6   | 80.5                              | 72.6   | 69.0               | 66.8   | 6844               | 78.1   |
| 1999 | 6108.8         | 880.0          | 86.8   | 76.2   | 82.7                              | 73.1   | 79.2               | 67.4   | 7679               | 87.7   |
| 2000 | 5403.2         | 880.0          | 77.3   | 76.2   | 74.6                              | 73.1   | 69.9               | 67.5   | 6889               | 78.4   |
| 2001 | 4358.6         | 880.0          | 77.9   | 76.3   | 72.1                              | 73.1   | 56.5               | 67.0   | 5604               | 64.0   |
| 2002 | 6146.9         | 900.0          | 91.2   | 76.9   | 91.2                              | 73.9   | 78.0               | 67.5   | 7925               | 90.5   |
| 2003 | 5711.1         | 880.0          | 83.5   | 77.2   | 80.0                              | 74.1   | 74.1               | 67.8   | 7220               | 82.4   |
| 2004 | 5256.1         | 880.0          | 72.7   | 77.0   | 71.4                              | 74.0   | 68.0               | 67.8   | 6438               | 73.3   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 265.0 | 36.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 19 Jan | 25.0  | 14.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 Feb | 226.0 | 22.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 02 Feb | 21.0  | 18.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 22 Feb | 12.0  | 10.0    | PF   | D    | WORK PLANNED TO BE DONE DURING THE YEAR                       |
| 01 Mar | 221.0 | 17.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 21 Mar | 19.0  | 1.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Apr | 309.0 | 39.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 May | 327.0 | 43.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 27 May | 22.0  | 4.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 Jun | 268.0 | 48.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Jul | 83.0  | 15.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 07 Jul | 80.0  | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 11 Jul | 973.0 | 78.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 21 Aug | 257.0 | 229.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 01 Sep | 720.0 | 633.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 01 Oct | 251.0 | 224.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 11 Oct | 489.0 | 431.0   | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                   |
| 01 Nov | 587.0 | 517.0   | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                   |
| 25 Nov | 86.0  | 30.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 25 Nov | 9.0   | 7.0     | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 03 Dec | 36.0  | 1.0     | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 11 Dec | 166.0 | 18.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1076      |          |  | 345       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1228            |           |          | 1335                                     | 14        |          |
| D. Inspection, maintenance or repair without refuelling                              | 12              |           |          | 25                                       |           |          |
| E. Testing of plant systems or components  | 30              |           |          | 7  | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 60        | 26       |
| P. Fire  |                 |           |          |  |           | 6        |
| Z. Others  |                 |           |          |  | 11        |          |
| Subtotal   | 1270            | 1076      | 0        | 1367                                     | 437       | 32       |
| Total  |                 | 2346      |          |  | 1836      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 28                                       |
| 12. Reactor I&C Systems             | 1076            | 11                                       |
| 13. Reactor Auxiliary Systems       |                 | 10                                       |
| 14. Safety Systems                  |                 | 4  |
| 15. Reactor Cooling Systems         |                 | 33                                       |
| 16. Steam generation systems        |                 | 172                                      |
| 31. Turbine and auxiliaries         |                 | 39                                       |
| 32. Feedwater and Main Steam System |                 | 6  |
| 41. Main Generator Systems          |                 | 19                                       |
| 42. Electrical Power Supply Systems |                 | 10                                       |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 1076            | 332                                      |

**FR-50 CATTENOM-1**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1300.0 MW(e)  
 Design Net RUP: 1300.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 9764.2 GW(e).h  
 Energy Availability Factor: 96.4%  
 Load Factor: 85.5%  
 Operating Factor: 97.7%  
 Energy Unavailability Factor: 3.6%  
 Total Off-line Time: 201 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 817.1 | 870.6 | 911.0 | 844.6 | 832.2 | 702.0 | 700.7 | 807.0 | 794.7 | 801.9 | 878.7 | 803.6 | 9764.2 |
| EAF (%)  | 96.1  | 99.9  | 100.0 | 100.0 | 98.0  | 93.2  | 86.7  | 99.7  | 96.8  | 93.0  | 94.5  | 99.0  | 96.4   |
| UCF (%)  | 96.7  | 99.9  | 100.0 | 100.0 | 99.7  | 95.2  | 87.6  | 99.7  | 96.8  | 93.0  | 95.1  | 99.9  | 96.9   |
| LF (%)   | 84.5  | 96.2  | 94.3  | 90.2  | 86.0  | 75.0  | 72.5  | 83.4  | 84.9  | 82.8  | 93.9  | 83.1  | 85.5   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.3  | 100.0 | 100.0 | 90.2  | 95.4  | 94.0  | 97.7   |
| EUF (%)  | 3.9   | 0.1   | 0.0   | 0.0   | 2.0   | 6.8   | 13.3  | 0.3   | 3.2   | 7.0   | 5.5   | 1.0   | 3.6    |
| PUF (%)  | 3.1   | 0.0   | 0.0   | 0.0   | 0.3   | 0.1   | 0.0   | 0.0   | 3.2   | 6.9   | 0.0   | 0.0   | 1.1    |
| UCLF (%) | 0.2   | 0.1   | 0.0   | 0.0   | 0.0   | 4.8   | 12.4  | 0.3   | 0.0   | 0.1   | 4.9   | 0.1   | 1.9    |
| XUF (%)  | 0.6   | 0.0   | 0.0   | 0.0   | 1.7   | 2.0   | 0.9   | 0.0   | 0.0   | 0.0   | 0.6   | 0.9   | 0.6    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 29 Oct 1979      Lifetime Generation: 136555.7 GW(e).h  
 Date of First Criticality: 24 Oct 1986      Cumulative Energy Availability Factor: 71.3%  
 Date of Grid Connection: 13 Nov 1986      Cumulative Load Factor: 66.8%  
 Date of Commercial Operation: 01 Apr 1987      Cumulative Unit Capability Factor: 78.6%  
    Cumulative Energy Unavailability Factor: 28.7%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1986 | 221.2             | 1294.0            | 0.0  | 0.0    | 88.7                                 | 100.0  | 2.0                | 0.0    | 665                   | 7.9    |
| 1987 | 7429.8            | 1265.0            | 0.0  | 0.0    | 69.6                                 | 100.0  | 67.0               | 0.0    | 6393                  | 73.0   |
| 1988 | 5283.0            | 1300.0            | 47.8   | 47.8   | 47.4                                 | 47.4   | 46.3               | 46.3   | 4369                  | 49.7   |
| 1989 | 6802.4            | 1300.0            | 60.3   | 54.0   | 60.3                                 | 53.8   | 59.7               | 53.0   | 5548                  | 63.3   |
| 1990 | 7781.9            | 1300.0            | 75.7   | 61.3   | 75.3                                 | 61.0   | 68.3               | 58.1   | 6710                  | 76.6   |
| 1991 | 1509.3            | 1300.0            | 13.5   | 49.3   | 13.5                                 | 49.1   | 13.3               | 46.9   | 1336                  | 15.3   |
| 1992 | 7933.3            | 1300.0            | 71.5   | 53.8   | 71.0                                 | 53.5   | 69.5               | 51.4   | 6595                  | 75.1   |
| 1993 | 6956.6            | 1300.0            | 63.5   | 55.4   | 61.5                                 | 54.8   | 61.1               | 53.0   | 5608                  | 64.0   |
| 1994 | 6775.4            | 1300.0            | 64.1   | 56.6   | 64.0                                 | 56.1   | 59.5               | 54.0   | 6006                  | 68.6   |
| 1995 | 6634.3            | 1300.0            | 59.8   | 57.0   | 59.5                                 | 56.6   | 58.3               | 54.5   | 6346                  | 72.4   |
| 1996 | 9539.2            | 1300.0            | 87.5   | 60.4   | 87.3                                 | 60.0   | 83.5               | 57.7   | 7783                  | 88.6   |
| 1997 | 8688.9            | 1300.0            | 84.1   | 62.8   | 81.4                                 | 62.1   | 76.3               | 59.6   | 7374                  | 84.2   |
| 1998 | 9365.8            | 1300.0            | 85.9   | 64.9   | 85.7                                 | 64.3   | 82.2               | 61.6   | 7644                  | 87.3   |
| 1999 | 8273.0            | 1300.0            | 79.8   | 66.1   | 76.3                                 | 65.3   | 72.6               | 62.6   | 7028                  | 80.2   |
| 2000 | 8053.8            | 1300.0            | 81.0   | 67.3   | 78.1                                 | 66.3   | 70.5               | 63.2   | 6873                  | 78.2   |
| 2001 | 9220.2            | 1300.0            | 96.4   | 69.3   | 96.4                                 | 68.4   | 81.0               | 64.4   | 8094                  | 92.4   |
| 2002 | 8270.2            | 1300.0            | 79.4   | 70.0   | 79.2                                 | 69.1   | 72.6               | 65.0   | 7011                  | 80.0   |
| 2003 | 8531.0            | 1300.0            | 80.3   | 70.7   | 78.4                                 | 69.7   | 74.9               | 65.6   | 7150                  | 81.6   |
| 2004 | 9764.2            | 1300.0            | 96.9   | 72.2   | 96.4                                 | 71.3   | 85.5               | 66.8   | 8583                  | 97.7   |

# FR-50 CATTENOM-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 291.0 | 76.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 03 Jan | 47.0  | 30.0    | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 09 Jan | 25.0  | 1.0     | UP2  | L    | HUMAN ERROR IN PADLOCKING                                      |
| 02 Feb | 215.0 | 32.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Mar | 195.0 | 17.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 21 Mar | 39.0  | 33.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 Apr | 270.0 | 90.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 May | 322.0 | 105.0   | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 08 May | 10.0  | 3.0     | PP   | E    | EQUIPMENT PERFORMANCE TEST (SPECIAL)                           |
| 01 Jun | 244.0 | 49.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 15 Jun | 24.0  | 19.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 19 Jun | 57.0  | 44.0    | UP2  | A33  | CIRCULATING PUMP   |
| 01 Jul | 221.0 | 134.0   | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 21 Jul | 50.0  | 40.0    | UP2  | A32  | FEEDWATER TANK AND GAS STRIPPER                                |
| 21 Jul | 62.0  | 81.0    | UF2  | A32  | FEEDWATER TANK AND GAS STRIPPER                                |
| 01 Aug | 227.0 | 147.0   | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 22 Aug | 14.0  | 2.0     | UP2  | A15  | PRIMARY PUMP   |
| 01 Sep | 212.0 | 110.0   | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 15 Sep | 54.0  | 30.0    | PP   | E    | EQUIPMENT PERFORMANCE TEST (SPECIAL)                           |
| 01 Oct | 328.0 | 40.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 02 Oct | 50.0  | 65.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 01 Nov | 341.0 | 5.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 16 Nov | 191.0 | 1.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                         |
| 20 Nov | 33.0  | 43.0    | UF2  | A    | GENERAL CONTROL AND REGULATION CHANNELS                        |
| 15 Dec | 221.0 | 8.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 95        |          |  | 934       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 942                                      | 18        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 56                                       | 10        |          |
| E. Testing of plant systems or components  | 50              |           |          | 77                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 8         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 78        |          |
| Subtotal   | 50              | 95        | 0        | 1075                                     | 1054      | 1        |
| Total  |                 | 145       |          |  | 2130      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 20                                       |
| 12. Reactor I&C Systems                        |                 | 44                                       |
| 13. Reactor Auxiliary Systems                  |                 | 33                                       |
| 14. Safety Systems                             |                 | 11                                       |
| 15. Reactor Cooling Systems                    |                 | 103                                      |
| 16. Steam generation systems                   |                 | 44                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 21. Fuel Handling and Storage Facilities       |                 | 4  |
| 31. Turbine and auxiliaries                    |                 | 44                                       |
| 32. Feedwater and Main Steam System            | 62              | 105                                      |
| 33. Circulating Water System                   |                 | 23                                       |
| 41. Main Generator Systems                     |                 | 450                                      |
| 42. Electrical Power Supply Systems            |                 | 18                                       |
| XX. Miscellaneous Systems                      |                 | 5  |
| Total  | 62              | 906                                      |

# FR-53 CATTENOM-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1300.0 MW(e)  
**Design Net RUP:** 1300.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7368.2 GW(e).h  
**Energy Availability Factor:** 66.8%  
**Load Factor:** 64.5%  
**Operating Factor:** 70.4%  
**Energy Unavailability Factor:** 33.2%  
**Total Off-line Time:** 2601 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 818.6 | 788.7 | 292.4 | 0.0   | 99.8 | 674.8 | 895.6 | 305.2 | 666.9 | 950.2 | 917.0 | 958.9 | 7368.2 |
| <b>EAF (%)</b>  | 85.2  | 87.5  | 31.3  | 0.0   | 12.0 | 76.9  | 100.0 | 36.1  | 73.5  | 99.9  | 99.9  | 99.9  | 66.8   |
| <b>UCF (%)</b>  | 87.6  | 99.9  | 38.8  | 0.0   | 12.0 | 78.0  | 100.0 | 36.1  | 73.5  | 99.9  | 99.9  | 99.9  | 68.7   |
| <b>LF (%)</b>   | 84.6  | 87.2  | 30.3  | 0.0   | 10.3 | 72.1  | 92.6  | 31.6  | 71.3  | 98.1  | 98.0  | 99.1  | 64.5   |
| <b>OF (%)</b>   | 90.9  | 100.0 | 39.0  | 0.0   | 23.3 | 79.4  | 100.0 | 38.0  | 75.0  | 100.0 | 100.0 | 100.0 | 70.4   |
| <b>EUF (%)</b>  | 14.8  | 12.5  | 68.7  | 100.0 | 88.0 | 23.1  | 0.0   | 63.9  | 26.5  | 0.1   | 0.1   | 0.1   | 33.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 61.2  | 100.0 | 29.8 | 0.6   | 0.0   | 0.0   | 0.0   | 0.1   | 0.1   | 0.0   | 16.0   |
| <b>UCLF (%)</b> | 12.4  | 0.1   | 0.0   | 0.0   | 58.2 | 21.4  | 0.0   | 63.9  | 26.5  | 0.0   | 0.0   | 0.1   | 15.3   |
| <b>XUF (%)</b>  | 2.4   | 12.4  | 7.4   | 0.0   | 0.0  | 1.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 28 Jul 1980  
**Date of First Criticality:** 07 Aug 1987  
**Date of Grid Connection:** 17 Sep 1987  
**Date of Commercial Operation:** 01 Feb 1988

**Lifetime Generation:** 138400.7 GW(e).h  
**Cumulative Energy Availability Factor:** 75.6%  
**Cumulative Load Factor:** 70.8%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 24.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 1317.0         | 1288.0         | 0.0  | 0.0    | 82.6                              | 100.0  | 12.2               | 0.0    | 1700               | 20.3   |
| 1988 | 8138.0         | 1300.0         | 0.0  | 0.0    | 89.0                              | 100.0  | 71.3               | 0.0    | 7156               | 81.5   |
| 1989 | 1765.5         | 1300.0         | 16.5   | 16.5   | 15.5                              | 15.5   | 15.5               | 15.5   | 1452               | 16.6   |
| 1990 | 8137.6         | 1300.0         | 83.0   | 49.7   | 82.7                              | 49.1   | 71.5               | 43.5   | 6670               | 76.1   |
| 1991 | 7543.1         | 1300.0         | 71.8   | 57.1   | 68.2                              | 55.5   | 66.2               | 51.1   | 6472               | 73.9   |
| 1992 | 8134.3         | 1300.0         | 75.6   | 61.7   | 72.4                              | 59.7   | 71.2               | 56.1   | 6752               | 76.9   |
| 1993 | 8627.0         | 1300.0         | 78.8   | 65.1   | 76.2                              | 63.0   | 75.8               | 60.0   | 6990               | 79.8   |
| 1994 | 8526.3         | 1300.0         | 80.5   | 67.7   | 77.7                              | 65.4   | 74.9               | 62.5   | 7158               | 81.7   |
| 1995 | 8603.7         | 1300.0         | 79.9   | 69.5   | 78.3                              | 67.3   | 75.6               | 64.4   | 7138               | 81.5   |
| 1996 | 9018.1         | 1300.0         | 99.6   | 73.2   | 98.1                              | 71.1   | 79.0               | 66.2   | 7804               | 88.8   |
| 1997 | 8487.4         | 1300.0         | 84.4   | 74.5   | 82.2                              | 72.4   | 74.5               | 67.1   | 7503               | 85.7   |
| 1998 | 7259.5         | 1300.0         | 69.0   | 73.9   | 68.0                              | 71.9   | 63.7               | 66.8   | 6144               | 70.1   |
| 1999 | 9367.5         | 1300.0         | 90.2   | 75.4   | 87.3                              | 73.3   | 82.3               | 68.2   | 7781               | 88.8   |
| 2000 | 9164.3         | 1300.0         | 88.6   | 76.5   | 88.6                              | 74.6   | 80.3               | 69.2   | 7868               | 89.6   |
| 2001 | 8649.0         | 1300.0         | 79.4   | 76.7   | 77.5                              | 74.8   | 75.9               | 69.7   | 7033               | 80.3   |
| 2002 | 8288.0         | 1300.0         | 76.9   | 76.7   | 76.9                              | 75.0   | 72.8               | 69.9   | 6918               | 79.0   |
| 2003 | 10197.5        | 1300.0         | 99.3   | 78.2   | 93.5                              | 76.2   | 89.5               | 71.2   | 8217               | 93.8   |
| 2004 | 7368.2         | 1300.0         | 68.7   | 77.6   | 66.8                              | 75.6   | 64.5               | 70.8   | 6183               | 70.4   |



## FR-53 CATTENOM-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 171.0  | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 08 Jan | 404.0  | 23.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 21 Jan | 68.0   | 89.0    | UF2  | A13  | COMPONENT COOLING SYSTEM                                      |
| 21 Jan | 91.0   | 31.0    | UP2  | A13  | COMPONENT COOLING SYSTEM                                      |
| 01 Feb | 19.0   | 1.0     | PP   | E    | EQUIPMENT PERFORMANCE TEST (SPECIAL)                          |
| 01 Mar | 274.0  | 72.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 12 Mar | 1394.0 | 1814.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 07 May | 433.0  | 563.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                           |
| 08 May | 9.0    | 12.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 08 May | 147.0  | 86.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 11 May | 20.0   | 26.0    | UF2  | Z    | MALFUNCTION OF REGULATION, PROTECTION AND CONTROL SYSTEMS     |
| 12 May | 16.0   | 11.0    | UP2  | A32  | HP WATER CIRCUIT  |
| 01 Jun | 20.0   | 8.0     | UP2  | A33  | CIRCULATING PUMP  |
| 07 Jun | 112.0  | 6.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 12 Jun | 255.0  | 12.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 15 Jun | 33.0   | 10.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 17 Jun | 56.0   | 27.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Jul | 345.0  | 70.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 01 Aug | 150.0  | 19.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 11 Aug | 32.0   | 16.0    | UP2  | A12  | INSTRUMENTATION AND CONTROL OF PRIMARY CIRCUIT (INCLUDING SG) |
| 11 Aug | 26.0   | 34.0    | UF2  | A12  | INSTRUMENTATION AND CONTROL OF PRIMARY CIRCUIT (INCLUDING SG) |
| 13 Aug | 624.0  | 811.0   | UF2  | A15  | STEAM CIRCUIT WITHOUT INLET VALVES                            |
| 07 Sep | 334.0  | 6.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 08 Sep | 27.0   | 36.0    | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                   |
| 11 Sep | 122.0  | 1.0     | UP2  | A31  | MAIN CONDENSER  |
| 01 Oct | 356.0  | 16.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 01 Nov | 185.0  | 22.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Dec | 114.0  | 3.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 20 Dec | 96.0   | 1.0     | UP2  | A31  | MAIN CONDENSER  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 745       |          |  | 521       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 12        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1394            |           |          | 901                                      | 9         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 67                                       | 25        |          |
| E. Testing of plant systems or components  | 9               |           |          | 67                                       | 0         | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 14        | 28       |
| L. Human factor related  |                 |           |          |  | 1         |          |
| Z. Others  |                 | 453       |          |  |           |          |
| Subtotal   | 1403            | 1198      | 0        | 1035                                     | 582       | 30       |
| Total  |                 | 2601      |          |  | 1647      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 15                                       |
| 12. Reactor I&C Systems             | 53              | 4  |
| 13. Reactor Auxiliary Systems       | 68              | 7  |
| 14. Safety Systems                  |                 | 35                                       |
| 15. Reactor Cooling Systems         | 624             | 227                                      |
| 16. Steam generation systems        |                 | 109                                      |
| 31. Turbine and auxiliaries         |                 | 18                                       |
| 32. Feedwater and Main Steam System |                 | 19                                       |
| 33. Circulating Water System        |                 | 1  |
| 41. Main Generator Systems          |                 | 2  |
| 42. Electrical Power Supply Systems |                 | 28                                       |
| XX. Miscellaneous Systems           |                 | 7  |
| Total                               | 745             | 472                                      |

## FR-60 CATTENOM-3

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1300.0 MW(e)  
**Design Net RUP:** 1300.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 9162.7 GW(e).h  
**Energy Availability Factor:** 80.3%  
**Load Factor:** 80.2%  
**Operating Factor:** 82.8%  
**Energy Unavailability Factor:** 19.7%  
**Total Off-line Time:** 1510 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 677.3 | 0.0   | 14.9 | 903.7 | 961.8 | 918.3 | 946.2 | 937.9 | 920.9 | 964.5 | 941.0 | 976.3 | 9162.7 |
| <b>EAF (%)</b>  | 70.5  | 0.0   | 3.5  | 96.5  | 99.3  | 98.3  | 98.0  | 97.4  | 98.4  | 99.4  | 99.8  | 100.0 | 80.3   |
| <b>UCF (%)</b>  | 74.2  | 0.0   | 3.5  | 96.8  | 99.9  | 99.8  | 99.9  | 99.6  | 99.9  | 99.9  | 99.9  | 100.0 | 81.4   |
| <b>LF (%)</b>   | 70.0  | 0.0   | 1.5  | 96.5  | 99.4  | 98.1  | 97.8  | 97.0  | 98.4  | 99.6  | 100.5 | 100.9 | 80.2   |
| <b>OF (%)</b>   | 74.5  | 0.0   | 16.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 82.8   |
| <b>EUF (%)</b>  | 29.5  | 100.0 | 96.5 | 3.5   | 0.7   | 1.7   | 2.0   | 2.6   | 1.6   | 0.6   | 0.2   | 0.0   | 19.7   |
| <b>PUF (%)</b>  | 25.8  | 100.0 | 64.4 | 2.7   | 0.1   | 0.0   | 0.0   | 0.1   | 0.0   | 0.1   | 0.0   | 0.0   | 15.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 32.0 | 0.4   | 0.0   | 0.2   | 0.1   | 0.4   | 0.0   | 0.0   | 0.1   | 0.0   | 2.8    |
| <b>XUF (%)</b>  | 3.7   | 0.0   | 0.0  | 0.3   | 0.6   | 1.5   | 1.9   | 2.2   | 1.5   | 0.5   | 0.0   | 0.0   | 1.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 15 Jun 1982  
**Date of First Criticality:** 16 Feb 1990  
**Date of Grid Connection:** 06 Jul 1990  
**Date of Commercial Operation:** 01 Feb 1991

**Lifetime Generation:** 119259.2 GW(e).h  
**Cumulative Energy Availability Factor:** 78.8%  
**Cumulative Load Factor:** 73.0%  
**Cumulative Unit Capability Factor:** 80.2%  
**Cumulative Energy Unavailability Factor:** 21.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 1545.4         | 1300.0         | 0.0  | 0.0    | 65.1                              | 100.0  | 13.6               | 0.0    | 1961               | 22.4   |
| 1991 | 9683.1         | 1300.0         | 0.0  | 0.0    | 87.3                              | 100.0  | 85.0               | 0.0    | 7897               | 90.1   |
| 1992 | 7145.0         | 1300.0         | 67.0   | 67.0   | 65.6                              | 65.6   | 62.6               | 62.6   | 5903               | 67.2   |
| 1993 | 8035.1         | 1300.0         | 81.2   | 74.1   | 75.9                              | 70.7   | 70.6               | 66.6   | 6858               | 78.3   |
| 1994 | 8613.3         | 1300.0         | 85.7   | 78.0   | 84.4                              | 75.3   | 75.6               | 69.6   | 7464               | 85.2   |
| 1995 | 8344.3         | 1300.0         | 82.2   | 79.0   | 78.9                              | 76.2   | 73.3               | 70.5   | 7269               | 83.0   |
| 1996 | 8264.7         | 1300.0         | 80.6   | 79.3   | 77.3                              | 76.4   | 72.4               | 70.9   | 7184               | 81.8   |
| 1997 | 9504.1         | 1300.0         | 94.5   | 81.8   | 93.2                              | 79.2   | 83.5               | 73.0   | 8097               | 92.4   |
| 1998 | 8054.9         | 1300.0         | 83.5   | 82.1   | 80.2                              | 79.3   | 70.7               | 72.7   | 7175               | 81.9   |
| 1999 | 8237.0         | 1300.0         | 83.5   | 82.3   | 79.7                              | 79.4   | 72.3               | 72.6   | 7169               | 81.8   |
| 2000 | 8933.5         | 1300.0         | 99.2   | 84.1   | 98.7                              | 81.5   | 78.2               | 73.2   | 7984               | 90.9   |
| 2001 | 3171.5         | 1300.0         | 29.8   | 78.7   | 29.7                              | 76.4   | 27.8               | 68.7   | 2739               | 31.3   |
| 2002 | 9402.5         | 1300.0         | 83.6   | 79.2   | 82.5                              | 76.9   | 82.6               | 70.0   | 7443               | 85.0   |
| 2003 | 11254.0        | 1300.0         | 99.3   | 80.8   | 98.4                              | 78.7   | 98.8               | 72.4   | 8715               | 99.5   |
| 2004 | 9162.7         | 1300.0         | 81.4   | 80.9   | 80.3                              | 78.8   | 80.2               | 73.0   | 7274               | 82.8   |

# FR-60 CATTENOM-3

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 02 Jan | 521.0 | 35.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                    |
| 23 Jan | 190.0 | 249.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                     |
| 01 Feb | 696.0 | 5.0     | PF   | C    | REFUELLING AND PARTIAL INSPECTION                     |
| 01 Mar | 409.0 | 531.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                     |
| 16 Mar | 32.0  | 42.0    | UF2  | A13  | CHEMICAL AND VOLUME CONTROL SYSTEM WITHOUT PUMP       |
| 17 Mar | 20.0  | 26.0    | UF2  | A22  | REFUELLING MACHINE                                    |
| 18 Mar | 22.0  | 29.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                   |
| 18 Mar | 12.0  | 16.0    | UF2  | A    | RELAYS/SYSTEMS COMMON TO SEVERAL FUNCTIONS            |
| 20 Mar | 49.0  | 64.0    | UF2  | A    | PARALLEL AND TAPER-SEAT VALVES                        |
| 25 Mar | 11.0  | 14.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                   |
| 26 Mar | 74.0  | 61.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                       |
| 26 Mar | 69.0  | 90.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                       |
| 01 Apr | 211.0 | 26.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                       |
| 09 Apr | 124.0 | 3.0     | UP2  | A16  | BLOWDOWNS AND MISCELLANEOUS SYSTEM                    |
| 14 Apr | 276.0 | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS |
| 01 May | 496.0 | 5.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS |
| 01 Jun | 645.0 | 14.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS |
| 01 Jul | 699.0 | 18.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS |
| 01 Aug | 563.0 | 21.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS |
| 01 Aug | 170.0 | 3.0     | UP2  | A31  | MAIN CONDENSER  |
| 01 Sep | 676.0 | 14.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS |
| 01 Oct | 404.0 | 5.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS |
| 05 Nov | 27.0  | 1.0     | UP2  | A32  | HIGH-PRESSURE HEATING                                 |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 124       |          |  | 219       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1295            |           |          | 774                                      | 23        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 77                                       |           |          |
| E. Testing of plant systems or components  | 69              |           |          | 13                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 135       |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 44        | 4        |
| Z. Others  |                 | 22        |          |  |           |          |
| Subtotal   | 1364            | 146       | 0        | 864                                      | 421       | 4        |
| Total  |                 | 1510      |          |  | 1289      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  | 11              | 31                                       |
| 13. Reactor Auxiliary Systems            | 32              | 64                                       |
| 14. Safety Systems                       |                 | 19                                       |
| 15. Reactor Cooling Systems              |                 | 15                                       |
| 16. Steam generation systems             |                 | 5  |
| 21. Fuel Handling and Storage Facilities |                 | 5  |
| 31. Turbine and auxiliaries              |                 | 28                                       |
| 32. Feedwater and Main Steam System      |                 | 6  |
| 41. Main Generator Systems               |                 | 12                                       |
| 42. Electrical Power Supply Systems      |                 | 7  |
| XX. Miscellaneous Systems                |                 | 4  |
| Total                                    | 43              | 196                                      |

**FR-65 CATTENOM-4**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1300.0 MW(e)  
 Design Net RUP: 1300.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 9311.8 GW(e).h  
 Energy Availability Factor: 84.5%  
 Load Factor: 81.5%  
 Operating Factor: 86.1%  
 Energy Unavailability Factor: 15.5%  
 Total Off-line Time: 1224 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 954.3 | 895.5 | 920.1 | 809.5 | 926.9 | 904.3 | 923.7 | 344.9 | 0.0   | 845.9 | 838.1 | 948.5 | 9311.8 |
| EAF (%)  | 99.8  | 100.0 | 97.3  | 89.5  | 99.0  | 99.3  | 97.1  | 40.3  | 0.0   | 91.5  | 100.0 | 100.0 | 84.5   |
| UCF (%)  | 100.0 | 100.0 | 97.4  | 91.0  | 99.8  | 99.6  | 99.2  | 41.1  | 0.0   | 91.7  | 100.0 | 100.0 | 85.0   |
| LF (%)   | 98.7  | 99.0  | 95.3  | 86.5  | 95.8  | 96.6  | 95.5  | 35.7  | 0.0   | 87.3  | 89.5  | 98.1  | 81.5   |
| OF (%)   | 100.0 | 100.0 | 98.7  | 91.7  | 100.0 | 100.0 | 100.0 | 42.1  | 0.0   | 99.6  | 100.0 | 100.0 | 86.1   |
| EUF (%)  | 0.2   | 0.0   | 2.7   | 10.5  | 1.0   | 0.7   | 2.9   | 59.7  | 100.0 | 8.5   | 0.0   | 0.0   | 15.5   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 4.6   | 0.0   | 0.0   | 0.0   | 58.2  | 99.6  | 3.3   | 0.0   | 0.0   | 13.8   |
| UCLF (%) | 0.0   | 0.0   | 2.6   | 4.4   | 0.2   | 0.4   | 0.8   | 0.7   | 0.4   | 5.0   | 0.0   | 0.0   | 1.2    |
| XUF (%)  | 0.2   | 0.0   | 0.1   | 1.5   | 0.8   | 0.4   | 2.1   | 0.8   | 0.0   | 0.2   | 0.0   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 28 Sep 1983  
 Date of First Criticality: 04 May 1991  
 Date of Grid Connection: 27 May 1991  
 Date of Commercial Operation: 01 Jan 1992

Lifetime Generation: 117031.9 GW(e).h  
 Cumulative Energy Availability Factor: 83.2%  
 Cumulative Load Factor: 77.6%  
 Cumulative Unit Capability Factor: 80.2%  
 Cumulative Energy Unavailability Factor: 16.8%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1991 | 2161.2            | 1300.0            | 0.0  | 0.0    | 59.5                                 | 100.0  | 19.0               | 0.0    | 2581                  | 29.5   |
| 1992 | 9356.0            | 1300.0            | 88.0   | 88.0   | 85.8                                 | 85.8   | 81.9               | 81.9   | 7649                  | 87.1   |
| 1993 | 7736.4            | 1300.0            | 79.1   | 83.6   | 78.0                                 | 81.9   | 67.9               | 74.9   | 6251                  | 71.4   |
| 1994 | 7828.8            | 1300.0            | 81.9   | 83.0   | 80.4                                 | 81.4   | 68.7               | 72.9   | 6866                  | 78.4   |
| 1995 | 8942.4            | 1300.0            | 85.5   | 83.6   | 82.8                                 | 81.8   | 78.5               | 74.3   | 7563                  | 86.3   |
| 1996 | 8897.6            | 1300.0            | 82.6   | 83.4   | 81.3                                 | 81.7   | 77.9               | 75.0   | 7399                  | 84.2   |
| 1997 | 8690.5            | 1300.0            | 82.6   | 83.3   | 79.3                                 | 81.3   | 76.3               | 75.2   | 7382                  | 84.3   |
| 1998 | 10000.1           | 1300.0            | 96.1   | 85.1   | 94.5                                 | 83.2   | 87.8               | 77.0   | 8476                  | 96.8   |
| 1999 | 8131.9            | 1300.0            | 82.8   | 84.8   | 80.8                                 | 82.9   | 71.4               | 76.3   | 7164                  | 81.8   |
| 2000 | 9139.0            | 1300.0            | 86.6   | 85.0   | 85.1                                 | 83.1   | 80.0               | 76.7   | 7692                  | 87.6   |
| 2001 | 8593.2            | 1300.0            | 86.5   | 85.2   | 84.8                                 | 83.3   | 75.5               | 76.6   | 7375                  | 84.2   |
| 2002 | 10598.8           | 1300.0            | 95.3   | 86.1   | 95.1                                 | 84.4   | 93.1               | 78.1   | 8467                  | 96.7   |
| 2003 | 7708.3            | 1300.0            | 72.1   | 84.9   | 69.8                                 | 83.1   | 67.7               | 77.2   | 6406                  | 73.1   |
| 2004 | 9311.8            | 1300.0            | 85.0   | 84.9   | 84.5                                 | 83.2   | 81.5               | 77.6   | 7560                  | 86.1   |

## FR-65 CATTENOM-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 311.0  | 16.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX  |
| 01 Feb | 164.0  | 17.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 01 Mar | 178.0  | 15.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX  |
| 03 Mar | 10.0   | 13.0    | UF2  | A41  | STATIC EXCITATION SYSTEM                                 |
| 03 Mar | 23.0   | 11.0    | UP2  | A41  | STATIC EXCITATION SYSTEM                                 |
| 13 Mar | 103.0  | 12.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 01 Apr | 197.0  | 23.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 03 Apr | 30.0   | 39.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN         |
| 07 Apr | 26.0   | 14.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION  |
| 11 Apr | 30.0   | 40.0    | UF2  | A    | CONTROL AND ISOLATING VALVES                             |
| 01 May | 297.0  | 32.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 02 May | 109.0  | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 27 May | 20.0   | 6.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION  |
| 01 Jun | 321.0  | 24.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 01 Jun | 255.0  | 4.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 08 Jun | 18.0   | 3.0     | UP2  | A31  | THRUST BEARINGS-SHAFTING, BEARING BUSHES                 |
| 01 Jul | 278.0  | 5.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 01 Jul | 54.0   | 2.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX  |
| 15 Jul | 245.0  | 24.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                       |
| 16 Jul | 152.0  | 6.0     | UP2  | A31  | MAIN CONDENSER   |
| 22 Jul | 231.0  | 7.0     | UP2  | A31  | VIBRATION OF TURBOGENERATOR SET WITHOUT DAMAGE           |
| 10 Aug | 74.0   | 2.0     | UP2  | A31  | MAIN CONDENSER   |
| 13 Aug | 1114.0 | 1449.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                        |
| 28 Sep | 36.0   | 46.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                          |
| 28 Sep | 21.0   | 20.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                          |
| 30 Sep | 4.0    | 3.0     | UP2  | A32  | EXTRACION UNIT (PUMP,COUPLING,REDUCING FITTING)          |
| 01 Oct | 136.0  | 32.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                          |
| 01 Oct | 48.0   | 36.0    | UP2  | A33  | CIRCULATING PUMP   |
| 10 Oct | 184.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 11 Oct | 51.0   | 36.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX  |
| 01 Nov | 332.0  | 99.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                  |
| 01 Dec | 263.0  | 18.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1991 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 40        |          |  | 168       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1114            |           |          | 866                                      | 47        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 82                                       |           |          |
| E. Testing of plant systems or components  | 66              |           |          | 75                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 4         |          |
| Subtotal   | 1180            | 40        | 0        | 1023                                     | 220       | 0        |
| Total  |                 | 1220      |          |  | 1243      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1991 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 13                                       |
| 13. Reactor Auxiliary Systems                  |                 | 3  |
| 14. Safety Systems                             |                 | 49                                       |
| 16. Steam generation systems                   |                 | 4  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 31. Turbine and auxiliaries                    |                 | 26                                       |
| 32. Feedwater and Main Steam System            |                 | 19                                       |
| 41. Main Generator Systems                     | 10              | 24                                       |
| 42. Electrical Power Supply Systems            |                 | 10                                       |
| Total  | 10              | 151                                      |

# FR-40 CHINON-B-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 905.0 MW(e)  
**Design Net RUP:** 870.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6252.6 GW(e).h  
**Energy Availability Factor:** 83.7%  
**Load Factor:** 78.7%  
**Operating Factor:** 85.8%  
**Energy Unavailability Factor:** 16.3%  
**Total Off-line Time:** 1248 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 635.3 | 601.7 | 595.6 | 600.8 | 635.8 | 569.9 | 273.1 | 98.0 | 612.5 | 639.2 | 345.2 | 645.6 | 6252.6 |
| <b>EAF (%)</b>  | 99.0  | 99.2  | 93.1  | 98.8  | 98.8  | 98.8  | 51.9  | 15.7 | 98.7  | 98.3  | 54.9  | 98.1  | 83.7   |
| <b>UCF (%)</b>  | 99.0  | 99.2  | 93.1  | 98.8  | 98.8  | 98.8  | 51.9  | 15.7 | 98.8  | 98.3  | 54.9  | 98.1  | 83.7   |
| <b>LF (%)</b>   | 94.4  | 95.5  | 88.6  | 92.2  | 94.4  | 87.5  | 40.6  | 14.6 | 94.0  | 94.8  | 53.0  | 95.9  | 78.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 94.3  | 100.0 | 100.0 | 100.0 | 52.7  | 23.5 | 100.0 | 100.0 | 60.4  | 100.0 | 85.8   |
| <b>EUF (%)</b>  | 1.0   | 0.8   | 6.9   | 1.2   | 1.2   | 1.2   | 48.1  | 84.3 | 1.3   | 1.7   | 45.1  | 1.9   | 16.3   |
| <b>PUF (%)</b>  | 0.1   | 0.1   | 0.1   | 0.2   | 0.2   | 0.1   | 47.5  | 76.6 | 0.3   | 0.1   | 0.0   | 0.1   | 10.6   |
| <b>UCLF (%)</b> | 0.9   | 0.7   | 6.8   | 1.0   | 1.0   | 1.1   | 0.6   | 7.6  | 0.9   | 1.6   | 45.1  | 1.8   | 5.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1977  
**Date of First Criticality:** 28 Oct 1982  
**Date of Grid Connection:** 30 Nov 1982  
**Date of Commercial Operation:** 01 Feb 1984

**Lifetime Generation:** 124968.4 GW(e).h  
**Cumulative Energy Availability Factor:** 79.6%  
**Cumulative Load Factor:** 74.3%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 20.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3835.0         | 870.0          | 0.0  | 0.0    | 50.8                              | 100.0  | 50.3               | 0.0    | 6027               | 68.8   |
| 1984 | 4568.0         | 870.0          | 0.0  | 0.0    | 61.0                              | 100.0  | 59.8               | 0.0    | 5570               | 63.4   |
| 1985 | 5978.2         | 870.0          | 84.5   | 84.5   | 82.1                              | 82.1   | 78.4               | 78.4   | 7402               | 84.5   |
| 1986 | 6322.2         | 870.0          | 86.1   | 85.3   | 86.1                              | 84.1   | 83.0               | 80.7   | 7609               | 86.9   |
| 1987 | 4914.1         | 870.0          | 73.7   | 81.4   | 72.9                              | 80.4   | 64.5               | 75.3   | 6438               | 73.5   |
| 1988 | 5271.0         | 870.0          | 97.4   | 85.4   | 96.2                              | 84.3   | 69.0               | 73.7   | 7195               | 81.9   |
| 1989 | 4734.3         | 870.0          | 64.4   | 81.2   | 63.6                              | 80.2   | 62.1               | 71.4   | 5724               | 65.3   |
| 1990 | 5913.0         | 870.0          | 79.3   | 80.9   | 79.1                              | 80.0   | 77.6               | 72.4   | 7043               | 80.4   |
| 1991 | 5339.2         | 905.0          | 68.0   | 79.0   | 67.7                              | 78.2   | 67.3               | 71.7   | 6033               | 68.9   |
| 1992 | 5972.0         | 905.0          | 80.9   | 79.2   | 80.6                              | 78.5   | 75.1               | 72.1   | 7133               | 81.2   |
| 1993 | 5651.7         | 905.0          | 77.7   | 79.1   | 73.3                              | 77.9   | 71.3               | 72.0   | 6914               | 78.9   |
| 1994 | 5366.3         | 905.0          | 71.9   | 78.3   | 71.4                              | 77.2   | 67.7               | 71.6   | 6347               | 72.5   |
| 1995 | 6333.9         | 905.0          | 85.6   | 79.0   | 84.4                              | 77.9   | 79.9               | 72.4   | 7573               | 86.4   |
| 1996 | 6295.2         | 905.0          | 83.6   | 79.4   | 83.4                              | 78.4   | 79.2               | 72.9   | 7476               | 85.1   |
| 1997 | 6093.3         | 905.0          | 81.9   | 79.6   | 81.8                              | 78.6   | 76.9               | 73.2   | 7268               | 83.0   |
| 1998 | 6631.3         | 905.0          | 87.1   | 80.1   | 85.7                              | 79.1   | 83.6               | 74.0   | 7759               | 88.6   |
| 1999 | 6214.0         | 905.0          | 84.3   | 80.4   | 82.1                              | 79.3   | 78.4               | 74.3   | 7483               | 85.4   |
| 2000 | 6166.8         | 905.0          | 83.6   | 80.6   | 82.7                              | 79.6   | 77.6               | 74.5   | 7416               | 84.4   |
| 2001 | 5769.0         | 905.0          | 82.6   | 80.8   | 81.2                              | 79.7   | 72.8               | 74.4   | 7260               | 82.9   |
| 2002 | 6229.3         | 920.0          | 88.8   | 81.2   | 85.6                              | 80.0   | 77.3               | 74.6   | 7671               | 87.6   |
| 2003 | 5181.7         | 905.0          | 71.0   | 80.7   | 68.4                              | 79.4   | 65.4               | 74.1   | 6357               | 72.6   |
| 2004 | 6252.6         | 905.0          | 83.7   | 80.8   | 83.7                              | 79.6   | 78.7               | 74.3   | 7536               | 85.8   |

# FR-40 CHINON-B-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 2027.0 | 16.0    | UP2  | A31  | VARIOUS, CONDENSERS   |
| 14 Mar | 6.0    | 5.0     | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                   |
| 14 Mar | 8.0    | 7.0     | UF2  | A15  | PRIMARY PUMP  |
| 14 Mar | 11.0   | 10.0    | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 15 Mar | 13.0   | 12.0    | UF2  | A14  | STEAM GENERATOR EMERGENCY FEED SYSTEMS                        |
| 15 Mar | 4.0    | 4.0     | UF2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT    |
| 15 Mar | 22.0   | 2.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                        |
| 01 Apr | 695.0  | 6.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 03 Apr | 17.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 01 May | 735.0  | 6.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 01 Jun | 716.0  | 7.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 01 Jul | 387.0  | 4.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 17 Jul | 352.0  | 319.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 01 Aug | 487.0  | 440.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 21 Aug | 24.0   | 22.0    | PF   | C    | REFUELLING AND INSPECTION                                     |
| 22 Aug | 24.0   | 22.0    | UF2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                        |
| 23 Aug | 29.0   | 26.0    | UF2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)       |
| 24 Aug | 165.0  | 44.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 24 Aug | 6.0    | 5.0     | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 25 Aug | 5.0    | 3.0     | UP2  | A12  | PRIMARY COOLANT PREPARATION CONTROLLING.                      |
| 01 Sep | 24.0   | 1.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 02 Sep | 24.0   | 1.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 03 Sep | 658.0  | 6.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 01 Oct | 945.0  | 14.0    | UP2  | A31  | VARIOUS, CONDENSERS   |
| 03 Nov | 187.0  | 207.0   | UF2  | A14  | HP SAFETY INJECTION SYSTEM ACCUMULATORS (EXCL. CHARGING PUMP) |
| 03 Nov | 82.0   | 17.0    | UP2  | A14  | HP SAFETY INJECTION SYSTEM ACCUMULATORS (EXCL. CHARGING PUMP) |
| 15 Nov | 134.0  | 12.0    | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                        |
| 17 Nov | 97.0   | 88.0    | UF2  | A41  | HYDROGEN COOLING SYSTEM                                       |
| 01 Dec | 712.0  | 8.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 04 Dec | 22.0   | 4.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                        |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 350       |          |  | 362       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 863             |           |          | 1044                                     | 74        |          |
| E. Testing of plant systems or components  | 6               |           |          | 6  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 5         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 58        |          |
| Z. Others  |                 | 29        |          |  |           |          |
| Subtotal   | 869             | 379       | 0        | 1050                                     | 504       | 5        |
| Total  |                 | 1248      |          |  | 1559      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 6  |
| 12. Reactor I&C Systems                  | 6               | 6  |
| 13. Reactor Auxiliary Systems            |                 | 31                                       |
| 14. Safety Systems                       | 200             | 11                                       |
| 15. Reactor Cooling Systems              | 8               | 14                                       |
| 16. Steam generation systems             | 24              | 12                                       |
| 21. Fuel Handling and Storage Facilities |                 | 1  |
| 31. Turbine and auxiliaries              | 15              | 157                                      |
| 32. Feedwater and Main Steam System      |                 | 10                                       |
| 41. Main Generator Systems               | 97              | 32                                       |
| 42. Electrical Power Supply Systems      |                 | 33                                       |
| XX. Miscellaneous Systems                |                 | 6  |
| Total                                    | 350             | 319                                      |

**FR-41 CHINON-B-2**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 905.0 MW(e)  
 Design Net RUP: 870.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6133.4 GW(e).h  
 Energy Availability Factor: 80.6%  
 Load Factor: 77.2%  
 Operating Factor: 82.6%  
 Energy Unavailability Factor: 19.4%  
 Total Off-line Time: 1532 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 644.6 | 447.8 | 648.4 | 600.1 | 623.4 | 585.7 | 625.4 | 532.7 | 181.7 | 0.0   | 589.2 | 654.5 | 6133.4 |
| EAF (%)  | 99.6  | 72.3  | 99.5  | 94.2  | 97.1  | 96.6  | 99.4  | 84.9  | 33.0  | 0.0   | 91.0  | 99.3  | 80.6   |
| UCF (%)  | 99.8  | 72.3  | 99.5  | 96.5  | 97.1  | 96.7  | 99.4  | 84.9  | 33.0  | 0.0   | 91.7  | 99.9  | 80.9   |
| LF (%)   | 95.7  | 71.1  | 96.4  | 92.1  | 92.6  | 89.9  | 92.9  | 79.1  | 27.9  | 0.0   | 90.4  | 97.2  | 77.2   |
| OF (%)   | 100.0 | 72.8  | 100.0 | 97.1  | 100.0 | 100.0 | 100.0 | 86.7  | 33.6  | 0.0   | 100.0 | 100.0 | 82.6   |
| EUF (%)  | 0.4   | 27.7  | 0.5   | 5.8   | 2.9   | 3.4   | 0.6   | 15.1  | 67.0  | 100.0 | 9.0   | 0.7   | 19.4   |
| PUF (%)  | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.2   | 0.1   | 0.1   | 66.6  | 84.4  | 8.3   | 0.1   | 13.4   |
| UCLF (%) | 0.2   | 27.6  | 0.4   | 3.5   | 2.8   | 3.1   | 0.6   | 15.1  | 0.4   | 15.6  | 0.0   | 0.0   | 5.7    |
| XUF (%)  | 0.2   | 0.0   | 0.0   | 2.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 0.6   | 0.3    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Mar 1977      Lifetime Generation: 120170.9 GW(e).h  
 Date of First Criticality: 23 Sep 1983      Cumulative Energy Availability Factor: 79.3%  
 Date of Grid Connection: 29 Nov 1983      Cumulative Load Factor: 73.6%  
 Date of Commercial Operation: 01 Aug 1984      Cumulative Unit Capability Factor: 78.1%  
    Cumulative Energy Unavailability Factor: 20.7%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 1.0               | 870.0             | 0.0  | 0.0    | 90.2                                 | 100.0  | 0.0                | 0.0    | 212                   | 2.6    |
| 1984 | 5394.0            | 870.0             | 0.0  | 0.0    | 82.2                                 | 100.0  | 70.6               | 0.0    | 7226                  | 82.3   |
| 1985 | 5037.4            | 870.0             | 69.3   | 69.3   | 67.9                                 | 67.9   | 66.1               | 66.1   | 6201                  | 70.8   |
| 1986 | 6215.1            | 870.0             | 86.4   | 77.9   | 86.0                                 | 77.0   | 81.6               | 73.8   | 7639                  | 87.2   |
| 1987 | 5618.8            | 870.0             | 81.1   | 79.0   | 80.7                                 | 78.2   | 73.7               | 73.8   | 7171                  | 81.9   |
| 1988 | 4425.0            | 870.0             | 68.4   | 76.3   | 67.3                                 | 75.5   | 57.9               | 69.8   | 5731                  | 65.2   |
| 1989 | 6043.4            | 870.0             | 94.4   | 79.9   | 91.2                                 | 78.6   | 79.3               | 71.7   | 7873                  | 89.9   |
| 1990 | 5217.0            | 870.0             | 84.4   | 80.7   | 84.1                                 | 79.5   | 68.5               | 71.2   | 6714                  | 76.6   |
| 1991 | 3142.2            | 870.0             | 55.8   | 77.1   | 53.2                                 | 75.8   | 41.2               | 66.9   | 3921                  | 44.8   |
| 1992 | 6295.4            | 870.0             | 82.0   | 77.7   | 80.8                                 | 76.4   | 82.4               | 68.8   | 7321                  | 83.3   |
| 1993 | 5491.6            | 870.0             | 81.4   | 78.1   | 76.2                                 | 76.4   | 72.1               | 69.2   | 6867                  | 78.4   |
| 1994 | 6174.6            | 905.0             | 84.7   | 78.8   | 83.9                                 | 77.2   | 77.9               | 70.1   | 7407                  | 84.6   |
| 1995 | 6356.3            | 905.0             | 86.1   | 79.5   | 86.0                                 | 78.0   | 80.2               | 71.0   | 7741                  | 88.4   |
| 1996 | 5287.6            | 905.0             | 69.6   | 78.7   | 69.4                                 | 77.2   | 66.5               | 70.6   | 6206                  | 70.7   |
| 1997 | 6637.9            | 905.0             | 86.5   | 79.3   | 85.2                                 | 77.9   | 83.7               | 71.7   | 7622                  | 87.0   |
| 1998 | 6186.4            | 905.0             | 80.4   | 79.3   | 79.9                                 | 78.0   | 78.0               | 72.1   | 7136                  | 81.5   |
| 1999 | 5900.9            | 905.0             | 79.1   | 79.3   | 79.0                                 | 78.1   | 74.4               | 72.3   | 7075                  | 80.8   |
| 2000 | 6177.0            | 905.0             | 81.2   | 79.5   | 80.8                                 | 78.3   | 77.7               | 72.6   | 7260                  | 82.7   |
| 2001 | 6646.2            | 905.0             | 88.5   | 80.0   | 87.5                                 | 78.8   | 83.8               | 73.3   | 7846                  | 89.6   |
| 2002 | 6155.6            | 920.0             | 86.4   | 80.4   | 85.6                                 | 79.2   | 76.4               | 73.5   | 7404                  | 84.5   |
| 2003 | 5746.2            | 905.0             | 81.3   | 80.4   | 78.7                                 | 79.2   | 72.5               | 73.4   | 7163                  | 81.8   |
| 2004 | 6133.4            | 905.0             | 80.9   | 80.4   | 80.6                                 | 79.3   | 77.2               | 73.6   | 7252                  | 82.6   |



## FR-41 CHINON-B-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 268.0  | 1.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 03 Jan | 153.0  | 10.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 20 Jan | 12.0   | 1.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION                   |
| 06 Feb | 190.0  | 172.0   | UF2  | A15  | PRIMARY PUMP  |
| 06 Feb | 20.0   | 2.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 02 Mar | 150.0  | 5.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER                |
| 12 Mar | 298.0  | 1.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 29 Mar | 59.0   | 1.0     | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 01 Apr | 509.0  | 2.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 08 Apr | 123.0  | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER                |
| 08 Apr | 22.0   | 15.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION                   |
| 11 Apr | 21.0   | 19.0    | UF2  | A15  | PRIMARY SYSTEM  |
| 01 May | 401.0  | 16.0    | UP2  | A31  | VARIOUS, CONDENSERS   |
| 07 May | 251.0  | 2.0     | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 01 Jun | 699.0  | 20.0    | UP2  | A31  | VARIOUS, CONDENSERS   |
| 06 Jun | 21.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN                          |
| 01 Jul | 1361.0 | 10.0    | UP2  | A31  | VARIOUS, CONDENSERS   |
| 03 Aug | 27.0   | 25.0    | UF2  | A14  | HP SAFETY INJECTION SYSTEM ACCUMULATORS (EXCL. CHARGING PUMP)             |
| 04 Aug | 35.0   | 31.0    | UF2  | A15  | PRIMARY PUMP  |
| 06 Aug | 36.0   | 33.0    | UF2  | A31  | STEAM TURBINE THERMAL EXPANSION.  |
| 01 Sep | 239.0  | 2.0     | UP2  | A31  | VARIOUS, CONDENSERS   |
| 11 Sep | 1030.0 | 933.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION   |
| 24 Oct | 98.0   | 89.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                                       |
| 26 Oct | 18.0   | 16.0    | UF2  | A15  | PRIMARY PUMP  |
| 29 Oct | 66.0   | 59.0    | PF   | E    | START-UP TESTS AFTER REFUELLING   |
| 01 Nov | 232.0  | 46.0    | PP   | E    | START-UP TESTS AFTER REFUELLING   |
| 11 Nov | 382.0  | 4.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER                |
| 04 Dec | 111.0  | 12.0    | XP   | K    | LOAD VARIATION WITH REMOTE LOAD DISPATCH CONTROL AT REQUEST OF DISPATCHER |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 327       |          |  | 422       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1030            |           |          | 996                                      | 12        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 4  |           |          |
| E. Testing of plant systems or components  | 66              |           |          | 17                                       | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 6         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 13        | 58       |
| Z. Others  |                 | 98        |          |  |           |          |
| Subtotal   | 1096            | 425       | 0        | 1017                                     | 462       | 58       |
| Total  |                 | 1521      |          |  | 1537      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 17                                       |
| 12. Reactor I&C Systems                  |                 | 13                                       |
| 13. Reactor Auxiliary Systems            |                 | 24                                       |
| 14. Safety Systems                       | 27              | 33                                       |
| 15. Reactor Cooling Systems              | 264             | 63                                       |
| 16. Steam generation systems             |                 | 3  |
| 21. Fuel Handling and Storage Facilities |                 | 4  |
| 31. Turbine and auxiliaries              | 36              | 66                                       |
| 32. Feedwater and Main Steam System      |                 | 20                                       |
| 33. Circulating Water System             |                 | 4  |
| 35. All other I&C Systems                |                 | 1  |
| 41. Main Generator Systems               |                 | 9  |
| 42. Electrical Power Supply Systems      |                 | 68                                       |
| XX. Miscellaneous Systems                |                 | 3  |
| Total                                    | 327             | 328                                      |

**FR-56 CHINON-B-3**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 905.0 MW(e)  
 Design Net RUP: 905.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 5784.4 GW(e).h  
 Energy Availability Factor: 82.3%  
 Load Factor: 72.8%  
 Operating Factor: 84.7%  
 Energy Unavailability Factor: 17.7%  
 Total Off-line Time: 1340 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 474.0 | 595.2 | 608.2 | 610.7 | 599.2 | 65.2 | 229.9 | 547.6 | 517.9 | 497.4 | 527.5 | 511.6 | 5784.4 |
| EAF (%)  | 72.9  | 97.6  | 92.9  | 96.9  | 96.0  | 12.8 | 36.2  | 94.8  | 95.9  | 97.3  | 97.0  | 97.8  | 82.3   |
| UCF (%)  | 72.9  | 97.6  | 92.9  | 96.9  | 96.0  | 12.8 | 37.8  | 94.8  | 95.9  | 97.3  | 97.0  | 97.8  | 82.5   |
| LF (%)   | 70.4  | 94.5  | 90.4  | 93.7  | 89.0  | 10.0 | 34.1  | 81.3  | 79.5  | 73.8  | 81.0  | 76.0  | 72.8   |
| OF (%)   | 79.0  | 100.0 | 100.0 | 100.0 | 100.0 | 13.3 | 46.0  | 98.1  | 98.5  | 95.3  | 97.5  | 89.2  | 84.7   |
| EUF (%)  | 27.1  | 2.4   | 7.1   | 3.1   | 4.0   | 87.2 | 63.8  | 5.2   | 4.1   | 2.7   | 3.0   | 2.2   | 17.7   |
| PUF (%)  | 0.0   | 0.1   | 0.1   | 0.2   | 0.0   | 86.7 | 41.8  | 0.1   | 0.0   | 0.1   | 0.1   | 0.1   | 10.7   |
| UCLF (%) | 27.1  | 2.3   | 7.0   | 2.9   | 4.0   | 0.6  | 20.5  | 5.2   | 4.0   | 2.6   | 2.9   | 2.1   | 6.8    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 1.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Oct 1980  
 Date of First Criticality: 18 Sep 1986  
 Date of Grid Connection: 20 Oct 1986  
 Date of Commercial Operation: 04 Mar 1987

Lifetime Generation: 104274.8 GW(e).h  
 Cumulative Energy Availability Factor: 79.6%  
 Cumulative Load Factor: 73.8%  
 Cumulative Unit Capability Factor: 78.6%  
 Cumulative Energy Unavailability Factor: 20.4%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1986 | 596.8             | 896.0             | 0.0  | 0.0    | 87.5                                 | 100.0  | 8.0                | 0.0    | 1190                  | 14.4   |
| 1987 | 4120.6            | 870.0             | 0.0  | 0.0    | 66.7                                 | 100.0  | 54.1               | 0.0    | 5311                  | 60.6   |
| 1988 | 4413.0            | 905.0             | 61.5   | 61.5   | 58.9                                 | 58.9   | 55.5               | 55.5   | 5354                  | 61.0   |
| 1989 | 5028.6            | 905.0             | 81.2   | 71.3   | 77.8                                 | 68.3   | 63.4               | 59.5   | 6125                  | 69.9   |
| 1990 | 5417.6            | 905.0             | 69.2   | 70.6   | 69.1                                 | 68.6   | 68.3               | 62.4   | 6274                  | 71.6   |
| 1991 | 7026.4            | 905.0             | 92.9   | 76.2   | 90.7                                 | 74.1   | 88.6               | 69.0   | 8204                  | 93.7   |
| 1992 | 6091.5            | 905.0             | 87.5   | 78.4   | 85.6                                 | 76.4   | 76.6               | 70.5   | 7468                  | 85.0   |
| 1993 | 5600.7            | 905.0             | 78.3   | 78.4   | 72.6                                 | 75.8   | 70.6               | 70.5   | 6827                  | 77.9   |
| 1994 | 5064.0            | 905.0             | 76.2   | 78.1   | 75.5                                 | 75.7   | 63.9               | 69.6   | 6325                  | 72.2   |
| 1995 | 6005.6            | 905.0             | 83.3   | 78.8   | 82.5                                 | 76.6   | 75.8               | 70.3   | 7177                  | 81.9   |
| 1996 | 6278.0            | 905.0             | 87.2   | 79.7   | 86.9                                 | 77.7   | 79.0               | 71.3   | 7761                  | 88.4   |
| 1997 | 5816.8            | 905.0             | 85.1   | 80.2   | 85.1                                 | 78.5   | 73.4               | 71.5   | 7249                  | 82.8   |
| 1998 | 6345.6            | 905.0             | 84.1   | 80.6   | 81.3                                 | 78.7   | 80.0               | 72.3   | 7472                  | 85.3   |
| 1999 | 5602.0            | 905.0             | 74.8   | 80.1   | 72.2                                 | 78.2   | 70.7               | 72.2   | 6656                  | 76.0   |
| 2000 | 6330.1            | 905.0             | 83.1   | 80.3   | 82.5                                 | 78.5   | 79.6               | 72.7   | 7386                  | 84.1   |
| 2001 | 6318.0            | 905.0             | 87.0   | 80.8   | 84.8                                 | 79.0   | 79.7               | 73.2   | 7665                  | 87.5   |
| 2002 | 6720.4            | 920.0             | 90.1   | 81.4   | 87.6                                 | 79.5   | 83.4               | 73.9   | 7971                  | 91.0   |
| 2003 | 5807.7            | 905.0             | 77.7   | 81.2   | 77.6                                 | 79.4   | 73.3               | 73.9   | 6954                  | 79.4   |
| 2004 | 5784.4            | 905.0             | 82.5   | 81.3   | 82.3                                 | 79.6   | 72.8               | 73.8   | 7444                  | 84.7   |

## FR-56 CHINON-B-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 14.0   | 2.0     | UP2  | A41  | ALTERNATOR STATOR   |
| 01 Jan | 111.0  | 101.0   | UF2  | A41  | ALTERNATOR STATOR   |
| 05 Jan | 13.0   | 12.0    | UF2  | A34  | AUXILIARY STEAM/SUPERHEATED WATER DISTRIBUTION SYSTEM     |
| 06 Jan | 6.0    | 5.0     | UF2  | A41  | STATOR BAR WATER COOLING CIRCUIT                          |
| 07 Jan | 568.0  | 37.0    | UP2  | A31  | VARIOUS, CONDENSERS                                       |
| 08 Jan | 9.0    | 8.0     | UF2  | L    | HUMAN OPERATING ERRORS                                    |
| 09 Jan | 16.0   | 15.0    | UF2  | A16  | BLOWDOWNS AND MISCELLANEOUS SYSTEM                        |
| 01 Feb | 2119.0 | 81.0    | UP2  | A31  | VARIOUS, CONDENSERS                                       |
| 03 Apr | 25.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN          |
| 01 May | 740.0  | 27.0    | UP2  | A31  | VARIOUS, CONDENSERS                                       |
| 01 Jun | 96.0   | 4.0     | UP2  | A31  | VARIOUS, CONDENSERS                                       |
| 05 Jun | 862.0  | 781.0   | PF   | C    | REFUELLING WITH NO INSPECTION                             |
| 11 Jul | 75.0   | 68.0    | UF3  | Z    | INDUSTRIAL ACTION DURING PROGRAMMED OUTAGE, EXTENSION     |
| 14 Jul | 27.0   | 24.0    | UF2  | A11  | VESSEL AND VESSEL HEAD                                    |
| 15 Jul | 41.0   | 37.0    | UF2  | A13  | CHEMICAL AND VOLUME CONTROL SYSTEM WITHOUT PUMP           |
| 16 Jul | 12.0   | 11.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES |
| 17 Jul | 231.0  | 54.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                           |
| 17 Jul | 7.0    | 6.0     | UF2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)   |
| 17 Jul | 10.0   | 9.0     | PF   | E    | START-UP TESTS AFTER REFUELLING                           |
| 27 Jul | 811.0  | 22.0    | UP2  | A31  | VARIOUS, CONDENSERS                                       |
| 13 Aug | 6.0    | 5.0     | UF2  | A31  | STEAM VALVES  |
| 24 Aug | 8.0    | 8.0     | UF2  | L    | HUMAN OPERATING ERRORS                                    |
| 01 Sep | 688.0  | 12.0    | UP2  | A31  | VARIOUS, CONDENSERS                                       |
| 13 Sep | 11.0   | 10.0    | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                            |
| 01 Oct | 1407.0 | 39.0    | UP2  | A31  | VARIOUS, CONDENSERS                                       |
| 21 Nov | 11.0   | 4.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)  |
| 01 Dec | 633.0  | 11.0    | UP2  | A31  | VARIOUS, CONDENSERS                                       |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 231       |          |  | 354       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 862             |           |          | 914                                      | 40        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 48                                       |           |          |
| E. Testing of plant systems or components  | 10              |           |          | 42                                       | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 13        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 22        |          |
| L. Human factor related  |                 | 17        |          |  |           |          |
| Z. Others  |                 | 82        |          |  | 0         |          |
| Subtotal   | 872             | 330       | 0        | 1004                                     | 435       | 0        |
| Total  |                 | 1202      |          |  | 1439      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              | 27              | 28                                       |
| 12. Reactor I&C Systems                  |                 | 6  |
| 13. Reactor Auxiliary Systems            | 41              | 43                                       |
| 14. Safety Systems                       |                 | 2  |
| 15. Reactor Cooling Systems              |                 | 39                                       |
| 16. Steam generation systems             | 16              |  |
| 21. Fuel Handling and Storage Facilities |                 | 1  |
| 31. Turbine and auxiliaries              | 17              | 81                                       |
| 32. Feedwater and Main Steam System      |                 | 35                                       |
| 33. Circulating Water System             |                 | 4  |
| 41. Main Generator Systems               | 117             | 33                                       |
| 42. Electrical Power Supply Systems      |                 | 8  |
| XX. Miscellaneous Systems                | 13              |  |
| Total                                    | 231             | 280                                      |

# FR-57 CHINON-B-4

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 905.0 MW(e)  
**Design Net RUP:** 905.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5513.2 GW(e).h  
**Energy Availability Factor:** 74.9%  
**Load Factor:** 69.4%  
**Operating Factor:** 78.4%  
**Energy Unavailability Factor:** 25.1%  
**Total Off-line Time:** 1901 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 640.5 | 550.1 | 311.0 | 0.0   | 152.2 | 289.8 | 551.6 | 611.0 | 597.5 | 610.2 | 593.5 | 605.7 | 5513.2 |
| <b>EAF (%)</b>  | 98.7  | 98.3  | 57.9  | 0.0   | 24.5  | 51.0  | 87.7  | 97.6  | 97.7  | 96.3  | 95.0  | 93.6  | 74.9   |
| <b>UCF (%)</b>  | 98.7  | 98.3  | 57.9  | 0.0   | 24.5  | 53.3  | 88.3  | 97.6  | 97.7  | 96.3  | 95.0  | 93.6  | 75.1   |
| <b>LF (%)</b>   | 95.1  | 87.3  | 46.3  | 0.0   | 22.6  | 44.5  | 81.9  | 90.7  | 91.7  | 90.5  | 91.1  | 90.0  | 69.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 61.8  | 0.0   | 35.3  | 54.0  | 90.9  | 100.0 | 100.0 | 100.0 | 99.6  | 98.1  | 78.4   |
| <b>EUF (%)</b>  | 1.3   | 1.7   | 42.1  | 100.0 | 75.5  | 49.0  | 12.3  | 2.4   | 2.3   | 3.7   | 5.0   | 6.4   | 25.1   |
| <b>PUF (%)</b>  | 0.1   | 0.0   | 38.7  | 100.0 | 23.0  | 0.0   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 13.5   |
| <b>UCLF (%)</b> | 1.3   | 1.7   | 3.4   | 0.0   | 52.5  | 46.7  | 11.7  | 2.3   | 2.2   | 3.6   | 4.9   | 6.4   | 11.4   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.3   | 0.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1981      **Lifetime Generation:** 99987.9 GW(e).h  
**Date of First Criticality:** 13 Oct 1987      **Cumulative Energy Availability Factor:** 80.5%  
**Date of Grid Connection:** 14 Nov 1987      **Cumulative Load Factor:** 75.3%  
**Date of Commercial Operation:** 01 Apr 1988      **Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 19.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 13.0           | 899.0          | 0.0  | 0.0    | 86.9                              | 100.0  | 0.2                | 0.0    | 236                | 2.8    |
| 1988 | 4410.0         | 905.0          | 0.0  | 0.0    | 77.9                              | 100.0  | 55.5               | 0.0    | 5897               | 67.1   |
| 1989 | 4688.1         | 905.0          | 63.6   | 63.6   | 60.4                              | 60.4   | 59.1               | 59.1   | 5664               | 64.7   |
| 1990 | 6098.0         | 905.0          | 77.2   | 70.4   | 77.0                              | 68.7   | 76.9               | 68.0   | 7003               | 79.9   |
| 1991 | 6340.0         | 905.0          | 80.0   | 73.6   | 79.2                              | 72.2   | 80.0               | 72.0   | 7204               | 82.2   |
| 1992 | 6388.0         | 905.0          | 85.0   | 76.5   | 82.8                              | 74.9   | 80.4               | 74.1   | 7544               | 85.9   |
| 1993 | 6016.9         | 905.0          | 85.8   | 78.3   | 80.1                              | 75.9   | 75.9               | 74.5   | 7359               | 84.0   |
| 1994 | 5935.1         | 905.0          | 82.4   | 79.0   | 81.2                              | 76.8   | 74.9               | 74.5   | 7196               | 82.1   |
| 1995 | 6566.0         | 905.0          | 88.2   | 80.3   | 87.9                              | 78.4   | 82.8               | 75.7   | 7805               | 89.1   |
| 1996 | 6574.2         | 905.0          | 87.6   | 81.2   | 87.0                              | 79.5   | 82.7               | 76.6   | 7764               | 88.4   |
| 1997 | 6345.4         | 905.0          | 88.7   | 82.1   | 85.6                              | 80.2   | 80.0               | 77.0   | 7795               | 89.0   |
| 1998 | 5940.1         | 905.0          | 83.1   | 82.2   | 80.2                              | 80.2   | 74.9               | 76.8   | 7326               | 83.6   |
| 1999 | 5596.3         | 905.0          | 89.9   | 82.9   | 88.2                              | 80.9   | 70.6               | 76.2   | 7059               | 80.6   |
| 2000 | 5110.7         | 905.0          | 74.1   | 82.1   | 72.9                              | 80.2   | 64.3               | 75.2   | 6445               | 73.4   |
| 2001 | 5765.0         | 905.0          | 81.3   | 82.1   | 79.9                              | 80.2   | 72.7               | 75.0   | 7078               | 80.8   |
| 2002 | 6321.3         | 920.0          | 85.8   | 82.3   | 84.3                              | 80.5   | 78.4               | 75.3   | 7584               | 86.6   |
| 2003 | 6431.8         | 905.0          | 87.7   | 82.7   | 86.6                              | 80.9   | 81.1               | 75.7   | 7811               | 89.2   |
| 2004 | 5513.2         | 905.0          | 75.1   | 82.2   | 74.9                              | 80.5   | 69.4               | 75.3   | 6883               | 78.4   |

## FR-57 CHINON-B-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1787.0 | 26.0    | UP2  | A31  | VARIOUS, CONDENSERS  |
| 17 Mar | 49.0   | 16.0    | UP2  | A32  | CHEMICAL CHARACTERISTICS OF THE SECONDARY SYSTEM           |
| 19 Mar | 1100.0 | 997.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 05 May | 285.0  | 260.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                        |
| 17 May | 67.0   | 60.0    | UF2  | A31  | MAIN CONDENSER   |
| 19 May | 147.0  | 66.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 26 May | 87.0   | 3.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 29 May | 291.0  | 263.0   | UF2  | A41  | ALTERNATOR BEARINGS AND SHAFT LINE                         |
| 29 May | 25.0   | 5.0     | UP2  | A41  | ALTERNATOR BEARINGS AND SHAFT LINE                         |
| 11 Jun | 18.0   | 16.0    | UF2  | A41  | HYDROGEN COOLING SYSTEM                                    |
| 12 Jun | 24.0   | 22.0    | UF2  | A34  | WATER PURIFICATION AND TREATMENT                           |
| 13 Jun | 103.0  | 1.0     | UP2  | A31  | VARIOUS, CONDENSERS  |
| 18 Jun | 183.0  | 6.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 19 Jun | 33.0   | 3.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 21 Jun | 24.0   | 15.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 29 Jun | 28.0   | 25.0    | UF2  | A32  | HIGH-PRESSURE HEATING                                      |
| 01 Jul | 69.0   | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Jul | 16.0   | 15.0    | UF2  | L    | HUMAN OPERATING ERRORS                                     |
| 02 Jul | 43.0   | 4.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 07 Jul | 4134.0 | 118.0   | UP2  | A31  | VARIOUS, CONDENSERS  |
| 16 Jul | 52.0   | 47.0    | UF2  | A33  | CIRCULATING PUMP   |
| 19 Jul | 14.0   | 6.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 28 Nov | 3.0    | 3.0     | UF2  | A31  | STEAM VALVES   |
| 31 Dec | 14.0   | 13.0    | UF2  | K    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)    |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 483       |          |  | 311       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1100            |           |          | 767                                      | 116       |          |
| E. Testing of plant systems or components  |                 |           |          | 36                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 | 14        |          | 0  | 25        | 31       |
| L. Human factor related  |                 | 16        |          |  |           |          |
| R. External restrictions on supply and services (lack of funds due to delayed payments from customers, disputes in fuel industries, fuel-rationing, labour strike outside the plant , spare part delivery problems etc.) |                 |           |          |  | 8         |          |
| Z. Others  |                 | 285       |          |  |           |          |
| Subtotal   | 1100            | 798       | 0        | 803                                      | 460       | 31       |
| Total  |                 | 1898      |          |  | 1294      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 18                                       |
| 12. Reactor I&C Systems             |                 | 20                                       |
| 13. Reactor Auxiliary Systems       |                 | 42                                       |
| 14. Safety Systems                  |                 | 8  |
| 15. Reactor Cooling Systems         |                 | 69                                       |
| 16. Steam generation systems        |                 | 2  |
| 31. Turbine and auxiliaries         | 70              | 30                                       |
| 32. Feedwater and Main Steam System | 28              | 16                                       |
| 33. Circulating Water System        | 52              | 6  |
| 41. Main Generator Systems          | 309             | 44                                       |
| 42. Electrical Power Supply Systems |                 | 19                                       |
| XX. Miscellaneous Systems           | 24              | 0  |
| Total                               | 483             | 274                                      |

# FR-62 CHOOZ-B-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1500.0 MW(e)  
**Design Net RUP:** 1455.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10671.1 GW(e).h  
**Energy Availability Factor:** 83.6%  
**Load Factor:** 81.0%  
**Operating Factor:** 87.2%  
**Energy Unavailability Factor:** 16.4%  
**Total Off-line Time:** 1127 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|-------|-------|---------|
| <b>GW(e).h</b>  | 969.6 | 165.2 | 382.6 | 1028.8 | 1102.9 | 1013.7 | 1074.2 | 1003.1 | 1053.4 | 1035.5 | 953.8 | 888.2 | 10671.1 |
| <b>EAF (%)</b>  | 86.9  | 16.4  | 35.6  | 96.4   | 100.0  | 99.4   | 99.4   | 92.4   | 99.6   | 99.8   | 94.9  | 79.7  | 83.6    |
| <b>UCF (%)</b>  | 100.0 | 21.0  | 35.6  | 96.4   | 100.0  | 100.0  | 99.4   | 92.8   | 99.8   | 99.9   | 100.0 | 92.3  | 86.7    |
| <b>LF (%)</b>   | 86.9  | 15.8  | 34.3  | 95.3   | 98.8   | 93.9   | 96.3   | 89.9   | 97.5   | 92.7   | 88.3  | 79.6  | 81.0    |
| <b>OF (%)</b>   | 100.0 | 21.0  | 45.5  | 96.7   | 100.0  | 100.0  | 100.0  | 93.5   | 100.0  | 96.2   | 93.8  | 96.4  | 87.2    |
| <b>EUF (%)</b>  | 13.1  | 83.6  | 64.4  | 3.6    | 0.0    | 0.6    | 0.6    | 7.6    | 0.4    | 0.2    | 5.1   | 20.3  | 16.4    |
| <b>PUF (%)</b>  | 0.0   | 79.0  | 29.7  | 0.0    | 0.0    | 0.0    | 0.0    | 6.9    | 0.0    | 0.1    | 0.0   | 0.0   | 9.4     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 34.7  | 3.6    | 0.0    | 0.0    | 0.6    | 0.2    | 0.2    | 0.0    | 0.0   | 7.7   | 4.0     |
| <b>XUF (%)</b>  | 13.1  | 4.6   | 0.0   | 0.0    | 0.0    | 0.6    | 0.1    | 0.4    | 0.2    | 0.1    | 5.1   | 12.7  | 3.1     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1984  
**Date of First Criticality:** 25 Jul 1996  
**Date of Grid Connection:** 30 Aug 1996  
**Date of Commercial Operation:** 15 May 2000

**Lifetime Generation:** 60134.1 GW(e).h  
**Cumulative Energy Availability Factor:** 81.3%  
**Cumulative Load Factor:** 76.7%  
**Cumulative Unit Capability Factor:** 83.7%  
**Cumulative Energy Unavailability Factor:** 18.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1997 | 5785.0         | 1455.0         | 0.0  | 0.0    | 45.4                              | 100.0  | 45.4               | 0.0    | 5063               | 57.8   |
| 1998 | 1540.5         | 1455.0         | 0.0  | 0.0    | 11.8                              | 100.0  | 12.1               | 0.0    | 1034               | 11.8   |
| 1999 | 4886.6         | 1455.0         | 0.0  | 0.0    | 38.2                              | 100.0  | 38.3               | 0.0    | 3617               | 41.3   |
| 2000 | 8429.2         | 1455.0         | 0.0  | 0.0    | 65.8                              | 100.0  | 66.0               | 0.0    | 5877               | 66.9   |
| 2001 | 9524.4         | 1455.0         | 78.0   | 78.0   | 75.0                              | 75.0   | 74.7               | 74.7   | 6800               | 77.6   |
| 2002 | 9515.1         | 1455.0         | 82.4   | 80.2   | 81.0                              | 78.0   | 74.7               | 74.7   | 6807               | 77.7   |
| 2003 | 10021.9        | 1500.0         | 89.4   | 83.3   | 85.6                              | 80.6   | 76.3               | 75.2   | 7219               | 82.4   |
| 2004 | 10671.1        | 1500.0         | 86.7   | 84.2   | 83.6                              | 81.3   | 81.0               | 76.7   | 7657               | 87.2   |

## FR-62 CHOOZ-B-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 890.0  | 194.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                              |
| 07 Feb | 750.0  | 1125.0  | PF   | C    | REFUELLING WITH NO INSPECTION                                   |
| 07 Mar | 24.0   | 36.0    | PF   | C    | REFUELLING AND INSPECTION                                       |
| 08 Mar | 195.0  | 299.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                             |
| 16 Mar | 21.0   | 31.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                                 |
| 16 Mar | 114.0  | 47.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                 |
| 20 Mar | 65.0   | 26.0    | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                    |
| 20 Mar | 37.0   | 56.0    | UF2  | A31  | MOISTURE SEPARATOR-REHEATERS                                    |
| 24 Mar | 18.0   | 6.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)        |
| 01 Apr | 491.0  | 13.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 18 Apr | 24.0   | 35.0    | UF2  | A34  | FIRE SYSTEM   |
| 18 Apr | 12.0   | 2.0     | UP2  | A34  | FIRE SYSTEM   |
| 01 May | 549.0  | 12.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 01 Jun | 471.0  | 46.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 03 Jun | 138.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS           |
| 01 Jul | 435.0  | 30.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 23 Jul | 163.0  | 7.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                  |
| 01 Aug | 443.0  | 25.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 01 Aug | 218.0  | 4.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS           |
| 14 Aug | 48.0   | 72.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN                |
| 01 Sep | 179.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS           |
| 02 Sep | 428.0  | 18.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 07 Sep | 14.0   | 2.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                  |
| 01 Oct | 62.0   | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS           |
| 01 Oct | 481.0  | 36.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 01 Nov | 57.0   | 2.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX         |
| 02 Nov | 110.0  | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS           |
| 11 Nov | 45.0   | 67.0    | XP   | K    | OUTAGE AGREED WITH INTERREGIONAL ELECTRICITY DISPATCHING CENTRE |
| 13 Nov | 1151.0 | 195.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                              |
| 03 Dec | 28.0   | 41.0    | UF2  | L    | HUMAN ERRORS DURING TESTING                                     |
| 03 Dec | 62.0   | 44.0    | UP2  | L    | HUMAN ERRORS DURING TESTING                                     |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1997 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 61        |          |  | 1226      |          |
| C. Inspection, maintenance or repair combined with refuelling  | 774             |           |          | 284                                      |           |          |
| E. Testing of plant systems or components  | 69              |           |          | 208                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  |           | 11       |
| L. Human factor related  |                 | 28        |          |  | 1         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 22       |
| Z. Others  |                 | 195       |          |  |           |          |
| Subtotal   | 843             | 284       | 0        | 492                                      | 1227      | 33       |
| Total  |                 | 1127      |          |  | 1752      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1997 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 6  |
| 12. Reactor I&C Systems             |                 | 110                                      |
| 13. Reactor Auxiliary Systems       |                 | 36                                       |
| 15. Reactor Cooling Systems         |                 | 111                                      |
| 31. Turbine and auxiliaries         | 37              | 876                                      |
| 32. Feedwater and Main Steam System |                 | 2  |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 12                                       |
| XX. Miscellaneous Systems           | 24              | 2  |
| Total                               | 61              | 1155                                     |

# FR-70 CHOOZ-B-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1500.0 MW(e)  
**Design Net RUP:** 1455.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10063.9 GW(e).h  
**Energy Availability Factor:** 80.1%  
**Load Factor:** 76.4%  
**Operating Factor:** 80.4%  
**Energy Unavailability Factor:** 19.9%  
**Total Off-line Time:** 1723 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb    | Mar    | Apr   | May   | Jun   | Jul    | Aug   | Sep   | Oct   | Nov    | Dec    | Annual  |
|-----------------|--------|--------|--------|-------|-------|-------|--------|-------|-------|-------|--------|--------|---------|
| <b>GW(e).h</b>  | 1108.7 | 1040.2 | 1039.1 | 679.2 | 0.0   | 840.9 | 1078.0 | 905.2 | 265.3 | 991.8 | 1055.8 | 1059.7 | 10063.9 |
| <b>EAF (%)</b>  | 99.9   | 100.0  | 93.2   | 63.2  | 0.0   | 78.9  | 99.9   | 98.7  | 36.6  | 91.1  | 100.0  | 100.0  | 80.1    |
| <b>UCF (%)</b>  | 99.9   | 100.0  | 100.0  | 77.1  | 0.0   | 80.0  | 100.0  | 100.0 | 100.0 | 100.0 | 100.0  | 100.0  | 88.0    |
| <b>LF (%)</b>   | 99.3   | 99.6   | 93.2   | 62.9  | 0.0   | 77.9  | 96.6   | 81.1  | 24.6  | 88.8  | 97.8   | 95.0   | 76.4    |
| <b>OF (%)</b>   | 100.0  | 100.0  | 100.0  | 77.1  | 0.0   | 87.4  | 99.9   | 86.4  | 27.6  | 91.1  | 100.0  | 95.4   | 80.4    |
| <b>EUF (%)</b>  | 0.1    | 0.0    | 6.8    | 36.8  | 100.0 | 21.1  | 0.1    | 1.3   | 63.4  | 8.9   | 0.0    | 0.0    | 19.9    |
| <b>PUF (%)</b>  | 0.1    | 0.0    | 0.0    | 22.9  | 77.2  | 5.6   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 8.9     |
| <b>UCLF (%)</b> | 0.0    | 0.0    | 0.0    | 0.0   | 22.8  | 14.4  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 3.1     |
| <b>XUF (%)</b>  | 0.0    | 0.0    | 6.8    | 13.9  | 0.0   | 1.1   | 0.1    | 1.3   | 63.4  | 8.9   | 0.0    | 0.0    | 7.9     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 31 Dec 1985  
**Date of First Criticality:** 10 Mar 1997  
**Date of Grid Connection:** 10 Apr 1997  
**Date of Commercial Operation:** 29 Sep 2000

**Lifetime Generation:** 57796.8 GW(e).h  
**Cumulative Energy Availability Factor:** 81.3%  
**Cumulative Load Factor:** 78.2%  
**Cumulative Unit Capability Factor:** 83.7%  
**Cumulative Energy Unavailability Factor:** 18.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1997 | 2960.3         | 1455.0         | 0.0  | 0.0    | 51.0                              | 100.0  | 23.2               | 0.0    | 2997               | 34.2   |
| 1998 | 86.3           | 1455.0         | 0.0  | 0.0    | 1.1                               | 100.0  | 0.7                | 0.0    | 172                | 2.0    |
| 1999 | 7308.7         | 1455.0         | 0.0  | 0.0    | 56.8                              | 100.0  | 57.3               | 0.0    | 5267               | 60.1   |
| 2000 | 7213.4         | 1455.0         | 0.0  | 0.0    | 56.0                              | 100.0  | 56.4               | 0.0    | 5347               | 60.9   |
| 2001 | 10159.5        | 1455.0         | 83.4   | 83.4   | 80.4                              | 80.4   | 79.7               | 79.7   | 7221               | 82.4   |
| 2002 | 9814.8         | 1455.0         | 83.0   | 83.2   | 81.5                              | 80.9   | 77.0               | 78.4   | 7240               | 82.6   |
| 2003 | 10472.8        | 1500.0         | 87.6   | 84.7   | 83.3                              | 81.7   | 79.7               | 78.8   | 7457               | 85.1   |
| 2004 | 10063.9        | 1500.0         | 88.0   | 85.6   | 80.1                              | 81.3   | 76.4               | 78.2   | 7061               | 80.4   |



## FR-70 CHOOZ-B-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 434.0  | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 09 Jan | 15.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN                          |
| 01 Feb | 339.0  | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 02 Mar | 1287.0 | 226.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT  |
| 24 Apr | 716.0  | 1075.0  | PF   | C    | REFUELLING WITH NO INSPECTION   |
| 24 May | 112.0  | 168.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                                       |
| 28 May | 22.0   | 33.0    | PF   | E    | START-UP TESTS AFTER REFUELLING   |
| 29 May | 58.0   | 86.0    | UF2  | A31  | BYPASS DEPRESSURIZATION COOLING   |
| 01 Jun | 91.0   | 137.0   | UF2  | A31  | BYPASS DEPRESSURIZATION COOLING   |
| 04 Jun | 115.0  | 60.0    | PP   | E    | START-UP TESTS AFTER REFUELLING   |
| 09 Jun | 163.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS                     |
| 13 Jun | 151.0  | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 15 Jun | 120.0  | 11.0    | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS  |
| 24 Jun | 14.0   | 10.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION                   |
| 01 Jul | 632.0  | 36.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 01 Aug | 404.0  | 76.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                                   |
| 03 Aug | 197.0  | 4.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS                     |
| 14 Aug | 11.0   | 11.0    | XP   | E    | LOAD LIMITATION OR SHUTDOWN FOR EXTERNAL THERMAL PRODUCTION SERVICE TESTS |
| 03 Sep | 116.0  | 5.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 04 Sep | 15.0   | 12.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                                   |
| 11 Sep | 522.0  | 783.0   | XF   | K    | OUTAGE AGREED WITH INTERREGIONAL ELECTRICITY DISPATCHING CENTRE           |
| 03 Oct | 397.0  | 20.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                                   |
| 04 Oct | 99.0   | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS                     |
| 01 Nov | 522.0  | 26.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 01 Dec | 162.0  | 2.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 25 Dec | 34.0   | 51.0    | XP   | K    | OUTAGE AGREED WITH INTERREGIONAL ELECTRICITY DISPATCHING CENTRE           |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1997 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 149       |          |  | 1257      |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 716             |           |          | 265                                      |           |          |
| E. Testing of plant systems or components  | 22              |           |          | 180                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           | 522      |  |           | 43       |
| Z. Others  |                 | 112       |          |  |           |          |
| Subtotal   | 738             | 261       | 522      | 445                                      | 1257      | 43       |
| Total  |                 | 1521      |          |  | 1745      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1997 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 133                                      |
| 13. Reactor Auxiliary Systems       |                 | 83                                       |
| 15. Reactor Cooling Systems         |                 | 15                                       |
| 31. Turbine and auxiliaries         | 149             | 855                                      |
| 32. Feedwater and Main Steam System |                 | 0  |
| 33. Circulating Water System        |                 | 74                                       |
| 41. Main Generator Systems          |                 | 15                                       |
| 42. Electrical Power Supply Systems |                 | 18                                       |
| XX. Miscellaneous Systems           |                 | 30                                       |
| Total                               | 149             | 1223                                     |

# FR-72 CIVAUX-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1495.0 MW(e)  
**Design Net RUP:** 1450.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 11276.5 GW(e).h  
**Energy Availability Factor:** 86.9%  
**Load Factor:** 85.9%  
**Operating Factor:** 89.0%  
**Energy Unavailability Factor:** 13.1%  
**Total Off-line Time:** 968 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb   | Mar    | Apr    | May    | Jun   | Jul   | Aug   | Sep    | Oct    | Nov    | Dec    | Annual  |
|-----------------|--------|-------|--------|--------|--------|-------|-------|-------|--------|--------|--------|--------|---------|
| <b>GW(e).h</b>  | 1117.8 | 994.1 | 1117.5 | 1047.2 | 1014.5 | 507.5 | 128.0 | 993.8 | 1066.1 | 1114.7 | 1091.2 | 1084.2 | 11276.5 |
| <b>EAF (%)</b>  | 99.4   | 94.6  | 99.7   | 97.3   | 96.6   | 58.4  | 13.2  | 89.6  | 98.9   | 99.8   | 100.0  | 96.2   | 86.9    |
| <b>UCF (%)</b>  | 99.4   | 94.6  | 99.7   | 97.3   | 97.9   | 58.9  | 13.2  | 99.3  | 100.0  | 100.0  | 100.0  | 96.2   | 88.0    |
| <b>LF (%)</b>   | 100.5  | 95.5  | 100.6  | 97.3   | 91.2   | 47.1  | 11.5  | 89.3  | 99.0   | 100.1  | 101.4  | 97.5   | 85.9    |
| <b>OF (%)</b>   | 99.6   | 96.8  | 100.0  | 100.0  | 100.0  | 60.1  | 21.9  | 93.4  | 100.0  | 100.0  | 100.0  | 96.5   | 89.0    |
| <b>EUF (%)</b>  | 0.6    | 5.4   | 0.3    | 2.7    | 3.4    | 41.6  | 86.8  | 10.4  | 1.1    | 0.2    | 0.0    | 3.8    | 13.1    |
| <b>PUF (%)</b>  | 0.6    | 3.9   | 0.1    | 0.0    | 0.1    | 39.9  | 59.7  | 0.7   | 0.0    | 0.0    | 0.0    | 3.8    | 9.1     |
| <b>UCLF (%)</b> | 0.0    | 1.5   | 0.3    | 2.7    | 2.0    | 1.2   | 27.2  | 0.0   | 0.0    | 0.0    | 0.0    | 0.0    | 2.9     |
| <b>XUF (%)</b>  | 0.0    | 0.0   | 0.0    | 0.0    | 1.3    | 0.5   | 0.0   | 9.7   | 1.0    | 0.2    | 0.0    | 0.0    | 1.1     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 15 Oct 1988  
**Date of First Criticality:** 29 Nov 1997  
**Date of Grid Connection:** 24 Dec 1997  
**Date of Commercial Operation:** 29 Jan 2002

**Lifetime Generation:** 46306.6 GW(e).h  
**Cumulative Energy Availability Factor:** 83.3%  
**Cumulative Load Factor:** 81.6%  
**Cumulative Unit Capability Factor:** 83.5%  
**Cumulative Energy Unavailability Factor:** 16.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1999 | 2916.8         | 1450.0         | 0.0  | 0.0    | 64.4                              | 100.0  | 23.0               | 0.0    | 2608               | 29.8   |
| 2000 | 8859.0         | 1450.0         | 0.0  | 0.0    | 68.6                              | 100.0  | 69.6               | 0.0    | 7133               | 81.2   |
| 2001 | 2026.8         | 1450.0         | 0.0  | 0.0    | 16.9                              | 100.0  | 16.0               | 0.0    | 1667               | 19.0   |
| 2002 | 9544.1         | 1450.0         | 81.0   | 81.0   | 79.8                              | 79.8   | 75.1               | 75.1   | 7331               | 83.7   |
| 2003 | 10932.1        | 1495.0         | 84.1   | 82.6   | 83.1                              | 81.4   | 83.5               | 79.4   | 7438               | 84.9   |
| 2004 | 11276.5        | 1495.0         | 88.0   | 84.4   | 86.9                              | 83.3   | 85.9               | 81.6   | 7816               | 89.0   |

# FR-72 CIVAUX-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 02 Jan | 3.0   | 4.0     | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 02 Jan | 4.0   | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 01 Feb | 11.0  | 9.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 01 Feb | 22.0  | 32.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 19 Feb | 14.0  | 11.0    | UP2  | A32  | EXTRACION UNIT (PUMP, COUPLING, REDUCING FITTING)             |
| 20 Feb | 12.0  | 4.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 29 Mar | 59.0  | 3.0     | UP2  | A32  | FEEDWATER TANK AND GAS STRIPPER                               |
| 01 Apr | 719.0 | 29.0    | UP2  | A32  | FEEDWATER TANK AND GAS STRIPPER                               |
| 01 May | 670.0 | 22.0    | UP2  | A32  | FEEDWATER TANK AND GAS STRIPPER                               |
| 28 May | 69.0  | 15.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 01 Jun | 410.0 | 13.0    | UP2  | A32  | FEEDWATER TANK AND GAS STRIPPER                               |
| 04 Jun | 22.0  | 6.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 19 Jun | 660.0 | 988.0   | PF   | C    | REFUELLING WITH NO INSPECTION                                 |
| 17 Jul | 94.0  | 142.0   | UF3  | Z    | INDUSTRIAL ACTION DURING PROGRAMMED OUTAGE, EXTENSION         |
| 21 Jul | 24.0  | 36.0    | UF2  | A14  | HP SAFETY INJECTION SYSTEM ACCUMULATORS (EXCL. CHARGING PUMP) |
| 22 Jul | 24.0  | 36.0    | UF2  | A13  | COMPONENT COOLING SYSTEM                                      |
| 23 Jul | 9.0   | 14.0    | UF2  | A13  | SHUTDOWN COOLING CIRCUIT                                      |
| 24 Jul | 49.0  | 73.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                           |
| 26 Jul | 7.0   | 10.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 26 Jul | 136.0 | 58.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 01 Aug | 53.0  | 3.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 03 Aug | 48.0  | 71.0    | XF   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Sep | 549.0 | 11.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Oct | 273.0 | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 25 Dec | 26.0  | 39.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 2002 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 106       |          |  |           |          |
| C. Inspection, maintenance or repair combined with refuelling  | 660             |           |          | 538                                      |           |          |
| E. Testing of plant systems or components  | 58              |           |          | 33                                       |           |          |
| L. Human factor related  |                 |           |          |  |           | 4        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 48       |  |           |          |
| Z. Others  |                 | 94        |          |  | 64        |          |
| Subtotal   | 718             | 200       | 48       | 571                                      | 68        | 0        |
| Total  |                 | 966       |          |  | 639       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                        | 2004 Hours Lost | 2002 to 2004 Average Hours Lost Per Year |
|-------------------------------|-----------------|--|
| 12. Reactor I&C Systems       | 49              |  |
| 13. Reactor Auxiliary Systems | 33              |  |
| 14. Safety Systems            | 24              |  |
| Total                         | 106             | 0  |

# FR-73 CIVAUX-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1495.0 MW(e)  
**Design Net RUP:** 1450.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 11698.6 GW(e).h  
**Energy Availability Factor:** 89.6%  
**Load Factor:** 89.1%  
**Operating Factor:** 91.6%  
**Energy Unavailability Factor:** 10.4%  
**Total Off-line Time:** 742 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug   | Sep   | Oct    | Nov    | Dec    | Annual  |
|-----------------|--------|--------|--------|--------|--------|--------|--------|-------|-------|--------|--------|--------|---------|
| <b>GW(e).h</b>  | 1101.6 | 1041.5 | 1112.7 | 1065.0 | 1036.2 | 1053.6 | 1027.6 | 431.1 | 542.6 | 1092.1 | 1074.9 | 1119.8 | 11698.6 |
| <b>EAF (%)</b>  | 98.8   | 99.9   | 99.9   | 100.0  | 93.9   | 99.1   | 93.9   | 39.3  | 51.6  | 99.8   | 100.0  | 99.9   | 89.6    |
| <b>UCF (%)</b>  | 98.8   | 99.9   | 100.0  | 100.0  | 94.1   | 100.0  | 94.8   | 41.8  | 51.7  | 99.9   | 100.0  | 99.9   | 90.0    |
| <b>LF (%)</b>   | 99.0   | 100.1  | 100.2  | 98.9   | 93.2   | 97.9   | 92.4   | 38.8  | 50.4  | 98.1   | 99.9   | 100.7  | 89.1    |
| <b>OF (%)</b>   | 100.0  | 100.0  | 100.0  | 100.0  | 94.8   | 100.0  | 95.7   | 42.2  | 66.5  | 100.0  | 100.0  | 100.0  | 91.6    |
| <b>EUF (%)</b>  | 1.2    | 0.1    | 0.1    | 0.0    | 6.1    | 0.9    | 6.1    | 60.7  | 48.4  | 0.2    | 0.0    | 0.1    | 10.4    |
| <b>PUF (%)</b>  | 0.0    | 0.0    | 0.0    | 0.0    | 2.7    | 0.0    | 0.2    | 58.2  | 48.3  | 0.0    | 0.0    | 0.0    | 9.1     |
| <b>UCLF (%)</b> | 1.2    | 0.1    | 0.0    | 0.0    | 3.2    | 0.0    | 5.1    | 0.0   | 0.0   | 0.1    | 0.0    | 0.1    | 0.8     |
| <b>XUF (%)</b>  | 0.0    | 0.0    | 0.0    | 0.0    | 0.2    | 0.9    | 0.8    | 2.5   | 0.1   | 0.1    | 0.0    | 0.0    | 0.4     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1991  
**Date of First Criticality:** 27 Nov 1999  
**Date of Grid Connection:** 24 Dec 1999  
**Date of Commercial Operation:** 23 Apr 2002

**Lifetime Generation:** 43375.3 GW(e).h  
**Cumulative Energy Availability Factor:** 80.0%  
**Cumulative Load Factor:** 79.2%  
**Cumulative Unit Capability Factor:** 82.9%  
**Cumulative Energy Unavailability Factor:** 20.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2000 | 5121.8         | 1450.0         | 0.0  | 0.0    | 40.8                              | 100.0  | 40.2               | 0.0    | 4638               | 52.8   |
| 2001 | 9055.4         | 1450.0         | 0.0  | 0.0    | 70.8                              | 100.0  | 71.3               | 0.0    | 6555               | 74.8   |
| 2002 | 7491.3         | 1450.0         | 0.0  | 0.0    | 71.8                              | 100.0  | 59.0               | 0.0    | 6080               | 69.4   |
| 2003 | 9084.8         | 1495.0         | 70.5   | 70.5   | 70.4                              | 70.4   | 69.4               | 69.4   | 6542               | 74.7   |
| 2004 | 11698.6        | 1495.0         | 90.0   | 80.3   | 89.6                              | 80.0   | 89.1               | 79.2   | 8042               | 91.6   |

## FR-73 CIVAUX-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 206.0 | 3.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 10 Jan | 24.0  | 10.0    | UP2  | A31  | STEAM VALVES  |
| 01 Feb | 299.0 | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 06 Mar | 223.0 | 5.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Apr | 450.0 | 12.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 May | 252.0 | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 02 May | 217.0 | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 07 May | 18.0  | 7.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 07 May | 15.0  | 22.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 23 May | 23.0  | 36.0    | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 01 Jun | 409.0 | 9.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 02 Jun | 278.0 | 13.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Jul | 293.0 | 15.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Jul | 354.0 | 9.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 02 Jul | 25.0  | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 07 Jul | 15.0  | 22.0    | UF2  | L    | HUMAN OPERATING ERRORS  |
| 27 Jul | 16.0  | 26.0    | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 27 Jul | 25.0  | 4.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 27 Jul | 25.0  | 4.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 01 Aug | 56.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 03 Aug | 254.0 | 25.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 13 Aug | 621.0 | 929.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 11 Sep | 52.0  | 78.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 11 Sep | 168.0 | 81.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 20 Sep | 86.0  | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 23 Sep | 111.0 | 3.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Oct | 309.0 | 11.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 02 Oct | 141.0 | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 01 Nov | 156.0 | 10.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Dec | 134.0 | 2.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2002 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 39        |          |  | 153       |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling | 621             |           |          | 606                                      |           |          |
| E. Testing of plant systems or components                     | 67              |           |          | 30                                       |           |          |
| L. Human factor related                                       |                 | 15        |          |  | 9         |          |
| Z. Others   |                 |           |          |  | 17        |          |
| Subtotal  | 688             | 54        | 0        | 636                                      | 187       | 0        |
| Total   |                 | 742       |          |  | 823       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2002 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 13. Reactor Auxiliary Systems       |                 | 46                                       |
| 15. Reactor Cooling Systems         |                 | 83                                       |
| 31. Turbine and auxiliaries         | 39              | 9  |
| 32. Feedwater and Main Steam System |                 | 11                                       |
| Total                               | 39              | 149                                      |

# FR-42 CRUAS-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 880.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5866.1 GW(e).h  
**Energy Availability Factor:** 76.1%  
**Load Factor:** 73.0%  
**Operating Factor:** 78.6%  
**Energy Unavailability Factor:** 23.9%  
**Total Off-line Time:** 1877 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb  | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 649.4 | 64.0 | 432.5 | 0.0   | 330.6 | 557.1 | 631.1 | 627.8 | 622.3 | 639.4 | 645.8 | 666.0 | 5866.1 |
| <b>EAF (%)</b>  | 98.5  | 12.2 | 64.5  | 0.0   | 50.3  | 90.0  | 99.9  | 98.6  | 98.9  | 97.1  | 99.6  | 99.2  | 76.1   |
| <b>UCF (%)</b>  | 98.5  | 12.2 | 68.3  | 0.0   | 50.3  | 96.0  | 99.9  | 98.7  | 98.9  | 97.3  | 99.6  | 99.2  | 77.0   |
| <b>LF (%)</b>   | 95.4  | 10.1 | 63.6  | 0.0   | 48.6  | 84.6  | 92.7  | 92.2  | 94.5  | 93.8  | 98.0  | 97.8  | 73.0   |
| <b>OF (%)</b>   | 100.0 | 12.4 | 69.9  | 0.0   | 62.1  | 97.5  | 100.0 | 99.3  | 100.0 | 97.6  | 100.0 | 100.0 | 78.6   |
| <b>EUF (%)</b>  | 1.5   | 87.9 | 35.5  | 100.0 | 49.7  | 10.0  | 0.1   | 1.4   | 1.1   | 2.9   | 0.4   | 0.8   | 23.9   |
| <b>PUF (%)</b>  | 0.3   | 0.0  | 16.1  | 96.1  | 40.8  | 0.0   | 0.1   | 0.2   | 1.1   | 0.1   | 0.1   | 0.1   | 12.9   |
| <b>UCLF (%)</b> | 1.2   | 87.9 | 15.7  | 3.9   | 8.9   | 4.0   | 0.0   | 1.1   | 0.0   | 2.6   | 0.3   | 0.7   | 10.2   |
| <b>XUF (%)</b>  | 0.0   | 0.0  | 3.8   | 0.0   | 0.0   | 5.9   | 0.0   | 0.2   | 0.0   | 0.3   | 0.0   | 0.0   | 0.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1978  
**Date of First Criticality:** 02 Apr 1983  
**Date of Grid Connection:** 29 Apr 1983  
**Date of Commercial Operation:** 02 Apr 1984

**Lifetime Generation:** 118100.0 GW(e).h  
**Cumulative Energy Availability Factor:** 80.6%  
**Cumulative Load Factor:** 71.3%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 19.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 388.4          | 888.0          | 0.0  | 0.0    | 33.0                              | 100.0  | 5.4                | 0.0    | 1150               | 14.2   |
| 1984 | 5482.0         | 880.0          | 0.0  | 0.0    | 70.9                              | 100.0  | 70.9               | 0.0    | 7165               | 81.6   |
| 1985 | 5185.2         | 880.0          | 77.2   | 77.2   | 72.0                              | 72.0   | 67.3               | 67.3   | 6615               | 75.5   |
| 1986 | 5888.0         | 880.0          | 87.6   | 82.4   | 86.0                              | 79.0   | 76.4               | 71.8   | 7377               | 84.2   |
| 1987 | 5359.5         | 880.0          | 83.7   | 82.8   | 81.8                              | 79.9   | 69.5               | 71.1   | 6860               | 78.3   |
| 1988 | 4025.0         | 880.0          | 98.0   | 86.6   | 96.7                              | 84.1   | 52.1               | 66.3   | 5562               | 63.3   |
| 1989 | 5648.9         | 880.0          | 86.0   | 86.5   | 83.6                              | 84.0   | 73.3               | 67.7   | 7239               | 82.6   |
| 1990 | 4983.5         | 880.0          | 84.8   | 86.2   | 82.6                              | 83.8   | 64.6               | 67.2   | 6809               | 77.7   |
| 1991 | 4477.8         | 880.0          | 68.2   | 83.7   | 65.3                              | 81.2   | 58.1               | 65.9   | 5762               | 65.8   |
| 1992 | 5739.4         | 880.0          | 81.0   | 83.3   | 77.8                              | 80.7   | 74.2               | 66.9   | 7183               | 81.8   |
| 1993 | 6156.6         | 880.0          | 87.2   | 83.8   | 84.6                              | 81.2   | 79.9               | 68.4   | 7353               | 83.9   |
| 1994 | 6181.2         | 915.0          | 84.5   | 83.8   | 84.3                              | 81.5   | 77.1               | 69.3   | 7498               | 85.6   |
| 1995 | 4630.4         | 915.0          | 63.3   | 81.9   | 62.5                              | 79.7   | 57.8               | 68.2   | 5624               | 64.2   |
| 1996 | 6258.5         | 915.0          | 83.9   | 82.1   | 83.0                              | 80.0   | 77.9               | 69.0   | 7478               | 85.1   |
| 1997 | 5271.2         | 915.0          | 77.9   | 81.7   | 74.1                              | 79.5   | 65.8               | 68.8   | 6784               | 77.4   |
| 1998 | 6387.3         | 915.0          | 90.8   | 82.4   | 89.5                              | 80.2   | 79.7               | 69.6   | 7864               | 89.8   |
| 1999 | 5890.7         | 915.0          | 85.5   | 82.6   | 83.8                              | 80.5   | 73.5               | 69.8   | 7367               | 84.1   |
| 2000 | 6320.5         | 915.0          | 87.6   | 82.9   | 86.0                              | 80.8   | 78.6               | 70.4   | 7742               | 88.1   |
| 2001 | 5918.3         | 915.0          | 81.7   | 82.9   | 81.1                              | 80.9   | 73.8               | 70.6   | 7264               | 82.9   |
| 2002 | 6069.8         | 915.0          | 80.6   | 82.7   | 80.5                              | 80.8   | 75.7               | 70.9   | 7349               | 83.9   |
| 2003 | 6120.5         | 915.0          | 82.5   | 82.7   | 81.1                              | 80.8   | 76.4               | 71.2   | 7403               | 84.5   |
| 2004 | 5866.1         | 915.0          | 77.0   | 82.4   | 76.1                              | 80.6   | 73.0               | 71.3   | 6907               | 78.6   |

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## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 582.0 | 12.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 03 Jan | 35.0  | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 06 Jan | 23.0  | 8.0     | UP2  | A31  | MAIN CONDENSER   |
| 12 Jan | 73.0  | 8.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 01 Feb | 84.0  | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 04 Feb | 692.0 | 634.0   | UF2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                     |
| 01 Mar | 39.0  | 9.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                     |
| 04 Mar | 23.0  | 21.0    | UF2  | A31  | MAIN CONDENSER   |
| 07 Mar | 462.0 | 26.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 27 Mar | 998.0 | 914.0   | PF   | C    | REFUELLING WITH NO INSPECTION                              |
| 07 Apr | 28.0  | 26.0    | UF3  | Z    | INDUSTRIAL ACTION DURING PROGRAMMED OUTAGE, EXTENSION      |
| 10 May | 45.0  | 41.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                        |
| 11 May | 357.0 | 51.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 11 May | 29.0  | 26.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                            |
| 22 May | 20.0  | 18.0    | UF2  | K    | UNSCHEDULED SHUTDOWNS FOR MISCELLANEOUS WORK               |
| 29 May | 350.0 | 37.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 12 Jun | 18.0  | 16.0    | UF2  | A13  | VENTILATION OF INSTALLATIONS                               |
| 14 Jun | 114.0 | 39.0    | XP   | K    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 26 Jun | 15.0  | 8.0     | UP2  | A12  | MISCELLANEOUS INDEPENDENT MEASUREMENTS                     |
| 01 Jul | 730.0 | 49.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Aug | 507.0 | 42.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |
| 13 Aug | 5.0   | 5.0     | UF2  | A    | VALVE DRIVE SYSTEM   |
| 01 Sep | 592.0 | 26.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Oct | 663.0 | 19.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 07 Oct | 18.0  | 17.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                        |
| 01 Nov | 487.0 | 8.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Dec | 417.0 | 7.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 19 Dec | 26.0  | 1.0     | UP2  | A12  | PRIMARY COOLANT PREPARATION CONTROLLING.                   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 756       |          |  | 437       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 998             |           |          | 859                                      | 23        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 29                                       |           |          |
| E. Testing of plant systems or components  | 29              |           |          | 18                                       |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 1        |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 | 20        |          |  | 41        | 23       |
| Z. Others  |                 | 73        |          |  | 5         |          |
| Subtotal   | 1027            | 849       | 0        | 906                                      | 508       | 26       |
| Total  |                 | 1876      |          |  | 1440      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 23                                       |
| 12. Reactor I&C Systems             | 18              | 14                                       |
| 13. Reactor Auxiliary Systems       | 18              | 8  |
| 14. Safety Systems                  |                 | 14                                       |
| 15. Reactor Cooling Systems         |                 | 23                                       |
| 16. Steam generation systems        | 692             | 0  |
| 31. Turbine and auxiliaries         | 23              | 30                                       |
| 32. Feedwater and Main Steam System |                 | 7  |
| 33. Circulating Water System        |                 | 4  |
| 41. Main Generator Systems          |                 | 276                                      |
| 42. Electrical Power Supply Systems |                 | 6  |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 751             | 406                                      |

# FR-43 CRUAS-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 915.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6613.0 GW(e).h  
**Energy Availability Factor:** 84.9%  
**Load Factor:** 82.3%  
**Operating Factor:** 87.2%  
**Energy Unavailability Factor:** 15.1%  
**Total Off-line Time:** 1123 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 632.6 | 611.3 | 661.0 | 628.5 | 654.9 | 609.3 | 618.1 | 107.0 | 124.9 | 653.7 | 637.4 | 674.2 | 6613.0 |
| <b>EAF (%)</b>  | 95.8  | 99.9  | 99.9  | 99.1  | 99.8  | 97.0  | 92.2  | 16.3  | 19.8  | 99.6  | 99.9  | 99.9  | 84.9   |
| <b>UCF (%)</b>  | 95.9  | 99.9  | 99.9  | 99.9  | 99.8  | 97.6  | 99.9  | 19.3  | 19.8  | 99.8  | 99.9  | 99.9  | 86.0   |
| <b>LF (%)</b>   | 92.9  | 96.0  | 97.2  | 95.4  | 96.2  | 92.5  | 90.8  | 15.7  | 19.0  | 95.9  | 96.7  | 99.0  | 82.3   |
| <b>OF (%)</b>   | 97.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 19.6  | 30.1  | 100.0 | 100.0 | 100.0 | 87.2   |
| <b>EUF (%)</b>  | 4.2   | 0.1   | 0.1   | 0.9   | 0.2   | 3.0   | 7.8   | 83.7  | 80.2  | 0.4   | 0.1   | 0.1   | 15.1   |
| <b>PUF (%)</b>  | 0.3   | 0.1   | 0.1   | 0.1   | 0.2   | 0.4   | 0.1   | 80.7  | 80.2  | 0.2   | 0.1   | 0.1   | 13.6   |
| <b>UCLF (%)</b> | 3.9   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.8   | 0.0   | 0.6   | 7.7   | 3.0   | 0.0   | 0.2   | 0.0   | 0.0   | 1.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 15 Nov 1978  
**Date of First Criticality:** 01 Aug 1984  
**Date of Grid Connection:** 06 Sep 1984  
**Date of Commercial Operation:** 01 Apr 1985

**Lifetime Generation:** 116380.8 GW(e).h  
**Cumulative Energy Availability Factor:** 78.9%  
**Cumulative Load Factor:** 72.6%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 21.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 146.0          | 903.0          | 0.0  | 0.0    | 70.5                              | 100.0  | 1.9                | 0.0    | 651                | 7.5    |
| 1985 | 6103.2         | 880.0          | 0.0  | 0.0    | 88.6                              | 100.0  | 79.2               | 0.0    | 8330               | 95.1   |
| 1986 | 4955.0         | 880.0          | 70.4   | 70.4   | 70.1                              | 70.1   | 64.3               | 64.3   | 6258               | 71.4   |
| 1987 | 5559.9         | 900.0          | 79.8   | 75.2   | 79.1                              | 74.6   | 70.5               | 67.4   | 6761               | 77.2   |
| 1988 | 5698.0         | 915.0          | 85.0   | 78.5   | 80.6                              | 76.7   | 70.9               | 68.6   | 7176               | 81.7   |
| 1989 | 6298.5         | 915.0          | 86.2   | 80.4   | 83.3                              | 78.3   | 78.6               | 71.1   | 7697               | 87.9   |
| 1990 | 6001.8         | 915.0          | 79.8   | 80.3   | 77.7                              | 78.2   | 74.9               | 71.9   | 7114               | 81.2   |
| 1991 | 4099.9         | 915.0          | 55.3   | 76.1   | 53.7                              | 74.1   | 51.2               | 68.4   | 4838               | 55.2   |
| 1992 | 5946.9         | 915.0          | 77.0   | 76.2   | 77.0                              | 74.5   | 74.0               | 69.2   | 6910               | 78.7   |
| 1993 | 5441.0         | 915.0          | 78.1   | 76.5   | 73.5                              | 74.4   | 67.9               | 69.0   | 6463               | 73.8   |
| 1994 | 5566.1         | 915.0          | 96.8   | 78.8   | 94.1                              | 76.6   | 69.4               | 69.1   | 6765               | 77.2   |
| 1995 | 5366.8         | 915.0          | 76.3   | 78.5   | 72.4                              | 76.2   | 67.0               | 68.9   | 6581               | 75.1   |
| 1996 | 6521.9         | 915.0          | 88.8   | 79.4   | 87.1                              | 77.2   | 81.1               | 70.0   | 7870               | 89.6   |
| 1997 | 5176.1         | 915.0          | 80.9   | 79.6   | 76.5                              | 77.1   | 64.6               | 69.5   | 6596               | 75.3   |
| 1998 | 6003.6         | 915.0          | 82.8   | 79.8   | 79.0                              | 77.3   | 74.9               | 70.0   | 7396               | 84.4   |
| 1999 | 6393.8         | 915.0          | 88.1   | 80.4   | 85.3                              | 77.8   | 79.8               | 70.7   | 7787               | 88.9   |
| 2000 | 6420.9         | 915.0          | 87.0   | 80.8   | 85.6                              | 78.4   | 79.9               | 71.3   | 7755               | 88.3   |
| 2001 | 5914.4         | 915.0          | 79.7   | 80.8   | 76.5                              | 78.2   | 73.8               | 71.4   | 7053               | 80.5   |
| 2002 | 6547.4         | 915.0          | 86.5   | 81.1   | 86.0                              | 78.7   | 81.7               | 72.0   | 7776               | 88.8   |
| 2003 | 5727.9         | 915.0          | 75.8   | 80.8   | 75.6                              | 78.5   | 71.5               | 72.0   | 6927               | 79.1   |
| 2004 | 6613.0         | 915.0          | 86.0   | 81.1   | 84.9                              | 78.9   | 82.3               | 72.6   | 7661               | 87.2   |



## FR-43 CRUAS-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 412.0  | 19.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Jan | 11.0   | 5.0     | UP2  | A31  | MAIN CONDENSER   |
| 04 Jan | 10.0   | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 10 Jan | 22.0   | 20.0    | UF2  | A32  | HIGH-PRESSURE HEATING  |
| 01 Feb | 306.0  | 23.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Mar | 512.0  | 18.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Apr | 426.0  | 23.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 07 Apr | 24.0   | 5.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 May | 593.0  | 23.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 02 May | 10.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 01 Jun | 452.0  | 29.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 02 Jun | 29.0   | 3.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 13 Jun | 36.0   | 3.0     | UP2  | A12  | REACTOR CONTROL  |
| 14 Jun | 76.0   | 4.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 22 Jun | 24.0   | 10.0    | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)       |
| 01 Jul | 125.0  | 9.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 07 Jul | 729.0  | 72.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 06 Aug | 1101.0 | 1010.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                              |
| 21 Sep | 216.0  | 67.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 01 Oct | 583.0  | 22.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 11 Oct | 22.0   | 2.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCOMAX       |
| 30 Oct | 583.0  | 22.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 Dec | 339.0  | 5.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 22        |          |  | 333       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1101            |           |          | 843                                      | 12        |          |
| E. Testing of plant systems or components  |                 |           |          | 9  | 0         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 50        |          |
| Z. Others  |                 |           |          |  | 25        |          |
| Subtotal   | 1101            | 22        | 0        | 852                                      | 423       | 0        |
| Total  |                 | 1123      |          |  | 1275      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 27                                       |
| 12. Reactor I&C Systems             |                 | 6  |
| 13. Reactor Auxiliary Systems       |                 | 1  |
| 15. Reactor Cooling Systems         |                 | 10                                       |
| 16. Steam generation systems        |                 | 20                                       |
| 31. Turbine and auxiliaries         |                 | 104                                      |
| 32. Feedwater and Main Steam System | 22              | 8  |
| 33. Circulating Water System        |                 | 1  |
| 35. All other I&C Systems           |                 | 1  |
| 41. Main Generator Systems          |                 | 142                                      |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 22              | 321                                      |

# FR-44 CRUAS-3

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 880.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5081.3 GW(e).h  
**Energy Availability Factor:** 64.1%  
**Load Factor:** 63.2%  
**Operating Factor:** 69.1%  
**Energy Unavailability Factor:** 35.9%  
**Total Off-line Time:** 2710 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 652.9 | 610.5 | 576.3 | 521.8 | 0.0   | 0.0   | 0.0   | 115.9 | 631.5 | 657.0 | 632.8 | 682.6 | 5081.3 |
| <b>EAF (%)</b>  | 97.5  | 96.5  | 85.1  | 79.2  | 0.0   | 0.0   | 0.0   | 18.8  | 98.2  | 99.3  | 97.0  | 99.9  | 64.1   |
| <b>UCF (%)</b>  | 97.8  | 96.5  | 88.7  | 97.8  | 0.0   | 0.0   | 0.0   | 18.8  | 98.2  | 99.3  | 97.0  | 99.9  | 65.9   |
| <b>LF (%)</b>   | 95.9  | 95.9  | 84.8  | 79.2  | 0.0   | 0.0   | 0.0   | 17.0  | 95.9  | 96.4  | 96.1  | 100.3 | 63.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 90.7  | 100.0 | 0.0   | 0.0   | 0.0   | 42.1  | 99.7  | 100.0 | 100.0 | 100.0 | 69.1   |
| <b>EUF (%)</b>  | 2.5   | 3.5   | 14.9  | 20.8  | 100.0 | 100.0 | 100.0 | 81.2  | 1.8   | 0.7   | 3.0   | 0.1   | 35.9   |
| <b>PUF (%)</b>  | 0.3   | 0.4   | 0.0   | 0.1   | 100.0 | 100.0 | 80.6  | 14.2  | 0.9   | 0.1   | 0.2   | 0.1   | 24.9   |
| <b>UCLF (%)</b> | 1.9   | 3.1   | 11.3  | 2.1   | 0.0   | 0.0   | 19.4  | 67.0  | 0.9   | 0.6   | 2.9   | 0.0   | 9.2    |
| <b>XUF (%)</b>  | 0.3   | 0.0   | 3.6   | 18.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|                                      |             |   |                  |
|--------------------------------------|-------------|---|------------------|
| <b>Date of Construction Start:</b>   | 15 Apr 1979 | <b>Lifetime Generation:</b>                     | 115649.9 GW(e).h |
| <b>Date of First Criticality:</b>    | 09 Apr 1984 | <b>Cumulative Energy Availability Factor:</b>   | 80.2%            |
| <b>Date of Grid Connection:</b>      | 14 May 1984 | <b>Cumulative Load Factor:</b>                  | 70.8%            |
| <b>Date of Commercial Operation:</b> | 10 Sep 1984 | <b>Cumulative Unit Capability Factor:</b>       | 78.1%            |
|                                      |             | <b>Cumulative Energy Unavailability Factor:</b> | 19.8%            |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 3272.0         | 880.0          | 0.0  | 0.0    | 79.9                              | 100.0  | 44.0               | 0.0    | 4380               | 51.8   |
| 1985 | 5247.4         | 880.0          | 74.6   | 74.6   | 72.5                              | 72.5   | 68.1               | 68.1   | 6557               | 74.9   |
| 1986 | 5967.1         | 880.0          | 89.5   | 82.1   | 89.2                              | 80.9   | 77.4               | 72.7   | 7456               | 85.1   |
| 1987 | 4721.4         | 880.0          | 75.7   | 79.9   | 75.1                              | 79.0   | 61.2               | 68.9   | 6013               | 68.6   |
| 1988 | 4773.0         | 880.0          | 99.9   | 84.9   | 98.6                              | 83.9   | 61.7               | 67.1   | 6679               | 76.0   |
| 1989 | 5577.9         | 880.0          | 74.2   | 82.8   | 72.8                              | 81.7   | 72.4               | 68.2   | 6571               | 75.0   |
| 1990 | 6129.2         | 915.0          | 87.5   | 83.6   | 85.2                              | 82.3   | 76.5               | 69.6   | 7499               | 85.6   |
| 1991 | 6003.2         | 915.0          | 85.2   | 83.8   | 84.7                              | 82.6   | 74.9               | 70.4   | 7374               | 84.2   |
| 1992 | 5174.6         | 915.0          | 73.2   | 82.5   | 71.0                              | 81.1   | 64.4               | 69.6   | 6323               | 72.0   |
| 1993 | 5715.3         | 915.0          | 85.7   | 82.8   | 73.9                              | 80.3   | 71.3               | 69.8   | 7232               | 82.6   |
| 1994 | 5014.0         | 915.0          | 78.9   | 82.4   | 78.1                              | 80.1   | 62.6               | 69.1   | 6428               | 73.4   |
| 1995 | 6032.7         | 915.0          | 89.6   | 83.1   | 84.3                              | 80.5   | 75.3               | 69.6   | 7525               | 85.9   |
| 1996 | 5882.2         | 915.0          | 99.7   | 84.5   | 91.9                              | 81.5   | 73.2               | 69.9   | 7724               | 87.9   |
| 1997 | 5347.8         | 915.0          | 86.1   | 84.6   | 80.2                              | 81.4   | 66.7               | 69.7   | 6961               | 79.5   |
| 1998 | 6281.4         | 915.0          | 81.7   | 84.4   | 78.7                              | 81.2   | 78.4               | 70.3   | 7758               | 88.6   |
| 1999 | 6316.7         | 915.0          | 89.8   | 84.8   | 87.8                              | 81.6   | 78.8               | 70.9   | 7654               | 87.4   |
| 2000 | 5494.0         | 915.0          | 81.4   | 84.5   | 79.0                              | 81.4   | 68.4               | 70.7   | 6914               | 78.7   |
| 2001 | 5867.9         | 915.0          | 82.1   | 84.4   | 79.6                              | 81.3   | 73.2               | 70.9   | 7254               | 82.8   |
| 2002 | 6052.0         | 915.0          | 82.1   | 84.3   | 80.9                              | 81.3   | 75.5               | 71.1   | 7307               | 83.4   |
| 2003 | 5779.4         | 915.0          | 79.2   | 84.0   | 76.8                              | 81.1   | 72.1               | 71.2   | 7146               | 81.6   |
| 2004 | 5081.3         | 915.0          | 65.9   | 83.1   | 64.1                              | 80.2   | 63.2               | 70.8   | 6074               | 69.1   |

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## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 238.0  | 6.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 04 Jan | 33.0   | 13.0    | UP2  | A31  | MAIN CONDENSER   |
| 10 Jan | 12.0   | 6.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 Feb | 43.0   | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 01 Feb | 57.0   | 20.0    | UP2  | A31  | MAIN CONDENSER   |
| 01 Feb | 296.0  | 5.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Mar | 47.0   | 11.0    | UP2  | A31  | MAIN CONDENSER   |
| 04 Mar | 558.0  | 24.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 13 Mar | 69.0   | 63.0    | UF2  | A41  | HYDROGEN COOLING SYSTEM  |
| 01 Apr | 673.0  | 122.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 04 Apr | 47.0   | 14.0    | UP2  | A31  | MAIN CONDENSER   |
| 01 May | 2061.0 | 1887.0  | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                            |
| 26 Jul | 505.0  | 463.0   | UF3  | Z    | INDUSTRIAL ACTION DURING PROGRAMMED OUTAGE, EXTENSION          |
| 11 Aug | 160.0  | 64.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 11 Aug | 36.0   | 33.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                                |
| 13 Aug | 10.0   | 9.0     | UF2  | A31  | MOISTURE SEPARATOR-REHEATERS                                   |
| 16 Aug | 35.0   | 23.0    | UP2  | A31  | VIBRATION OF TURBOGENERATOR SET WITHOUT DAMAGE                 |
| 16 Aug | 12.0   | 11.0    | UF2  | A    | VIBRATION OF TURBOGENERATOR SET WITHOUT DAMAGE                 |
| 17 Aug | 3.0    | 3.0     | UF2  | A12  | REACTOR CONTROL  |
| 19 Aug | 78.0   | 41.0    | UP2  | A41  | GENERATOR ELECTRICAL PROTECTION                                |
| 25 Aug | 10.0   | 7.0     | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT     |
| 01 Sep | 90.0   | 2.0     | UP2  | Z    | MALFUNCTION OF REGULATION, CONTROL AND PROTECTION SYSTEM       |
| 04 Sep | 256.0  | 6.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 10 Sep | 2.0    | 2.0     | UF2  | A31  | VIBRATION OF TURBOGENERATOR SET WITHOUT DAMAGE                 |
| 15 Sep | 176.0  | 14.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Oct | 446.0  | 18.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 10 Oct | 28.0   | 3.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 Nov | 278.0  | 7.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 20 Nov | 49.0   | 18.0    | UP2  | A31  | MAIN CONDENSER   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 96        |          |  | 160       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 2061            |           |          | 889                                      | 40        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          |  | 7         |          |
| E. Testing of plant systems or components  | 36              |           |          | 6  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 24        | 24       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 3        |
| Z. Others  |                 | 505       |          |  | 5         |          |
| Subtotal   | 2097            | 601       | 0        | 895                                      | 237       | 27       |
| Total  |                 | 2698      |          |  | 1159      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 3               | 7  |
| 13. Reactor Auxiliary Systems       |                 | 1  |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 63                                       |
| 16. Steam generation systems        |                 | 15                                       |
| 31. Turbine and auxiliaries         | 12              | 37                                       |
| 32. Feedwater and Main Steam System |                 | 7  |
| 41. Main Generator Systems          | 69              | 0  |
| 42. Electrical Power Supply Systems |                 | 11                                       |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 84              | 143                                      |

# FR-45 CRUAS-4

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 880.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6377.4 GW(e).h  
**Energy Availability Factor:** 80.6%  
**Load Factor:** 79.3%  
**Operating Factor:** 84.7%  
**Energy Unavailability Factor:** 19.4%  
**Total Off-line Time:** 1341 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|-------|--------|
| <b>GW(e).h</b>  | 644.5 | 616.2 | 687.3 | 664.1 | 657.1 | 588.4 | 653.5 | 624.0 | 533.3 | 11.3 | 27.2 | 670.7 | 6377.4 |
| <b>EAF (%)</b>  | 99.8  | 99.4  | 99.9  | 99.9  | 97.3  | 94.5  | 97.4  | 91.7  | 81.0  | 2.3  | 5.7  | 98.6  | 80.6   |
| <b>UCF (%)</b>  | 99.8  | 99.4  | 99.9  | 99.9  | 99.2  | 98.8  | 97.5  | 99.9  | 99.8  | 3.2  | 5.7  | 98.6  | 83.4   |
| <b>LF (%)</b>   | 94.7  | 96.8  | 101.1 | 100.8 | 96.5  | 89.3  | 96.0  | 91.7  | 80.9  | 1.7  | 4.1  | 98.5  | 79.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 3.4  | 13.8 | 100.0 | 84.7   |
| <b>EUF (%)</b>  | 0.2   | 0.6   | 0.1   | 0.1   | 2.7   | 5.5   | 2.6   | 8.3   | 19.0  | 97.7 | 94.3 | 1.4   | 19.4   |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.1   | 0.1   | 0.4   | 0.0   | 0.6   | 0.1   | 0.3   | 96.8 | 52.1 | 1.4   | 12.8   |
| <b>UCLF (%)</b> | 0.0   | 0.5   | 0.0   | 0.0   | 0.5   | 1.2   | 1.9   | 0.0   | 0.0   | 0.0  | 42.2 | 0.0   | 3.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 1.8   | 4.2   | 0.1   | 8.2   | 18.8  | 0.9  | 0.0  | 0.0   | 2.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1979  
**Date of First Criticality:** 01 Oct 1984  
**Date of Grid Connection:** 27 Oct 1984  
**Date of Commercial Operation:** 11 Feb 1985

**Lifetime Generation:** 115494.3 GW(e).h  
**Cumulative Energy Availability Factor:** 80.2%  
**Cumulative Load Factor:** 72.8%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 19.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 671.0          | 880.0          | 0.0  | 0.0    | 90.2                              | 100.0  | 9.4                | 0.0    | 1158               | 14.2   |
| 1985 | 5773.6         | 880.0          | 0.0  | 0.0    | 85.8                              | 100.0  | 74.9               | 0.0    | 7434               | 84.9   |
| 1986 | 5452.6         | 880.0          | 80.3   | 80.3   | 76.7                              | 76.7   | 70.7               | 70.7   | 6816               | 77.8   |
| 1987 | 5313.4         | 880.0          | 85.1   | 82.7   | 84.2                              | 80.5   | 68.9               | 69.8   | 6888               | 78.6   |
| 1988 | 3247.0         | 880.0          | 76.0   | 80.5   | 74.2                              | 78.4   | 42.0               | 60.5   | 4271               | 48.6   |
| 1989 | 4852.2         | 880.0          | 71.4   | 78.2   | 71.3                              | 76.6   | 62.9               | 61.1   | 6025               | 68.8   |
| 1990 | 6215.3         | 880.0          | 86.4   | 79.8   | 86.0                              | 78.5   | 80.6               | 65.0   | 7607               | 86.8   |
| 1991 | 6005.4         | 880.0          | 83.9   | 80.5   | 81.1                              | 78.9   | 77.9               | 67.2   | 7259               | 82.9   |
| 1992 | 4953.6         | 880.0          | 66.0   | 78.5   | 65.0                              | 76.9   | 64.1               | 66.7   | 5862               | 66.7   |
| 1993 | 5280.0         | 880.0          | 84.9   | 79.3   | 77.1                              | 76.9   | 68.5               | 67.0   | 6653               | 75.9   |
| 1994 | 5552.1         | 915.0          | 86.8   | 80.1   | 83.8                              | 77.7   | 69.3               | 67.2   | 6856               | 78.3   |
| 1995 | 6280.3         | 915.0          | 86.0   | 80.7   | 82.1                              | 78.2   | 78.4               | 68.4   | 7375               | 84.2   |
| 1996 | 5886.5         | 915.0          | 80.7   | 80.7   | 79.4                              | 78.3   | 73.2               | 68.8   | 7180               | 81.7   |
| 1997 | 5976.6         | 915.0          | 84.1   | 81.0   | 80.2                              | 78.5   | 74.6               | 69.3   | 7334               | 83.7   |
| 1998 | 6629.2         | 915.0          | 88.7   | 81.6   | 85.5                              | 79.0   | 82.7               | 70.4   | 7885               | 90.0   |
| 1999 | 5829.8         | 915.0          | 85.4   | 81.9   | 81.9                              | 79.2   | 72.7               | 70.5   | 7159               | 81.7   |
| 2000 | 6630.7         | 915.0          | 89.7   | 82.4   | 88.4                              | 79.9   | 82.5               | 71.4   | 7915               | 90.1   |
| 2001 | 5915.8         | 915.0          | 83.3   | 82.5   | 80.6                              | 79.9   | 73.8               | 71.5   | 7172               | 81.9   |
| 2002 | 6399.6         | 915.0          | 83.4   | 82.5   | 82.9                              | 80.1   | 79.8               | 72.0   | 7474               | 85.3   |
| 2003 | 6296.7         | 915.0          | 82.9   | 82.5   | 81.6                              | 80.2   | 78.6               | 72.4   | 7371               | 84.1   |
| 2004 | 6377.4         | 915.0          | 83.4   | 82.6   | 80.6                              | 80.2   | 79.3               | 72.8   | 7443               | 84.7   |

## FR-45 CRUAS-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 233.0  | 38.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                    |
| 04 Jan | 12.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 01 Feb | 228.0  | 16.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 25 Feb | 70.0   | 3.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                     |
| 03 May | 23.0   | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 04 May | 270.0  | 3.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                     |
| 25 May | 59.0   | 4.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 01 Jun | 176.0  | 33.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 15 Jun | 111.0  | 28.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 20 Jun | 22.0   | 8.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 01 Jul | 642.0  | 10.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 02 Jul | 28.0   | 4.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 07 Jul | 32.0   | 13.0    | UP2  | A33  | VARIOUS, PUMPHOUSE-CIRCULATING WATER                       |
| 01 Aug | 1456.0 | 179.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 02 Aug | 8.0    | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 05 Sep | 7.0    | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 01 Oct | 984.0  | 901.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 01 Oct | 23.0   | 6.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 12 Nov | 48.0   | 44.0    | PF   | C    | REFUELLING AND INSPECTION                                  |
| 14 Nov | 143.0  | 131.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                        |
| 20 Nov | 121.0  | 110.0   | UF2  | A42  | MAIN TRANSFORMER WITH FIRE PROTECTION                      |
| 25 Nov | 87.0   | 42.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 25 Nov | 17.0   | 16.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                            |
| 26 Nov | 28.0   | 26.0    | UF3  | A41  | GENERATOR ELECTRICAL PROTECTION                            |
| 01 Dec | 92.0   | 9.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 18 Dec | 82.0   | 6.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 149       |          |  | 217       |          |
| B. Refuelling without a maintenance  |                 |           |          | 45                                       | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1032            |           |          | 780                                      | 65        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 11                                       |           |          |
| E. Testing of plant systems or components  | 17              |           |          | 14                                       |           | 3        |
| J. Grid failure or grid unavailability   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 13        | 54       |
| Z. Others  |                 | 143       |          |  |           |          |
| Subtotal   | 1049            | 292       | 0        | 850                                      | 299       | 57       |
| Total  |                 | 1341      |          |  | 1206      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 8  |
| 13. Reactor Auxiliary Systems                  |                 | 22                                       |
| 14. Safety Systems                             |                 | 3  |
| 15. Reactor Cooling Systems                    |                 | 26                                       |
| 16. Steam generation systems                   |                 | 15                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 21. Fuel Handling and Storage Facilities       |                 | 4  |
| 31. Turbine and auxiliaries                    |                 | 28                                       |
| 32. Feedwater and Main Steam System            |                 | 14                                       |
| 41. Main Generator Systems                     | 28              | 39                                       |
| 42. Electrical Power Supply Systems            | 121             | 6  |
| XX. Miscellaneous Systems                      |                 | 1  |
| Total  | 149             | 166                                      |

# FR-22 DAMPIERRE-1

Operator: EDF (ELECTRICITE DE FRANCE)  
 Contractor: FRAM (FRAMATOME)

## 1. Station Details

Type: PWR  
 Net Reference Unit Power at the beginning of 2004: 890.0 MW(e)  
 Design Net RUP: 890.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

## 2. Production Summary 2004

Energy Production: 6091.2 GW(e).h  
 Energy Availability Factor: 89.3%  
 Load Factor: 77.9%  
 Operating Factor: 89.3%  
 Energy Unavailability Factor: 10.7%  
 Total Off-line Time: 944 hours

## 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 634.0 | 578.3 | 74.4 | 512.8 | 552.2 | 499.3 | 572.0 | 526.6 | 508.8 | 474.6 | 565.9 | 592.2 | 6091.2 |
| EAF (%)  | 99.8  | 94.1  | 12.4 | 84.1  | 95.4  | 96.6  | 98.7  | 99.1  | 99.1  | 93.8  | 99.4  | 99.6  | 89.3   |
| UCF (%)  | 99.8  | 95.4  | 13.2 | 84.2  | 95.5  | 99.5  | 98.7  | 99.1  | 99.1  | 93.8  | 99.4  | 99.8  | 89.7   |
| LF (%)   | 95.7  | 93.4  | 11.3 | 80.0  | 83.4  | 77.9  | 86.4  | 79.5  | 79.4  | 71.6  | 88.3  | 89.4  | 77.9   |
| OF (%)   | 100.0 | 96.7  | 13.2 | 92.9  | 93.8  | 100.0 | 100.0 | 100.0 | 95.7  | 87.1  | 96.0  | 96.9  | 89.3   |
| EUF (%)  | 0.2   | 5.9   | 87.6 | 15.9  | 4.6   | 3.4   | 1.3   | 0.9   | 0.9   | 6.2   | 0.6   | 0.4   | 10.7   |
| PUF (%)  | 0.2   | 0.0   | 86.8 | 13.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5    |
| UCLF (%) | 0.0   | 4.6   | 0.0  | 2.2   | 4.5   | 0.5   | 1.3   | 0.9   | 0.9   | 6.2   | 0.6   | 0.1   | 1.8    |
| XUF (%)  | 0.0   | 1.3   | 0.8  | 0.1   | 0.1   | 2.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|                               |             |  |                  |
|-------------------------------|-------------|--|------------------|
| Date of Construction Start:   | 01 Feb 1975 | Lifetime Generation:                     | 133728.8 GW(e).h |
| Date of First Criticality:    | 15 Mar 1980 | Cumulative Energy Availability Factor:   | 75.0%            |
| Date of Grid Connection:      | 23 Mar 1980 | Cumulative Load Factor:                  | 70.0%            |
| Date of Commercial Operation: | 10 Sep 1980 | Cumulative Unit Capability Factor:       | 77.7%            |
|                               |             | Cumulative Energy Unavailability Factor: | 25.0%            |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6263.0         | 890.0          | 85.9   | 69.2   | 85.9                              | 69.1   | 80.3               | 66.6   | 7847               | 89.6   |
| 1984 | 5391.0         | 890.0          | 75.1   | 70.7   | 73.6                              | 70.2   | 69.0               | 67.2   | 6777               | 77.2   |
| 1985 | 5738.5         | 890.0          | 80.9   | 72.7   | 80.6                              | 72.3   | 73.6               | 68.5   | 7223               | 82.5   |
| 1986 | 5157.4         | 890.0          | 75.9   | 73.2   | 75.7                              | 72.9   | 66.2               | 68.1   | 6673               | 76.2   |
| 1987 | 4780.2         | 890.0          | 67.9   | 72.5   | 65.9                              | 71.9   | 61.3               | 67.1   | 6245               | 71.3   |
| 1988 | 3920.0         | 890.0          | 61.1   | 71.0   | 59.6                              | 70.3   | 50.1               | 65.0   | 5239               | 59.6   |
| 1989 | 6467.6         | 890.0          | 98.7   | 74.1   | 97.9                              | 73.4   | 83.0               | 67.0   | 8207               | 93.7   |
| 1990 | 2187.1         | 890.0          | 36.3   | 70.3   | 34.0                              | 69.5   | 28.1               | 63.1   | 3110               | 35.5   |
| 1991 | 6390.9         | 890.0          | 82.3   | 71.4   | 81.8                              | 70.6   | 82.0               | 64.8   | 7305               | 83.4   |
| 1992 | 6305.1         | 890.0          | 81.7   | 72.3   | 80.7                              | 71.4   | 80.7               | 66.1   | 7293               | 83.0   |
| 1993 | 6702.8         | 890.0          | 86.6   | 73.4   | 86.4                              | 72.6   | 86.0               | 67.7   | 7676               | 87.6   |
| 1994 | 5299.2         | 890.0          | 69.7   | 73.1   | 68.9                              | 72.3   | 68.0               | 67.7   | 6185               | 70.6   |
| 1995 | 6194.0         | 890.0          | 84.4   | 73.9   | 82.9                              | 73.0   | 79.4               | 68.5   | 7413               | 84.6   |
| 1996 | 5895.5         | 890.0          | 83.1   | 74.5   | 82.2                              | 73.6   | 75.4               | 68.9   | 7378               | 84.0   |
| 1997 | 5172.1         | 890.0          | 72.3   | 74.3   | 71.9                              | 73.5   | 66.3               | 68.7   | 6465               | 73.8   |
| 1998 | 6042.7         | 890.0          | 81.9   | 74.7   | 80.5                              | 73.9   | 77.5               | 69.2   | 7294               | 83.3   |
| 1999 | 5492.4         | 890.0          | 76.8   | 74.8   | 75.3                              | 74.0   | 70.4               | 69.3   | 6815               | 77.8   |
| 2000 | 6153.8         | 890.0          | 87.0   | 75.5   | 85.4                              | 74.5   | 78.7               | 69.8   | 7676               | 87.4   |
| 2001 | 4125.1         | 890.0          | 56.8   | 74.6   | 56.7                              | 73.7   | 52.9               | 69.0   | 5152               | 58.8   |
| 2002 | 6249.6         | 890.0          | 87.6   | 75.2   | 86.8                              | 74.3   | 80.2               | 69.5   | 7586               | 86.6   |
| 2003 | 5733.3         | 890.0          | 78.3   | 75.3   | 76.8                              | 74.4   | 73.5               | 69.6   | 6964               | 79.5   |
| 2004 | 6091.2         | 890.0          | 89.7   | 75.9   | 89.3                              | 75.0   | 77.9               | 70.0   | 7840               | 89.3   |

## FR-22 DAMPIERRE-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 222.0 | 27.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Feb | 150.0 | 3.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 08 Feb | 449.0 | 8.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 10 Feb | 23.0  | 21.0    | UF2  | L    | HUMAN ERROR DURING MAINTENANCE                                |
| 01 Mar | 98.0  | 5.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 05 Mar | 695.0 | 620.0   | PF   | C    | REFUELLING WITH NO INSPECTION                                 |
| 03 Apr | 84.0  | 40.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 07 Apr | 342.0 | 4.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 14 Apr | 71.0  | 23.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 May | 75.0  | 38.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 May | 429.0 | 6.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 04 May | 21.0  | 19.0    | UF2  | A    | MISCELLANEOUS   |
| 10 May | 99.0  | 10.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Jun | 185.0 | 111.0   | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Jun | 209.0 | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 15 Jun | 27.0  | 19.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 Jul | 430.0 | 9.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 02 Jul | 129.0 | 73.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                       |
| 01 Aug | 306.0 | 7.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 01 Aug | 163.0 | 122.0   | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                       |
| 01 Sep | 146.0 | 118.0   | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                       |
| 01 Sep | 360.0 | 6.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 01 Oct | 214.0 | 139.0   | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                       |
| 01 Oct | 177.0 | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 22 Oct | 40.0  | 35.0    | UF2  | A32  | STEAM TURBINE PIPING  |
| 02 Nov | 405.0 | 4.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 12 Nov | 122.0 | 41.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Dec | 131.0 | 66.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Dec | 145.0 | 1.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 61        |          |  | 321       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 7         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 695             |           |          | 1163                                     | 42        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 75                                       | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 178       | 47       |
| L. Human factor related  |                 | 23        |          |  | 13        |          |
| Z. Others  |                 |           |          |  | 13        |          |
| Subtotal   | 695             | 84        | 0        | 1240                                     | 575       | 47       |
| Total  |                 | 779       |          |  | 1862      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 3  |
| 12. Reactor I&C Systems                        |                 | 44                                       |
| 13. Reactor Auxiliary Systems                  |                 | 14                                       |
| 14. Safety Systems                             |                 | 9  |
| 15. Reactor Cooling Systems                    |                 | 52                                       |
| 16. Steam generation systems                   |                 | 61                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 21. Fuel Handling and Storage Facilities       |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 12                                       |
| 32. Feedwater and Main Steam System            | 40              | 22                                       |
| 33. Circulating Water System                   |                 | 0  |
| 41. Main Generator Systems                     |                 | 66                                       |
| 42. Electrical Power Supply Systems            |                 | 9  |
| Total  | 40              | 292                                      |

# FR-29 DAMPIERRE-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 890.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5983.9 GW(e).h  
**Energy Availability Factor:** 93.7%  
**Load Factor:** 76.5%  
**Operating Factor:** 82.9%  
**Energy Unavailability Factor:** 6.3%  
**Total Off-line Time:** 1498 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 649.1 | 533.5 | 163.6 | 626.7 | 643.2 | 612.3 | 151.8 | 347.6 | 615.6 | 640.7 | 584.2 | 415.7 | 5983.9 |
| <b>EAF (%)</b>  | 98.1  | 96.2  | 95.1  | 97.8  | 97.4  | 96.9  | 99.4  | 95.6  | 97.2  | 96.9  | 91.2  | 63.1  | 93.7   |
| <b>UCF (%)</b>  | 98.1  | 96.2  | 95.1  | 97.8  | 97.4  | 96.9  | 99.4  | 95.6  | 97.2  | 97.8  | 100.0 | 77.7  | 95.7   |
| <b>LF (%)</b>   | 98.0  | 86.1  | 24.7  | 97.8  | 97.1  | 95.6  | 22.9  | 52.5  | 96.1  | 96.6  | 91.2  | 62.8  | 76.5   |
| <b>OF (%)</b>   | 100.0 | 90.5  | 33.9  | 100.0 | 100.0 | 100.0 | 29.3  | 66.5  | 100.0 | 100.0 | 100.0 | 77.7  | 82.9   |
| <b>EUF (%)</b>  | 1.9   | 3.8   | 4.9   | 2.2   | 2.6   | 3.1   | 0.6   | 4.4   | 2.8   | 3.1   | 8.8   | 36.9  | 6.3    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 22.3  | 1.9    |
| <b>UCLF (%)</b> | 1.9   | 3.8   | 4.9   | 2.2   | 2.6   | 3.1   | 0.6   | 4.4   | 2.8   | 2.1   | 0.0   | 0.0   | 2.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.9   | 8.8   | 14.5  | 2.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1975  
**Date of First Criticality:** 05 Dec 1980  
**Date of Grid Connection:** 10 Dec 1980  
**Date of Commercial Operation:** 16 Feb 1981

**Lifetime Generation:** 127258.0 GW(e).h  
**Cumulative Energy Availability Factor:** 76.1%  
**Cumulative Load Factor:** 67.7%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 23.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5191.0         | 890.0          | 67.7   | 60.4   | 67.7                              | 60.4   | 66.6               | 59.7   | 6139               | 70.1   |
| 1984 | 5781.0         | 890.0          | 76.6   | 65.8   | 76.1                              | 65.6   | 73.9               | 64.4   | 6884               | 78.4   |
| 1985 | 6056.9         | 890.0          | 84.5   | 70.5   | 84.3                              | 70.3   | 77.7               | 67.7   | 7400               | 84.5   |
| 1986 | 5658.5         | 890.0          | 82.2   | 72.8   | 82.0                              | 72.6   | 72.6               | 68.7   | 6983               | 79.7   |
| 1987 | 4856.0         | 890.0          | 78.8   | 73.8   | 76.4                              | 73.3   | 62.3               | 67.6   | 5715               | 65.2   |
| 1988 | 4583.0         | 890.0          | 95.1   | 76.8   | 92.4                              | 76.0   | 58.6               | 66.3   | 6153               | 70.0   |
| 1989 | 5485.3         | 890.0          | 79.7   | 77.2   | 77.0                              | 76.1   | 70.4               | 66.8   | 6927               | 79.1   |
| 1990 | 4869.5         | 890.0          | 70.0   | 76.4   | 67.8                              | 75.2   | 62.5               | 66.4   | 6292               | 71.8   |
| 1991 | 4201.9         | 890.0          | 67.6   | 75.5   | 63.3                              | 74.0   | 53.9               | 65.1   | 5407               | 61.7   |
| 1992 | 5049.8         | 890.0          | 75.9   | 75.5   | 74.7                              | 74.1   | 64.6               | 65.1   | 6429               | 73.2   |
| 1993 | 5976.6         | 890.0          | 87.4   | 76.5   | 79.6                              | 74.5   | 76.7               | 66.0   | 7625               | 87.0   |
| 1994 | 4445.0         | 890.0          | 84.8   | 77.2   | 84.8                              | 75.3   | 57.0               | 65.3   | 5328               | 60.8   |
| 1995 | 5562.0         | 890.0          | 95.5   | 78.5   | 95.0                              | 76.7   | 71.3               | 65.8   | 6952               | 79.4   |
| 1996 | 5761.0         | 890.0          | 84.2   | 78.9   | 81.5                              | 77.0   | 73.7               | 66.3   | 7437               | 84.7   |
| 1997 | 4966.6         | 890.0          | 69.3   | 78.3   | 67.5                              | 76.4   | 63.7               | 66.1   | 6204               | 70.8   |
| 1998 | 5855.9         | 890.0          | 80.3   | 78.4   | 78.3                              | 76.6   | 75.1               | 66.7   | 7192               | 82.1   |
| 1999 | 5312.9         | 890.0          | 72.6   | 78.1   | 69.2                              | 76.1   | 68.1               | 66.7   | 6688               | 76.3   |
| 2000 | 5866.1         | 890.0          | 77.5   | 78.0   | 76.0                              | 76.1   | 75.0               | 67.2   | 7121               | 81.1   |
| 2001 | 5355.9         | 890.0          | 75.1   | 77.9   | 72.4                              | 76.0   | 68.7               | 67.3   | 6593               | 75.3   |
| 2002 | 4307.5         | 890.0          | 56.3   | 76.9   | 56.0                              | 75.0   | 55.3               | 66.7   | 5196               | 59.3   |
| 2003 | 6268.3         | 890.0          | 81.4   | 77.1   | 81.3                              | 75.3   | 80.4               | 67.3   | 7631               | 87.1   |
| 2004 | 5983.9         | 890.0          | 95.7   | 77.9   | 93.7                              | 76.1   | 76.5               | 67.7   | 7286               | 82.9   |



## FR-29 DAMPIERRE-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                                      |
|--------|--------|---------|------|------|--|
| 02 Jan | 1347.0 | 36.0    | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS           |
| 27 Feb | 69.0   | 60.0    | XP   | K    | LOAD LIMITATION OR SHUTDOWN TO OPTIMIZE SHUTDOWN |
| 01 Apr | 1392.0 | 29.0    | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS           |
| 18 May | 72.0   | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)  |
| 01 Jun | 860.0  | 24.0    | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS           |
| 10 Aug | 28.0   | 25.0    | UF2  | A32  | LOW-PRESSURE HEATING                             |
| 24 Aug | 176.0  | 4.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)  |
| 01 Sep | 717.0  | 18.0    | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)  |
| 01 Oct | 523.0  | 12.0    | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)  |
| 05 Oct | 16.0   | 1.0     | PP   | E    | EQUIPMENT PERFORMANCE TEST (SPECIAL)             |
| 05 Oct | 27.0   | 2.0     | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL              |
| 24 Oct | 1478.0 | 159.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT               |
| 25 Dec | 165.0  | 147.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 28        |          |  | 364       |          |
| B. Refuelling without a maintenance  |                 |           |          | 32                                       | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 165             |           |          | 1076                                     | 19        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 94                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 5         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 1         | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 108       | 26       |
| Z. Others  |                 |           |          |  | 8         |          |
| Subtotal   | 165             | 28        | 0        | 1205                                     | 510       | 27       |
| Total  |                 | 193       |          |  | 1742      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 13                                       |
| 13. Reactor Auxiliary Systems            |                 | 17                                       |
| 14. Safety Systems                       |                 | 28                                       |
| 15. Reactor Cooling Systems              |                 | 54                                       |
| 16. Steam generation systems             |                 | 35                                       |
| 21. Fuel Handling and Storage Facilities |                 | 0  |
| 31. Turbine and auxiliaries              |                 | 74                                       |
| 32. Feedwater and Main Steam System      | 28              | 14                                       |
| 41. Main Generator Systems               |                 | 46                                       |
| 42. Electrical Power Supply Systems      |                 | 32                                       |
| Total                                    | 28              | 313                                      |

## FR-30 DAMPIERRE-3

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

### 1. Station Details

Type: PWR  
 Net Reference Unit Power at the beginning of 2004: 890.0 MW(e)  
 Design Net RUP: 890.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

### 2. Production Summary 2004

Energy Production: 6867.2 GW(e).h  
 Energy Availability Factor: 88.0%  
 Load Factor: 87.8%  
 Operating Factor: 90.2%  
 Energy Unavailability Factor: 12.0%  
 Total Off-line Time: 864 hours

### 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 651.0 | 619.2 | 659.4 | 631.4 | 654.1 | 623.4 | 566.6 | 0.0   | 504.4 | 653.7 | 638.6 | 665.4 | 6867.2 |
| EAF (%)  | 98.1  | 99.9  | 99.5  | 99.1  | 99.2  | 98.3  | 85.7  | 0.0   | 79.9  | 99.1  | 99.0  | 99.5  | 88.0   |
| UCF (%)  | 98.1  | 99.9  | 99.7  | 99.5  | 99.3  | 99.7  | 96.9  | 0.0   | 79.9  | 99.6  | 99.9  | 99.9  | 89.3   |
| LF (%)   | 98.3  | 100.0 | 99.7  | 98.5  | 98.8  | 97.3  | 85.6  | 0.0   | 78.7  | 98.6  | 99.7  | 100.5 | 87.8   |
| OF (%)   | 99.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.0  | 0.0   | 87.4  | 100.0 | 100.0 | 100.0 | 90.2   |
| EUF (%)  | 1.9   | 0.1   | 0.5   | 0.9   | 0.8   | 1.7   | 14.3  | 100.0 | 20.1  | 0.9   | 1.0   | 0.5   | 12.0   |
| PUF (%)  | 0.2   | 0.0   | 0.0   | 0.1   | 0.0   | 0.1   | 3.1   | 100.0 | 19.5  | 0.0   | 0.0   | 0.0   | 10.4   |
| UCLF (%) | 1.7   | 0.1   | 0.3   | 0.4   | 0.7   | 0.3   | 0.0   | 0.0   | 0.6   | 0.4   | 0.1   | 0.0   | 0.4    |
| XUF (%)  | 0.0   | 0.0   | 0.2   | 0.4   | 0.1   | 1.3   | 11.3  | 0.0   | 0.0   | 0.5   | 0.9   | 0.5   | 1.3    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

Date of Construction Start: 01 Sep 1975  
 Date of First Criticality: 25 Jan 1981  
 Date of Grid Connection: 30 Jan 1981  
 Date of Commercial Operation: 27 May 1981

Lifetime Generation: 133353.8 GW(e).h  
 Cumulative Energy Availability Factor: 76.3%  
 Cumulative Load Factor: 71.5%  
 Cumulative Unit Capability Factor: 77.8%  
 Cumulative Energy Unavailability Factor: 23.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5517.0         | 890.0          | 72.7   | 60.7   | 72.7                              | 60.7   | 70.8               | 59.5   | 6638               | 75.8   |
| 1984 | 6206.0         | 890.0          | 79.8   | 67.1   | 79.7                              | 67.0   | 79.4               | 66.2   | 7121               | 81.1   |
| 1985 | 6364.4         | 890.0          | 85.1   | 71.6   | 84.9                              | 71.5   | 81.6               | 70.0   | 7523               | 85.9   |
| 1986 | 6717.2         | 890.0          | 99.9   | 77.2   | 99.5                              | 77.1   | 86.2               | 73.3   | 8330               | 95.1   |
| 1987 | 5019.5         | 890.0          | 82.4   | 78.1   | 79.3                              | 77.5   | 64.4               | 71.8   | 6269               | 71.6   |
| 1988 | 4964.0         | 890.0          | 72.9   | 77.3   | 68.5                              | 76.2   | 63.5               | 70.6   | 6435               | 73.3   |
| 1989 | 5912.9         | 890.0          | 82.2   | 78.0   | 78.4                              | 76.5   | 75.8               | 71.2   | 7242               | 82.7   |
| 1990 | 5996.5         | 890.0          | 82.5   | 78.5   | 79.8                              | 76.8   | 76.9               | 71.9   | 7348               | 83.9   |
| 1991 | 5124.1         | 890.0          | 70.0   | 77.6   | 69.6                              | 76.1   | 65.7               | 71.3   | 6244               | 71.3   |
| 1992 | 4875.1         | 890.0          | 65.5   | 76.5   | 65.5                              | 75.1   | 62.4               | 70.5   | 5814               | 66.2   |
| 1993 | 6148.8         | 890.0          | 82.8   | 77.0   | 82.8                              | 75.8   | 78.9               | 71.2   | 7333               | 83.7   |
| 1994 | 5537.6         | 890.0          | 86.2   | 77.7   | 82.7                              | 76.3   | 71.0               | 71.1   | 7013               | 80.1   |
| 1995 | 4773.5         | 890.0          | 83.4   | 78.1   | 80.2                              | 76.6   | 61.2               | 70.4   | 6343               | 72.4   |
| 1996 | 5575.1         | 890.0          | 77.6   | 78.1   | 77.1                              | 76.6   | 71.3               | 70.5   | 6940               | 79.0   |
| 1997 | 5720.9         | 890.0          | 81.0   | 78.3   | 78.3                              | 76.7   | 73.4               | 70.7   | 7211               | 82.3   |
| 1998 | 5905.8         | 890.0          | 82.7   | 78.5   | 81.4                              | 77.0   | 75.8               | 71.0   | 7210               | 82.3   |
| 1999 | 5779.4         | 890.0          | 80.9   | 78.7   | 78.2                              | 77.1   | 74.1               | 71.1   | 7186               | 82.0   |
| 2000 | 4308.3         | 890.0          | 59.8   | 77.7   | 57.6                              | 76.0   | 55.1               | 70.3   | 5378               | 61.2   |
| 2001 | 5993.0         | 890.0          | 77.8   | 77.7   | 77.4                              | 76.1   | 76.9               | 70.6   | 7060               | 80.6   |
| 2002 | 5929.8         | 890.0          | 77.4   | 77.7   | 76.8                              | 76.1   | 76.1               | 70.9   | 6877               | 78.5   |
| 2003 | 5346.9         | 890.0          | 69.0   | 77.3   | 68.9                              | 75.8   | 68.6               | 70.8   | 6152               | 70.2   |
| 2004 | 6867.2         | 890.0          | 89.3   | 77.8   | 88.0                              | 76.3   | 87.8               | 71.5   | 7920               | 90.2   |

## FR-30 DAMPIERRE-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 04 Jan | 7.0    | 6.0     | UF2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                   |
| 04 Jan | 8.0    | 4.0     | UP2  | A32  | VARIOUS, VENTILATION, TRANSFER AND COOLING SYSTEMS       |
| 08 Jan | 312.0  | 1.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)          |
| 05 Mar | 276.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)          |
| 17 Mar | 75.0   | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 01 Apr | 404.0  | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)          |
| 01 Apr | 134.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 07 Apr | 3.0    | 1.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION  |
| 08 Apr | 14.0   | 1.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX |
| 01 May | 654.0  | 4.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)          |
| 01 Jun | 398.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)          |
| 18 Jun | 1020.0 | 83.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                       |
| 31 Jul | 720.0  | 641.0   | PF   | C    | REFUELLING WITH NO INSPECTION                            |
| 31 Aug | 115.0  | 102.0   | PF   | C    | REFUELLING AND INSPECTION                                |
| 04 Sep | 86.0   | 32.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                          |
| 04 Sep | 13.0   | 12.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                          |
| 08 Sep | 444.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)          |
| 09 Sep | 50.0   | 2.0     | UP2  | A12  | REACTOR CONTROL  |
| 01 Oct | 178.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS    |
| 01 Oct | 512.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)          |
| 16 Nov | 10.0   | 6.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION  |
| 08 Dec | 6.0    | 3.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 7         |          |  | 315       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 835             |           |          | 1235                                     | 11        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 35                                       | 2         |          |
| E. Testing of plant systems or components  | 13              |           |          | 5  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 85        |          |
| Z. Others  |                 |           |          |  | 8         |          |
| Subtotal   | 848             | 7         | 0        | 1275                                     | 438       | 0        |
| Total  |                 | 855       |          |  | 1713      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             |                 | 4  |
| 13. Reactor Auxiliary Systems       |                 | 10                                       |
| 14. Safety Systems                  |                 | 48                                       |
| 15. Reactor Cooling Systems         |                 | 78                                       |
| 16. Steam generation systems        | 7               | 56                                       |
| 31. Turbine and auxiliaries         |                 | 34                                       |
| 32. Feedwater and Main Steam System |                 | 9  |
| 33. Circulating Water System        |                 | 1  |
| 41. Main Generator Systems          |                 | 35                                       |
| 42. Electrical Power Supply Systems |                 | 6  |
| Total                               | 7               | 282                                      |

# FR-31 DAMPIERRE-4

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 890.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4531.8 GW(e).h  
**Energy Availability Factor:** 59.4%  
**Load Factor:** 58.0%  
**Operating Factor:** 63.2%  
**Energy Unavailability Factor:** 40.6%  
**Total Off-line Time:** 3233 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 635.9 | 577.3 | 451.8 | 0.0   | 0.0   | 0.0   | 145.3 | 212.4 | 602.9 | 634.4 | 624.1 | 647.7 | 4531.8 |
| <b>EAF (%)</b>  | 99.7  | 93.2  | 68.8  | 0.0   | 0.0   | 0.0   | 23.7  | 34.3  | 97.5  | 98.9  | 98.6  | 99.4  | 59.4   |
| <b>UCF (%)</b>  | 99.8  | 100.0 | 83.9  | 0.0   | 0.0   | 0.0   | 23.8  | 34.3  | 97.5  | 98.9  | 99.2  | 99.4  | 61.3   |
| <b>LF (%)</b>   | 96.0  | 93.2  | 68.3  | 0.0   | 0.0   | 0.0   | 21.9  | 32.1  | 94.1  | 95.7  | 97.4  | 97.8  | 58.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 84.0  | 0.0   | 0.0   | 0.0   | 35.2  | 39.8  | 100.0 | 100.0 | 100.0 | 100.0 | 63.2   |
| <b>EUF (%)</b>  | 0.3   | 6.8   | 31.2  | 100.0 | 100.0 | 100.0 | 76.3  | 65.7  | 2.5   | 1.1   | 1.4   | 0.6   | 40.6   |
| <b>PUF (%)</b>  | 0.1   | 0.0   | 16.1  | 100.0 | 100.0 | 88.4  | 10.8  | 0.0   | 0.0   | 0.1   | 0.2   | 0.0   | 26.2   |
| <b>UCLF (%)</b> | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 11.6  | 65.5  | 65.7  | 2.5   | 1.0   | 0.6   | 0.6   | 12.5   |
| <b>XUF (%)</b>  | 0.1   | 6.8   | 15.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 0.0   | 1.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1975  
**Date of First Criticality:** 05 Aug 1981  
**Date of Grid Connection:** 18 Aug 1981  
**Date of Commercial Operation:** 20 Nov 1981

**Lifetime Generation:** 126505.1 GW(e).h  
**Cumulative Energy Availability Factor:** 75.6%  
**Cumulative Load Factor:** 69.7%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 24.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4156.0         | 890.0          | 57.6   | 69.7   | 57.6                              | 69.7   | 53.3               | 63.5   | 5207               | 59.4   |
| 1984 | 6276.0         | 890.0          | 87.1   | 75.5   | 85.1                              | 74.8   | 80.3               | 69.1   | 7765               | 88.4   |
| 1985 | 5859.9         | 890.0          | 83.5   | 77.5   | 78.9                              | 75.9   | 75.2               | 70.6   | 7387               | 84.3   |
| 1986 | 6664.9         | 890.0          | 88.8   | 79.8   | 88.5                              | 78.4   | 85.5               | 73.6   | 7862               | 89.7   |
| 1987 | 5447.8         | 890.0          | 78.4   | 79.5   | 78.1                              | 78.3   | 69.9               | 73.0   | 6795               | 77.6   |
| 1988 | 5086.0         | 890.0          | 82.9   | 80.0   | 79.9                              | 78.6   | 65.1               | 71.8   | 6645               | 75.6   |
| 1989 | 5392.4         | 890.0          | 73.7   | 79.2   | 72.9                              | 77.9   | 69.2               | 71.5   | 6621               | 75.6   |
| 1990 | 5153.0         | 890.0          | 91.2   | 80.6   | 87.3                              | 78.9   | 66.1               | 70.9   | 6792               | 77.5   |
| 1991 | 6062.8         | 890.0          | 88.3   | 81.3   | 86.7                              | 79.7   | 77.8               | 71.6   | 7612               | 86.9   |
| 1992 | 5331.5         | 890.0          | 76.7   | 80.9   | 74.5                              | 79.2   | 68.2               | 71.3   | 6832               | 77.8   |
| 1993 | 4827.7         | 890.0          | 69.3   | 79.9   | 63.4                              | 77.9   | 61.9               | 70.5   | 6103               | 69.7   |
| 1994 | 5264.0         | 890.0          | 80.7   | 80.0   | 79.5                              | 78.0   | 67.5               | 70.3   | 7103               | 81.1   |
| 1995 | 5488.0         | 890.0          | 78.8   | 79.9   | 75.4                              | 77.8   | 70.4               | 70.3   | 6997               | 79.9   |
| 1996 | 6118.5         | 890.0          | 83.7   | 80.2   | 82.9                              | 78.2   | 78.3               | 70.8   | 7596               | 86.5   |
| 1997 | 5918.6         | 890.0          | 80.9   | 80.2   | 80.5                              | 78.3   | 75.9               | 71.1   | 7178               | 81.9   |
| 1998 | 4506.5         | 890.0          | 60.6   | 79.1   | 59.0                              | 77.2   | 57.8               | 70.3   | 5435               | 62.0   |
| 1999 | 4642.5         | 890.0          | 64.8   | 78.3   | 64.1                              | 76.5   | 59.5               | 69.7   | 5770               | 65.9   |
| 2000 | 5598.7         | 890.0          | 76.0   | 78.2   | 75.2                              | 76.4   | 71.6               | 69.8   | 6752               | 76.9   |
| 2001 | 5361.8         | 890.0          | 70.9   | 77.8   | 70.1                              | 76.1   | 68.8               | 69.8   | 6422               | 73.3   |
| 2002 | 6134.5         | 890.0          | 85.3   | 78.1   | 83.8                              | 76.4   | 78.7               | 70.2   | 7576               | 86.5   |
| 2003 | 5547.4         | 890.0          | 77.4   | 78.1   | 73.4                              | 76.3   | 71.2               | 70.3   | 6759               | 77.2   |
| 2004 | 4531.8         | 890.0          | 61.3   | 77.4   | 59.4                              | 75.6   | 58.0               | 69.7   | 5551               | 63.2   |

# FR-31 DAMPIERRE-4

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 186.0  | 24.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                        |
| 01 Feb | 693.0  | 42.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 01 Mar | 617.0  | 99.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 26 Mar | 2195.0 | 1953.0  | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                            |
| 30 Jun | 11.0   | 10.0    | PF   | C    | REFUELLING AND INSPECTION                                      |
| 30 Jun | 13.0   | 9.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 01 Jul | 180.0  | 71.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 08 Jul | 78.0   | 2.0     | UP2  | A12  | REACTOR CONTROL  |
| 11 Jul | 482.0  | 429.0   | UF2  | A41  | ALTERNATOR ROTOR   |
| 11 Jul | 2.0    | 2.0     | UP2  | A41  | ALTERNATOR ROTOR   |
| 01 Aug | 73.0   | 26.0    | UP2  | A41  | ALTERNATOR ROTOR   |
| 01 Aug | 449.0  | 400.0   | UF2  | A41  | ALTERNATOR ROTOR   |
| 22 Aug | 43.0   | 2.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                         |
| 24 Aug | 18.0   | 4.0     | UP2  | A12  | INSTRUMENTATION AND CONTROL OF PRIMARY CIRCUIT (INCLUDING SG)  |
| 25 Aug | 162.0  | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 01 Sep | 569.0  | 13.0    | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 12 Sep | 42.0   | 5.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 19 Sep | 14.0   | 6.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 19 Sep | 8.0    | 3.0     | UP2  | A12  | REACTOR CONTROL  |
| 23 Sep | 61.0   | 4.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 Oct | 486.0  | 7.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 01 Oct | 111.0  | 19.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCOMAX       |
| 01 Nov | 362.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 13 Nov | 50.0   | 5.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 16 Nov | 7.0    | 4.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 21 Nov | 67.0   | 1.0     | UP2  | Z    | MALFUNCTION OF REGULATION, PROTECTION AND CONTROL SYSTEMS      |
| 21 Nov | 3.0    | 1.0     | PP   | E    | TEST OF HOUSE LOAD OPERATION                                   |
| 01 Dec | 72.0   | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 Dec | 303.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 27 Dec | 110.0  | 2.0     | UP2  | A32  | LOW-PRESSURE HEATING   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 931       |          |  | 497       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 2206            |           |          | 996                                      | 35        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 6  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 6  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 90        | 13       |
| Z. Others  |                 |           |          |  | 13        |          |
| Subtotal   | 2206            | 931       | 0        | 1008                                     | 638       | 13       |
| Total  |                 | 3137      |          |  | 1659      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 63                                       |
| 12. Reactor I&C Systems             |                 | 5  |
| 13. Reactor Auxiliary Systems       |                 | 66                                       |
| 14. Safety Systems                  |                 | 7  |
| 15. Reactor Cooling Systems         |                 | 10                                       |
| 16. Steam generation systems        |                 | 129                                      |
| 31. Turbine and auxiliaries         |                 | 31                                       |
| 32. Feedwater and Main Steam System |                 | 35                                       |
| 33. Circulating Water System        |                 | 2  |
| 41. Main Generator Systems          | 931             | 71                                       |
| 42. Electrical Power Supply Systems |                 | 5  |
| Total                               | 931             | 424                                      |

**FR-11 FESSENHEIM-1**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 880.0 MW(e)  
 Design Net RUP: 880.0 MW(e)  
 Design Discharge Burnup: 33700 MW.d/t

**2. Production Summary 2004**

Energy Production: 3726.5 GW(e).h  
 Energy Availability Factor: 49.6%  
 Load Factor: 48.2%  
 Operating Factor: 51.2%  
 Energy Unavailability Factor: 50.4%  
 Total Off-line Time: 4284 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 472.6 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 335.6 | 602.7 | 609.1 | 456.7 | 608.2 | 641.6 | 3726.5 |
| EAF (%)  | 72.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 53.5  | 96.7  | 99.3  | 71.9  | 99.0  | 99.4  | 49.6   |
| UCF (%)  | 79.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 53.5  | 96.7  | 99.3  | 71.9  | 99.0  | 99.4  | 50.2   |
| LF (%)   | 72.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 51.3  | 92.1  | 96.1  | 69.7  | 96.0  | 98.0  | 48.2   |
| OF (%)   | 79.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 60.2  | 98.0  | 100.0 | 73.2  | 100.0 | 100.0 | 51.2   |
| EUF (%)  | 27.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 46.5  | 3.3   | 0.7   | 28.1  | 1.0   | 0.6   | 50.4   |
| PUF (%)  | 0.0   | 30.7  | 67.8  | 0.0   | 0.0   | 0.0   | 6.5   | 2.5   | 0.0   | 0.0   | 0.0   | 0.0   | 8.9    |
| UCLF (%) | 20.2  | 69.3  | 32.2  | 100.0 | 100.0 | 100.0 | 39.9  | 0.8   | 0.7   | 28.1  | 1.1   | 0.6   | 40.8   |
| XUF (%)  | 7.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Sep 1971      Lifetime Generation: 139723.1 GW(e).h  
 Date of First Criticality: 07 Mar 1977      Cumulative Energy Availability Factor: 70.2%  
 Date of Grid Connection: 06 Apr 1977      Cumulative Load Factor: 66.6%  
 Date of Commercial Operation: 01 Jan 1978      Cumulative Unit Capability Factor: 77.6%  
    Cumulative Energy Unavailability Factor: 29.8%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 5690.0            | 880.0             | 75.3   | 72.7   | 75.3                                 | 62.1   | 73.8               | 61.6   | 6701                  | 76.5   |
| 1984 | 6503.0            | 880.0             | 86.1   | 74.6   | 85.2                                 | 65.4   | 84.1               | 64.8   | 7731                  | 88.0   |
| 1985 | 6044.6            | 880.0             | 80.4   | 75.3   | 79.8                                 | 67.2   | 78.4               | 66.5   | 7105                  | 81.1   |
| 1986 | 5661.3            | 880.0             | 75.1   | 75.3   | 74.7                                 | 68.0   | 73.4               | 67.3   | 6702                  | 76.5   |
| 1987 | 5029.6            | 880.0             | 74.1   | 75.2   | 73.6                                 | 68.6   | 65.2               | 67.1   | 6147                  | 70.2   |
| 1988 | 5399.0            | 880.0             | 86.5   | 76.2   | 77.9                                 | 69.4   | 69.8               | 67.3   | 7069                  | 80.5   |
| 1989 | 3253.3            | 880.0             | 46.1   | 73.7   | 43.4                                 | 67.3   | 42.2               | 65.2   | 4108                  | 46.9   |
| 1990 | 5036.7            | 880.0             | 79.6   | 74.1   | 74.6                                 | 67.8   | 65.3               | 65.3   | 6481                  | 74.0   |
| 1991 | 4053.5            | 880.0             | 55.8   | 72.8   | 55.5                                 | 66.9   | 52.6               | 64.4   | 4900                  | 55.9   |
| 1992 | 4867.1            | 880.0             | 67.1   | 72.5   | 66.8                                 | 66.9   | 63.1               | 64.3   | 6079                  | 69.4   |
| 1993 | 5548.7            | 880.0             | 81.0   | 73.0   | 74.6                                 | 67.4   | 72.0               | 64.8   | 7161                  | 81.7   |
| 1994 | 6186.1            | 880.0             | 87.4   | 73.8   | 86.5                                 | 68.5   | 80.2               | 65.7   | 7508                  | 85.7   |
| 1995 | 5856.1            | 880.0             | 85.5   | 74.5   | 84.7                                 | 69.4   | 76.0               | 66.2   | 6990                  | 79.8   |
| 1996 | 6165.0            | 880.0             | 85.3   | 75.0   | 85.2                                 | 70.3   | 79.8               | 66.9   | 7544                  | 85.9   |
| 1997 | 5826.8            | 880.0             | 81.6   | 75.4   | 81.5                                 | 70.8   | 75.6               | 67.4   | 7209                  | 82.3   |
| 1998 | 4617.1            | 880.0             | 64.3   | 74.8   | 61.7                                 | 70.4   | 59.9               | 67.0   | 5727                  | 65.4   |
| 1999 | 5228.8            | 880.0             | 71.2   | 74.7   | 70.8                                 | 70.4   | 67.8               | 67.1   | 6283                  | 71.7   |
| 2000 | 5782.6            | 880.0             | 81.1   | 75.0   | 80.8                                 | 70.9   | 74.8               | 67.4   | 7145                  | 81.3   |
| 2001 | 5507.5            | 880.0             | 79.6   | 75.2   | 78.4                                 | 71.2   | 71.4               | 67.6   | 7095                  | 81.0   |
| 2002 | 2989.7            | 880.0             | 42.9   | 73.9   | 41.1                                 | 70.0   | 38.8               | 66.4   | 3832                  | 43.7   |
| 2003 | 6985.2            | 880.0             | 98.2   | 74.8   | 96.5                                 | 71.0   | 90.6               | 67.3   | 8518                  | 97.2   |
| 2004 | 3726.5            | 880.0             | 50.2   | 73.9   | 49.6                                 | 70.2   | 48.2               | 66.6   | 4500                  | 51.2   |

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## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 591.0  | 46.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 25 Jan | 54.0   | 48.0    | UF2  | L    | HUMAN OPERATING ERRORS  |
| 28 Jan | 96.0   | 84.0    | UF2  | A15  | PRIMARY PUMP  |
| 01 Feb | 192.0  | 168.0   | UF2  | A15  | PRIMARY PUMP  |
| 09 Feb | 290.0  | 256.0   | UF2  | L    | HUMAN OPERATING ERRORS  |
| 21 Feb | 716.0  | 631.0   | PF   | C    | REFUELLING WITH NO INSPECTION                                 |
| 22 Mar | 2709.0 | 2384.0  | UF2  | L    | HUMAN OPERATING ERRORS  |
| 13 Jul | 14.0   | 12.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 13 Jul | 337.0  | 31.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 01 Aug | 625.0  | 3.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 06 Aug | 15.0   | 13.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 06 Aug | 8.0    | 3.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 21 Aug | 59.0   | 2.0     | UP2  | A31  | STEAM VALVES  |
| 01 Sep | 679.0  | 5.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 01 Oct | 534.0  | 6.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 02 Oct | 198.0  | 175.0   | UF2  | A15  | STEAM CIRCUIT WITHOUT INLET VALVES                            |
| 02 Oct | 7.0    | 3.0     | UP2  | A15  | STEAM CIRCUIT WITHOUT INLET VALVES                            |
| 30 Oct | 2.0    | 1.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Nov | 6.0    | 4.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Nov | 400.0  | 4.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 05 Nov | 312.0  | 3.0     | UP2  | A31  | VACUUM CIRCUIT  |
| 01 Dec | 727.0  | 4.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 486       |          |  | 694       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 716             |           |          | 1272                                     | 14        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 59                                       | 11        |          |
| E. Testing of plant systems or components  | 29              |           |          | 8  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 61        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         | 6        |
| L. Human factor related  |                 | 3053      |          |  |           |          |
| Subtotal   | 745             | 3539      | 0        | 1339                                     | 791       | 6        |
| Total  |                 | 4284      |          |  | 2136      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 326                                      |
| 12. Reactor I&C Systems                  |                 | 28                                       |
| 13. Reactor Auxiliary Systems            |                 | 6  |
| 14. Safety Systems                       |                 | 15                                       |
| 15. Reactor Cooling Systems              | 486             | 37                                       |
| 16. Steam generation systems             |                 | 32                                       |
| 21. Fuel Handling and Storage Facilities |                 | 0  |
| 31. Turbine and auxiliaries              |                 | 88                                       |
| 32. Feedwater and Main Steam System      |                 | 31                                       |
| 41. Main Generator Systems               |                 | 88                                       |
| 42. Electrical Power Supply Systems      |                 | 5  |
| XX. Miscellaneous Systems                |                 | 0  |
| Total                                    | 486             | 656                                      |

**FR-12 FESSENHEIM-2**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 880.0 MW(e)  
 Design Net RUP: 880.0 MW(e)  
 Design Discharge Burnup: 33700 MW.d/t

**2. Production Summary 2004**

Energy Production: 6913.7 GW(e).h  
 Energy Availability Factor: 93.6%  
 Load Factor: 89.4%  
 Operating Factor: 96.0%  
 Energy Unavailability Factor: 6.4%  
 Total Off-line Time: 349 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 636.9 | 576.0 | 629.0 | 585.3 | 589.1 | 540.4 | 517.1 | 577.6 | 554.0 | 574.6 | 548.4 | 585.5 | 6913.7 |
| EAF (%)  | 98.5  | 95.9  | 98.0  | 94.1  | 95.6  | 90.9  | 82.5  | 95.1  | 92.6  | 95.1  | 93.5  | 90.9  | 93.6   |
| UCF (%)  | 99.0  | 95.9  | 98.0  | 94.4  | 95.6  | 97.7  | 82.5  | 95.1  | 94.3  | 95.1  | 93.5  | 92.7  | 94.5   |
| LF (%)   | 97.3  | 94.0  | 96.2  | 92.4  | 90.0  | 85.3  | 79.0  | 88.2  | 87.4  | 87.7  | 86.6  | 89.4  | 89.4   |
| OF (%)   | 100.0 | 97.0  | 100.0 | 95.6  | 97.6  | 100.0 | 87.5  | 97.7  | 95.8  | 93.8  | 91.1  | 96.2  | 96.0   |
| EUF (%)  | 1.5   | 4.1   | 2.0   | 5.9   | 4.4   | 9.1   | 17.5  | 4.9   | 7.4   | 4.9   | 6.5   | 9.1   | 6.4    |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.3    |
| UCLF (%) | 1.0   | 4.1   | 2.0   | 5.6   | 4.4   | 2.3   | 14.2  | 4.9   | 5.7   | 4.9   | 6.5   | 7.1   | 5.2    |
| XUF (%)  | 0.5   | 0.0   | 0.0   | 0.4   | 0.0   | 6.8   | 0.0   | 0.0   | 1.7   | 0.0   | 0.0   | 1.8   | 0.9    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Feb 1972      Lifetime Generation: 146625.8 GW(e).h  
 Date of First Criticality: 27 Jun 1977      Cumulative Energy Availability Factor: 75.1%  
 Date of Grid Connection: 07 Oct 1977      Cumulative Load Factor: 70.1%  
 Date of Commercial Operation: 01 Apr 1978      Cumulative Unit Capability Factor: 77.5%  
    Cumulative Energy Unavailability Factor: 24.9%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 4315.0            | 880.0             | 58.5   | 80.7   | 58.5                                 | 72.4   | 56.0               | 68.4   | 5206                  | 59.4   |
| 1984 | 6459.0            | 880.0             | 88.4   | 82.0   | 88.4                                 | 75.0   | 83.6               | 70.9   | 7860                  | 89.5   |
| 1985 | 5917.2            | 880.0             | 80.0   | 81.7   | 78.6                                 | 75.6   | 76.8               | 71.7   | 7248                  | 82.7   |
| 1986 | 5522.5            | 880.0             | 73.4   | 80.7   | 73.2                                 | 75.3   | 71.6               | 71.7   | 6573                  | 75.0   |
| 1987 | 6150.1            | 880.0             | 83.6   | 81.0   | 82.6                                 | 76.1   | 79.8               | 72.6   | 7335                  | 83.7   |
| 1988 | 4830.0            | 880.0             | 72.4   | 80.1   | 69.8                                 | 75.5   | 62.5               | 71.6   | 6158                  | 70.1   |
| 1989 | 5643.4            | 880.0             | 97.0   | 81.7   | 96.2                                 | 77.3   | 73.2               | 71.7   | 6944                  | 79.3   |
| 1990 | 3552.4            | 880.0             | 52.0   | 79.2   | 49.6                                 | 75.0   | 46.1               | 69.6   | 4612                  | 52.6   |
| 1991 | 5308.4            | 880.0             | 73.3   | 78.8   | 72.8                                 | 74.9   | 68.9               | 69.5   | 6537                  | 74.6   |
| 1992 | 2202.0            | 880.0             | 29.7   | 75.3   | 29.7                                 | 71.6   | 28.6               | 66.6   | 2699                  | 30.8   |
| 1993 | 5775.1            | 880.0             | 81.0   | 75.6   | 77.6                                 | 72.0   | 74.9               | 67.2   | 7167                  | 81.8   |
| 1994 | 5294.9            | 880.0             | 98.5   | 77.1   | 98.2                                 | 73.7   | 68.7               | 67.3   | 6807                  | 77.7   |
| 1995 | 5098.3            | 880.0             | 71.5   | 76.7   | 70.5                                 | 73.5   | 66.1               | 67.2   | 6305                  | 72.0   |
| 1996 | 6192.1            | 880.0             | 84.9   | 77.2   | 84.4                                 | 74.1   | 80.1               | 67.9   | 7515                  | 85.6   |
| 1997 | 5808.6            | 880.0             | 80.6   | 77.4   | 80.0                                 | 74.4   | 75.3               | 68.3   | 6982                  | 79.7   |
| 1998 | 5597.0            | 880.0             | 75.9   | 77.3   | 73.7                                 | 74.4   | 72.6               | 68.5   | 6797                  | 77.6   |
| 1999 | 6392.6            | 880.0             | 87.1   | 77.8   | 86.4                                 | 74.9   | 82.9               | 69.2   | 7708                  | 88.0   |
| 2000 | 3730.4            | 880.0             | 51.4   | 76.6   | 51.1                                 | 73.8   | 48.3               | 68.3   | 4514                  | 51.4   |
| 2001 | 6699.9            | 880.0             | 88.6   | 77.1   | 87.3                                 | 74.4   | 86.9               | 69.1   | 7876                  | 89.9   |
| 2002 | 6562.6            | 880.0             | 87.1   | 77.5   | 85.6                                 | 74.9   | 85.1               | 69.7   | 7729                  | 88.2   |
| 2003 | 4589.5            | 880.0             | 60.7   | 76.8   | 60.7                                 | 74.3   | 59.5               | 69.3   | 5434                  | 62.0   |
| 2004 | 6913.7            | 880.0             | 94.5   | 77.5   | 93.6                                 | 75.1   | 89.4               | 70.1   | 8435                  | 96.0   |



## FR-12 FESSENHEIM-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 184.0  | 2.0     | UP2  | A31  | MAIN CONDENSER  |
| 04 Jan | 2968.0 | 38.0    | UP2  | A31  | VACUUM CIRCUIT  |
| 16 Feb | 21.0   | 19.0    | UF2  | Z    | MALFUNCTION OF REGULATION, CONTROL AND PROTECTION SYSTEM        |
| 14 Mar | 111.0  | 5.0     | UP2  | A32  | HP WATER CIRCUIT  |
| 25 Mar | 111.0  | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER      |
| 30 Mar | 694.0  | 6.0     | UP2  | A31  | MAIN CONDENSER  |
| 03 Apr | 33.0   | 29.0    | UF2  | A12  | INSTRUMENTATION AND CONTROL OF PRIMARY CIRCUIT (INCLUDING SG)   |
| 03 May | 70.0   | 4.0     | UP2  | A31  | MAIN CONDENSER  |
| 12 May | 18.0   | 15.0    | UF2  | A15  | PRIMARY PUMP  |
| 23 Jun | 75.0   | 43.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION         |
| 01 Jul | 409.0  | 9.0     | UP2  | A31  | VACUUM CIRCUIT  |
| 11 Jul | 131.0  | 13.0    | UP2  | A32  | HP WATER CIRCUIT  |
| 23 Jul | 22.0   | 20.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN                |
| 25 Jul | 71.0   | 62.0    | UF2  | A31  | CLEANING OF THE CONDENSER.                                      |
| 01 Aug | 2543.0 | 32.0    | UP2  | A31  | VACUUM CIRCUIT  |
| 28 Aug | 18.0   | 15.0    | UF2  | A15  | PRIMARY PUMP  |
| 14 Sep | 38.0   | 6.0     | UP2  | A32  | MAIN DRAIN RECOVERY PUMP  |
| 17 Sep | 121.0  | 6.0     | UP2  | A32  | HP WATER CIRCUIT  |
| 25 Sep | 17.0   | 15.0    | UF2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                          |
| 19 Oct | 24.0   | 21.0    | UF2  | A15  | PRIMARY PUMP  |
| 31 Oct | 49.0   | 43.0    | XP   | K    | OUTAGE AGREED WITH INTERREGIONAL ELECTRICITY DISPATCHING CENTRE |
| 06 Nov | 38.0   | 34.0    | UF2  | A    | VALVE ACCESSORIES   |
| 07 Dec | 72.0   | 8.0     | UP2  | A32  | HP WATER CIRCUIT  |
| 11 Dec | 322.0  | 12.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                              |
| 25 Dec | 28.0   | 25.0    | UF2  | A15  | PRIMARY PUMP  |
| 25 Dec | 30.0   | 10.0    | UP2  | A15  | PRIMARY PUMP  |
| 27 Dec | 63.0   | 2.0     | UP2  | A31  | MAIN CONDENSER  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 247       |          |  | 508       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1221                                     | 8         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 62                                       |           |          |
| E. Testing of plant systems or components  | 22              |           |          | 14                                       | 1         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 1  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 3         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         | 32       |
| Z. Others  |                 | 21        |          |  |           |          |
| Subtotal   | 22              | 268       | 0        | 1298                                     | 528       | 32       |
| Total  |                 | 290       |          |  | 1858      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 56                                       |
| 12. Reactor I&C Systems             | 33              | 16                                       |
| 13. Reactor Auxiliary Systems       |                 | 15                                       |
| 14. Safety Systems                  |                 | 16                                       |
| 15. Reactor Cooling Systems         | 88              | 27                                       |
| 16. Steam generation systems        | 17              | 127                                      |
| 31. Turbine and auxiliaries         | 71              | 38                                       |
| 32. Feedwater and Main Steam System |                 | 44                                       |
| 33. Circulating Water System        |                 | 5  |
| 41. Main Generator Systems          |                 | 74                                       |
| 42. Electrical Power Supply Systems |                 | 6  |
| XX. Miscellaneous Systems           |                 | 2  |
| Total                               | 209             | 426                                      |

# FR-46 FLAMANVILLE-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1330.0 MW(e)  
**Design Net RUP:** 1330.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10630.0 GW(e).h  
**Energy Availability Factor:** 96.8%  
**Load Factor:** 91.0%  
**Operating Factor:** 98.7%  
**Energy Unavailability Factor:** 3.2%  
**Total Off-line Time:** 116 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 896.1 | 853.9 | 944.8 | 860.4 | 887.2 | 819.1 | 926.8 | 884.9 | 873.2 | 831.9 | 898.3 | 953.6 | 10630.0 |
| <b>EAF (%)</b>  | 96.0  | 97.0  | 99.8  | 95.7  | 97.5  | 96.4  | 99.5  | 99.9  | 97.8  | 87.6  | 95.8  | 99.0  | 96.8    |
| <b>UCF (%)</b>  | 98.1  | 97.0  | 99.8  | 99.9  | 99.8  | 99.8  | 99.5  | 99.9  | 97.8  | 91.6  | 95.8  | 99.3  | 98.2    |
| <b>LF (%)</b>   | 90.6  | 92.2  | 95.6  | 89.8  | 89.7  | 85.5  | 93.7  | 89.4  | 91.2  | 84.0  | 93.8  | 96.4  | 91.0    |
| <b>OF (%)</b>   | 98.3  | 97.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.0  | 97.1  | 100.0 | 98.7    |
| <b>EUF (%)</b>  | 4.0   | 3.0   | 0.2   | 4.3   | 2.5   | 3.6   | 0.5   | 0.1   | 2.2   | 12.4  | 4.2   | 1.0   | 3.2     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.3   | 0.1   | 0.0   | 0.1     |
| <b>UCLF (%)</b> | 1.9   | 3.0   | 0.1   | 0.1   | 0.2   | 0.2   | 0.5   | 0.1   | 2.1   | 7.1   | 4.1   | 0.7   | 1.7     |
| <b>XUF (%)</b>  | 2.1   | 0.0   | 0.0   | 4.2   | 2.3   | 3.4   | 0.0   | 0.0   | 0.0   | 4.0   | 0.0   | 0.2   | 1.4     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1979  
**Date of First Criticality:** 29 Sep 1985  
**Date of Grid Connection:** 04 Dec 1985  
**Date of Commercial Operation:** 01 Dec 1986

**Lifetime Generation:** 149026.5 GW(e).h  
**Cumulative Energy Availability Factor:** 74.0%  
**Cumulative Load Factor:** 68.8%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 26.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 0.0            | 1290.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 0.0                | 0.0    | 0                  | 0.0    |
| 1986 | 5273.0         | 1290.0         | 0.0  | 0.0    | 46.4                              | 100.0  | 46.7               | 0.0    | 4840               | 55.3   |
| 1987 | 7150.8         | 1290.0         | 63.2   | 63.2   | 62.2                              | 62.2   | 63.3               | 63.3   | 5656               | 64.6   |
| 1988 | 7175.0         | 1330.0         | 67.4   | 65.4   | 66.0                              | 64.1   | 61.4               | 62.3   | 5757               | 65.5   |
| 1989 | 8775.2         | 1330.0         | 81.0   | 70.6   | 80.6                              | 69.7   | 75.3               | 66.7   | 7146               | 81.6   |
| 1990 | 7090.0         | 1330.0         | 67.0   | 69.7   | 65.7                              | 68.7   | 60.9               | 65.2   | 6360               | 72.6   |
| 1991 | 5882.9         | 1330.0         | 68.3   | 69.5   | 59.4                              | 66.8   | 50.5               | 62.3   | 5481               | 62.6   |
| 1992 | 7606.8         | 1330.0         | 66.2   | 68.9   | 66.2                              | 66.7   | 65.1               | 62.7   | 5901               | 67.2   |
| 1993 | 9301.8         | 1330.0         | 96.8   | 72.9   | 87.2                              | 69.6   | 79.8               | 65.2   | 7936               | 90.6   |
| 1994 | 7145.8         | 1330.0         | 80.1   | 73.8   | 75.3                              | 70.3   | 61.3               | 64.7   | 6515               | 74.4   |
| 1995 | 7665.1         | 1330.0         | 77.4   | 74.2   | 73.2                              | 70.7   | 65.8               | 64.8   | 6654               | 76.0   |
| 1996 | 8598.3         | 1330.0         | 84.6   | 75.3   | 77.8                              | 71.4   | 73.6               | 65.7   | 7050               | 80.3   |
| 1997 | 6853.9         | 1330.0         | 63.9   | 74.2   | 62.3                              | 70.6   | 58.8               | 65.1   | 5529               | 63.1   |
| 1998 | 9469.4         | 1330.0         | 86.7   | 75.3   | 86.7                              | 71.9   | 81.3               | 66.4   | 7855               | 89.7   |
| 1999 | 6979.4         | 1330.0         | 66.1   | 74.6   | 64.4                              | 71.3   | 59.9               | 65.9   | 5906               | 67.4   |
| 2000 | 8035.3         | 1330.0         | 75.5   | 74.6   | 74.5                              | 71.6   | 68.8               | 66.1   | 6607               | 75.2   |
| 2001 | 10038.5        | 1330.0         | 92.6   | 75.8   | 92.5                              | 73.0   | 86.2               | 67.5   | 8126               | 92.8   |
| 2002 | 8141.8         | 1330.0         | 75.5   | 75.8   | 73.1                              | 73.0   | 69.9               | 67.6   | 6736               | 76.9   |
| 2003 | 7510.8         | 1330.0         | 68.2   | 75.4   | 67.8                              | 72.7   | 64.5               | 67.4   | 6090               | 69.5   |
| 2004 | 10630.0        | 1330.0         | 98.2   | 76.6   | 96.8                              | 74.0   | 91.0               | 68.8   | 8668               | 98.7   |

## FR-46 FLAMANVILLE-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 259.0  | 53.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 01 Jan | 13.0   | 17.0    | UF2  | A12  | INSTRUMENTATION AND CONTROL OF PRIMARY CIRCUIT (INCLUDING SG)             |
| 01 Feb | 176.0  | 39.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 22 Feb | 14.0   | 19.0    | UF2  | A31  | CONTROL FLUID SYSTEM  |
| 23 Feb | 42.0   | 1.0     | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 01 Mar | 231.0  | 36.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 09 Mar | 169.0  | 1.0     | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)                   |
| 01 Apr | 270.0  | 56.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 07 Apr | 49.0   | 40.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION                   |
| 01 May | 381.0  | 75.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 01 May | 162.0  | 2.0     | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)                   |
| 01 Jun | 408.0  | 102.0   | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 02 Jun | 113.0  | 2.0     | UP3  | K    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)                   |
| 14 Jun | 65.0   | 31.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION                   |
| 01 Jul | 388.0  | 5.0     | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)                   |
| 02 Jul | 194.0  | 51.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 01 Aug | 454.0  | 104.0   | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 01 Sep | 176.0  | 58.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 12 Sep | 16.0   | 2.0     | UP2  | A33  | RAW WATER-EMERGENCY COOLING SYSTEM  |
| 26 Sep | 30.0   | 17.0    | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT                |
| 01 Oct | 363.0  | 4.0     | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)                   |
| 01 Oct | 146.0  | 28.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 02 Oct | 31.0   | 40.0    | XP   | E    | LOAD LIMITATION OR SHUTDOWN FOR EXTERNAL THERMAL PRODUCTION SERVICE TESTS |
| 03 Oct | 10.0   | 13.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN                          |
| 05 Oct | 41.0   | 26.0    | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT                |
| 06 Oct | 29.0   | 38.0    | UF2  | A15  | STEAM CIRCUIT WITHOUT INLET VALVES  |
| 01 Nov | 78.0   | 14.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX             |
| 01 Nov | 1051.0 | 15.0    | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)                   |
| 07 Nov | 21.0   | 28.0    | UF2  | A    | CONTROL AND ISOLATING VALVES  |
| 02 Dec | 111.0  | 22.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 77        |          |  | 801       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 978                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 39                                       |           |          |
| E. Testing of plant systems or components  | 10              |           |          | 13                                       | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 25        | 39       |
| Z. Others  |                 |           |          |  | 2         |          |
| Subtotal   | 10              | 77        | 0        | 1030                                     | 831       | 41       |
| Total  |                 | 87        |          |  | 1902      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 147                                      |
| 12. Reactor I&C Systems             | 13              | 43                                       |
| 13. Reactor Auxiliary Systems       |                 | 20                                       |
| 14. Safety Systems                  |                 | 15                                       |
| 15. Reactor Cooling Systems         | 29              | 28                                       |
| 16. Steam generation systems        |                 | 3  |
| 31. Turbine and auxiliaries         | 14              | 187                                      |
| 32. Feedwater and Main Steam System |                 | 61                                       |
| 33. Circulating Water System        |                 | 4  |
| 41. Main Generator Systems          |                 | 164                                      |
| 42. Electrical Power Supply Systems |                 | 51                                       |
| XX. Miscellaneous Systems           |                 | 5  |
| Total                               | 56              | 728                                      |

**FR-47 FLAMANVILLE-2**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1330.0 MW(e)  
 Design Net RUP: 1330.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 7499.8 GW(e).h  
 Energy Availability Factor: 66.8%  
 Load Factor: 64.2%  
 Operating Factor: 69.7%  
 Energy Unavailability Factor: 33.2%  
 Total Off-line Time: 2659 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 931.0 | 617.3 | 0.0   | 0.0   | 0.0   | 582.5 | 940.3 | 907.1 | 883.0 | 938.9 | 915.2 | 784.6 | 7499.8 |
| EAF (%)  | 94.4  | 67.1  | 0.0   | 0.0   | 0.0   | 62.5  | 100.0 | 96.2  | 98.0  | 99.9  | 100.0 | 82.8  | 66.8   |
| UCF (%)  | 100.0 | 79.2  | 0.0   | 0.0   | 0.0   | 63.6  | 100.0 | 96.3  | 98.1  | 100.0 | 100.0 | 82.8  | 68.3   |
| LF (%)   | 94.1  | 66.7  | 0.0   | 0.0   | 0.0   | 60.8  | 95.0  | 91.7  | 92.2  | 94.8  | 95.6  | 79.3  | 64.2   |
| OF (%)   | 100.0 | 80.6  | 0.0   | 0.0   | 0.0   | 72.6  | 100.0 | 98.5  | 100.0 | 100.0 | 100.0 | 85.3  | 69.7   |
| EUF (%)  | 5.6   | 32.9  | 100.0 | 100.0 | 100.0 | 37.5  | 0.0   | 3.8   | 2.0   | 0.1   | 0.0   | 17.2  | 33.2   |
| PUF (%)  | 0.0   | 6.7   | 100.0 | 100.0 | 45.2  | 7.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.6   |
| UCLF (%) | 0.0   | 14.1  | 0.0   | 0.0   | 54.8  | 29.0  | 0.0   | 3.7   | 1.9   | 0.0   | 0.0   | 17.2  | 10.1   |
| XUF (%)  | 5.6   | 12.1  | 0.0   | 0.0   | 0.0   | 1.1   | 0.0   | 0.1   | 0.2   | 0.0   | 0.0   | 0.0   | 1.5    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 May 1980  
 Date of First Criticality: 12 Jun 1986  
 Date of Grid Connection: 18 Jul 1986  
 Date of Commercial Operation: 09 Mar 1987

Lifetime Generation: 146002.6 GW(e).h  
 Cumulative Energy Availability Factor: 75.0%  
 Cumulative Load Factor: 69.3%  
 Cumulative Unit Capability Factor: 78.6%  
 Cumulative Energy Unavailability Factor: 25.0%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1986 | 1665.0            | 1310.0            | 0.0  | 0.0    | 42.3                                 | 100.0  | 28.8               | 0.0    | 1915                  | 43.4   |
| 1987 | 7140.2            | 1290.0            | 0.0  | 0.0    | 87.6                                 | 100.0  | 63.2               | 0.0    | 6310                  | 72.0   |
| 1988 | 7106.0            | 1330.0            | 67.4   | 67.4   | 65.4                                 | 65.4   | 60.8               | 60.8   | 5674                  | 64.6   |
| 1989 | 4824.5            | 1330.0            | 50.6   | 59.0   | 48.7                                 | 57.0   | 41.4               | 51.1   | 3836                  | 43.8   |
| 1990 | 7819.6            | 1330.0            | 76.6   | 64.9   | 75.7                                 | 63.3   | 67.1               | 56.5   | 6392                  | 73.0   |
| 1991 | 7965.7            | 1330.0            | 72.3   | 66.7   | 70.6                                 | 65.1   | 68.4               | 59.4   | 6432                  | 73.4   |
| 1992 | 8842.4            | 1330.0            | 78.2   | 69.0   | 78.0                                 | 67.7   | 75.7               | 62.7   | 6962                  | 79.3   |
| 1993 | 7985.2            | 1330.0            | 71.4   | 69.4   | 69.1                                 | 67.9   | 68.5               | 63.7   | 6338                  | 72.4   |
| 1994 | 8384.3            | 1330.0            | 75.4   | 70.3   | 75.3                                 | 69.0   | 72.0               | 64.8   | 6711                  | 76.6   |
| 1995 | 8962.4            | 1330.0            | 82.1   | 71.8   | 81.4                                 | 70.5   | 76.9               | 66.4   | 7264                  | 82.9   |
| 1996 | 9387.5            | 1330.0            | 87.5   | 73.5   | 86.6                                 | 72.3   | 80.4               | 67.9   | 7685                  | 87.5   |
| 1997 | 8546.0            | 1330.0            | 95.4   | 75.7   | 95.3                                 | 74.6   | 73.4               | 68.5   | 7351                  | 83.9   |
| 1998 | 5656.6            | 1330.0            | 55.4   | 73.9   | 55.4                                 | 72.9   | 48.6               | 66.6   | 4880                  | 55.7   |
| 1999 | 7248.9            | 1330.0            | 67.4   | 73.3   | 65.2                                 | 72.2   | 62.2               | 66.3   | 6034                  | 68.9   |
| 2000 | 9907.9            | 1330.0            | 94.2   | 74.9   | 93.7                                 | 73.9   | 84.8               | 67.7   | 8122                  | 92.5   |
| 2001 | 8565.1            | 1330.0            | 77.9   | 75.1   | 76.2                                 | 74.1   | 73.5               | 68.1   | 6863                  | 78.3   |
| 2002 | 8502.3            | 1330.0            | 78.0   | 75.3   | 77.9                                 | 74.3   | 73.0               | 68.4   | 6839                  | 78.1   |
| 2003 | 10065.3           | 1330.0            | 93.6   | 76.5   | 93.4                                 | 75.5   | 86.4               | 69.6   | 8365                  | 95.5   |
| 2004 | 7499.8            | 1330.0            | 68.3   | 76.0   | 66.8                                 | 75.0   | 64.2               | 69.3   | 6125                  | 69.7   |

## FR-47 FLAMANVILLE-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 02 Jan | 670.0  | 56.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 02 Jan | 50.0   | 3.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Feb | 504.0  | 112.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 21 Feb | 20.0   | 11.0    | UP2  | A42  | 6.6 KV SWITCHBOARD OF THE AUXILIARIES                         |
| 21 Feb | 97.0   | 130.0   | UF2  | A42  | 6.6 KV SWITCHBOARD OF THE AUXILIARIES                         |
| 28 Feb | 1765.0 | 2347.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 12 May | 72.0   | 96.0    | PF   | C    | REFUELLING AND INSPECTION                                     |
| 15 May | 546.0  | 728.0   | UF2  | A42  | MAIN TRANSFORMER WITH FIRE PROTECTION                         |
| 06 Jun | 233.0  | 71.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 08 Jun | 57.0   | 76.0    | UF2  | A13  | COMPONENT COOLING SYSTEM                                      |
| 21 Jun | 77.0   | 10.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 23 Jun | 48.0   | 10.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 Jul | 280.0  | 49.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Aug | 192.0  | 44.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Aug | 11.0   | 15.0    | UF2  | A31  | CONTROL FLUID SYSTEM  |
| 18 Aug | 19.0   | 10.0    | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                           |
| 01 Sep | 141.0  | 48.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Sep | 257.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 22 Sep | 32.0   | 18.0    | UP2  | A31  | MAIN CONDENSER  |
| 01 Oct | 180.0  | 50.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 01 Nov | 196.0  | 43.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 03 Dec | 158.0  | 26.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 20 Dec | 34.0   | 5.0     | UP2  | A12  | INSTRUMENTATION AND CONTROL OF PRIMARY CIRCUIT (INCLUDING SG) |
| 24 Dec | 21.0   | 13.0    | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 25 Dec | 109.0  | 145.0   | UF2  | A31  | BYPASS DEPRESSURIZATION COOLING                               |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 820       |          |  | 647       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1837            |           |          | 852                                      | 39        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 115                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 27                                       | 2         | 0        |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          | 1  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 18        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 23        | 3        |
| L. Human factor related  |                 |           |          |  | 0         |          |
| Subtotal   | 1837            | 820       | 0        | 995                                      | 733       | 6        |
| Total  |                 | 2657      |          |  | 1734      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 13                                       |
| 12. Reactor I&C Systems                        |                 | 22                                       |
| 13. Reactor Auxiliary Systems                  | 57              | 47                                       |
| 14. Safety Systems                             |                 | 24                                       |
| 15. Reactor Cooling Systems                    |                 | 229                                      |
| 16. Steam generation systems                   |                 | 45                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    | 120             | 95                                       |
| 32. Feedwater and Main Steam System            |                 | 40                                       |
| 41. Main Generator Systems                     |                 | 65                                       |
| 42. Electrical Power Supply Systems            | 643             | 31                                       |
| XX. Miscellaneous Systems                      |                 | 5  |
| Total  | 820             | 616                                      |

**FR-61 GOLFECH-1**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1310.0 MW(e)  
 Design Net RUP: 1310.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 9051.1 GW(e).h  
 Energy Availability Factor: 84.7%  
 Load Factor: 78.7%  
 Operating Factor: 87.9%  
 Energy Unavailability Factor: 15.3%  
 Total Off-line Time: 1063 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 812.3 | 138.2 | 268.9 | 894.1 | 897.6 | 785.1 | 874.4 | 875.4 | 854.3 | 906.3 | 834.4 | 909.9 | 9051.1 |
| EAF (%)  | 83.3  | 15.8  | 29.5  | 99.6  | 99.8  | 93.6  | 99.9  | 99.0  | 99.4  | 100.0 | 94.0  | 100.0 | 84.7   |
| UCF (%)  | 100.0 | 21.1  | 29.5  | 99.7  | 99.8  | 100.0 | 99.9  | 99.0  | 99.4  | 100.0 | 100.0 | 100.0 | 87.6   |
| LF (%)   | 83.3  | 15.2  | 27.6  | 94.8  | 92.1  | 83.2  | 89.7  | 89.8  | 90.6  | 92.9  | 88.5  | 93.4  | 78.7   |
| OF (%)   | 100.0 | 21.1  | 36.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.0  | 100.0 | 87.9   |
| EUF (%)  | 16.7  | 84.2  | 70.5  | 0.4   | 0.2   | 6.4   | 0.1   | 1.0   | 0.6   | 0.0   | 6.0   | 0.0   | 15.3   |
| PUF (%)  | 0.0   | 78.9  | 44.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.0   |
| UCLF (%) | 0.0   | 0.0   | 25.9  | 0.4   | 0.2   | 0.0   | 0.1   | 1.0   | 0.6   | 0.0   | 0.0   | 0.0   | 2.4    |
| XUF (%)  | 16.7  | 5.3   | 0.0   | 0.0   | 0.0   | 6.4   | 0.0   | 0.0   | 0.0   | 0.0   | 6.0   | 0.0   | 2.9    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 17 Nov 1982      Lifetime Generation: 121249.3 GW(e).h  
 Date of First Criticality: 24 Apr 1990      Cumulative Energy Availability Factor: 80.7%  
 Date of Grid Connection: 07 Jun 1990      Cumulative Load Factor: 73.7%  
 Date of Commercial Operation: 01 Feb 1991      Cumulative Unit Capability Factor: 80.2%  
    Cumulative Energy Unavailability Factor: 19.3%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1990 | 1820.6            | 1310.0            | 0.0  | 0.0    | 60.3                                 | 100.0  | 15.9               | 0.0    | 2092                  | 23.9   |
| 1991 | 9536.9            | 1310.0            | 0.0  | 0.0    | 93.8                                 | 100.0  | 83.1               | 0.0    | 8167                  | 93.2   |
| 1992 | 7065.9            | 1310.0            | 67.9   | 67.9   | 64.3                                 | 64.3   | 61.4               | 61.4   | 6128                  | 69.8   |
| 1993 | 7925.6            | 1310.0            | 82.6   | 75.2   | 72.7                                 | 68.5   | 69.1               | 65.2   | 7143                  | 81.5   |
| 1994 | 7756.1            | 1310.0            | 81.3   | 77.3   | 77.8                                 | 71.6   | 67.6               | 66.0   | 7215                  | 82.4   |
| 1995 | 7897.8            | 1310.0            | 83.5   | 78.8   | 75.6                                 | 72.6   | 68.8               | 66.7   | 7005                  | 80.0   |
| 1996 | 8862.4            | 1310.0            | 84.8   | 80.0   | 83.2                                 | 74.7   | 77.0               | 68.8   | 7598                  | 86.5   |
| 1997 | 9151.6            | 1310.0            | 94.6   | 82.5   | 94.5                                 | 78.0   | 79.7               | 70.6   | 8000                  | 91.3   |
| 1998 | 8576.6            | 1310.0            | 84.8   | 82.8   | 81.1                                 | 78.5   | 74.7               | 71.2   | 7472                  | 85.3   |
| 1999 | 7926.3            | 1310.0            | 80.8   | 82.5   | 77.2                                 | 78.3   | 69.1               | 70.9   | 6837                  | 78.0   |
| 2000 | 8766.3            | 1310.0            | 94.1   | 83.8   | 93.9                                 | 80.0   | 76.2               | 71.5   | 7901                  | 89.9   |
| 2001 | 7511.9            | 1310.0            | 69.1   | 82.3   | 68.4                                 | 78.9   | 65.5               | 70.9   | 6147                  | 70.2   |
| 2002 | 9242.4            | 1310.0            | 82.5   | 82.4   | 81.4                                 | 79.1   | 80.5               | 71.8   | 7301                  | 83.3   |
| 2003 | 10342.7           | 1310.0            | 99.2   | 83.8   | 93.9                                 | 80.3   | 90.1               | 73.3   | 8252                  | 94.2   |
| 2004 | 9051.1            | 1310.0            | 87.6   | 84.1   | 84.7                                 | 80.7   | 78.7               | 73.7   | 7721                  | 87.9   |

# FR-61 GOLFECH-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 891.0 | 210.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT  |
| 07 Feb | 817.0 | 1070.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION   |
| 10 Mar | 48.0  | 63.0    | PF   | C    | REFUELLING AND INSPECTION   |
| 12 Mar | 9.0   | 12.0    | UF2  | A42  | EMERGENCY GENERATOR   |
| 13 Mar | 24.0  | 31.0    | UF2  | A    | CONTROL AND ISOLATING VALVES  |
| 14 Mar | 32.0  | 42.0    | UF2  | A15  | PRIMARY SYSTEM  |
| 15 Mar | 13.0  | 17.0    | UF2  | A13  | SHUTDOWN COOLING CIRCUIT  |
| 15 Mar | 27.0  | 35.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                                       |
| 17 Mar | 72.0  | 94.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                                       |
| 20 Mar | 137.0 | 67.0    | PP   | E    | START-UP TESTS AFTER REFUELLING   |
| 20 Mar | 15.0  | 20.0    | UF2  | A41  | GENERATOR ELECTRICAL PROTECTION   |
| 01 Apr | 653.0 | 2.0     | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 01 May | 432.0 | 1.0     | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 19 May | 203.0 | 33.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 01 Jun | 291.0 | 96.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 14 Jun | 73.0  | 61.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION                   |
| 01 Jul | 488.0 | 94.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 01 Aug | 458.0 | 89.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 04 Aug | 6.0   | 8.0     | UF2  | A41  | GENERATOR ELECTRICAL PROTECTION   |
| 01 Sep | 292.0 | 70.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 18 Sep | 10.0  | 4.0     | UP2  | A31  | CONTROL FLUID SYSTEM  |
| 01 Oct | 366.0 | 118.0   | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER                |
| 26 Nov | 44.0  | 57.0    | XP   | E    | LOAD LIMITATION OR SHUTDOWN FOR EXTERNAL THERMAL PRODUCTION SERVICE TESTS |
| 01 Dec | 277.0 | 64.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 126       |          |  | 208       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 865             |           |          | 837                                      | 3         |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 75                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 79                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 3         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 12        |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 27       |
| Z. Others  |                 | 72        |          |  | 1         |          |
| Subtotal   | 865             | 198       | 0        | 991                                      | 230       | 27       |
| Total  |                 | 1063      |          |  | 1248      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1990 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 7  |
| 12. Reactor I&C Systems                  | 27              | 2  |
| 13. Reactor Auxiliary Systems            | 13              | 9  |
| 14. Safety Systems                       |                 | 14                                       |
| 15. Reactor Cooling Systems              | 32              | 33                                       |
| 16. Steam generation systems             |                 | 8  |
| 21. Fuel Handling and Storage Facilities |                 | 24                                       |
| 31. Turbine and auxiliaries              |                 | 10                                       |
| 32. Feedwater and Main Steam System      |                 | 8  |
| 33. Circulating Water System             |                 | 7  |
| 35. All other I&C Systems                |                 | 0  |
| 41. Main Generator Systems               | 21              | 50                                       |
| 42. Electrical Power Supply Systems      | 9               | 2  |
| Total                                    | 102             | 174                                      |

# FR-68 GOLFECH-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1310.0 MW(e)  
**Design Net RUP:** 1310.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7093.7 GW(e).h  
**Energy Availability Factor:** 65.7%  
**Load Factor:** 61.6%  
**Operating Factor:** 69.8%  
**Energy Unavailability Factor:** 34.3%  
**Total Off-line Time:** 2655 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 824.5 | 836.5 | 862.4 | 848.6 | 829.9 | 278.6 | 0.0   | 0.0   | 47.1 | 843.2 | 866.3 | 856.6 | 7093.7 |
| <b>EAF (%)</b>  | 87.3  | 94.1  | 91.5  | 93.2  | 89.0  | 34.1  | 0.0   | 0.0   | 6.6  | 95.9  | 99.7  | 97.9  | 65.7   |
| <b>UCF (%)</b>  | 87.3  | 94.1  | 91.5  | 93.2  | 89.0  | 34.4  | 0.0   | 0.0   | 6.7  | 95.9  | 99.7  | 97.9  | 65.7   |
| <b>LF (%)</b>   | 84.6  | 91.7  | 88.6  | 90.0  | 85.1  | 29.5  | 0.0   | 0.0   | 5.0  | 86.4  | 91.8  | 87.9  | 61.6   |
| <b>OF (%)</b>   | 92.9  | 100.0 | 97.8  | 100.0 | 96.4  | 36.9  | 0.0   | 0.0   | 18.1 | 98.4  | 100.0 | 98.0  | 69.8   |
| <b>EUF (%)</b>  | 12.7  | 5.9   | 8.5   | 6.8   | 11.0  | 65.9  | 100.0 | 100.0 | 93.4 | 4.1   | 0.3   | 2.1   | 34.3   |
| <b>PUF (%)</b>  | 4.0   | 0.0   | 0.0   | 0.0   | 0.0   | 63.1  | 100.0 | 100.0 | 93.4 | 2.0   | 0.0   | 0.1   | 30.3   |
| <b>UCLF (%)</b> | 8.7   | 5.9   | 8.4   | 6.8   | 11.0  | 2.6   | 0.0   | 0.0   | 0.0  | 2.1   | 0.3   | 2.1   | 4.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1984  
**Date of First Criticality:** 21 May 1993  
**Date of Grid Connection:** 18 Jun 1993  
**Date of Commercial Operation:** 04 Mar 1994

**Lifetime Generation:** 94333.9 GW(e).h  
**Cumulative Energy Availability Factor:** 81.2%  
**Cumulative Load Factor:** 74.0%  
**Cumulative Unit Capability Factor:** 81.5%  
**Cumulative Energy Unavailability Factor:** 18.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 2180.0         | 1310.0         | 0.0  | 0.0    | 65.5                              | 100.0  | 19.0               | 0.0    | 2577               | 29.4   |
| 1994 | 7281.5         | 1310.0         | 0.0  | 0.0    | 90.5                              | 100.0  | 63.5               | 0.0    | 6577               | 75.1   |
| 1995 | 7030.1         | 1310.0         | 66.7   | 66.7   | 62.9                              | 62.9   | 61.3               | 61.3   | 6002               | 68.5   |
| 1996 | 9016.4         | 1310.0         | 84.7   | 75.7   | 83.6                              | 73.3   | 78.4               | 69.8   | 7549               | 85.9   |
| 1997 | 8649.9         | 1310.0         | 83.7   | 78.3   | 80.2                              | 75.6   | 75.4               | 71.7   | 7414               | 84.6   |
| 1998 | 8359.6         | 1310.0         | 85.1   | 80.0   | 82.9                              | 77.4   | 72.8               | 72.0   | 7222               | 82.4   |
| 1999 | 9516.9         | 1310.0         | 98.0   | 83.6   | 97.7                              | 81.5   | 82.9               | 74.2   | 8407               | 96.0   |
| 2000 | 8877.6         | 1310.0         | 84.5   | 83.8   | 81.8                              | 81.5   | 77.1               | 74.7   | 7535               | 85.8   |
| 2001 | 8958.3         | 1310.0         | 85.3   | 84.0   | 84.3                              | 81.9   | 78.1               | 75.1   | 7586               | 86.6   |
| 2002 | 9847.1         | 1310.0         | 97.3   | 85.7   | 97.3                              | 83.8   | 85.8               | 76.5   | 8553               | 97.6   |
| 2003 | 7614.9         | 1310.0         | 77.7   | 84.8   | 75.2                              | 82.9   | 66.4               | 75.4   | 7115               | 81.2   |
| 2004 | 7093.7         | 1310.0         | 65.7   | 82.9   | 65.7                              | 81.2   | 61.6               | 74.0   | 6129               | 69.8   |



## FR-68 GOLFECH-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 686.0  | 51.0    | UP2  | A33  | AIR COOLANT  |
| 03 Jan | 29.0   | 38.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 05 Jan | 24.0   | 32.0    | UF2  | A33  | CIRCULATING PUMP   |
| 01 Feb | 1420.0 | 113.0   | UP2  | A33  | AIR COOLANT  |
| 07 Mar | 16.0   | 21.0    | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                |
| 01 Apr | 1430.0 | 132.0   | UP2  | A33  | AIR COOLANT  |
| 30 May | 26.0   | 34.0    | UF2  | A    | GENERAL CONTROL AND REGULATION CHANNELS                    |
| 01 Jun | 264.0  | 24.0    | UP2  | A33  | AIR COOLANT  |
| 12 Jun | 2531.0 | 3316.0  | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                        |
| 25 Sep | 264.0  | 27.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 07 Oct | 10.0   | 2.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 07 Oct | 106.0  | 3.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 08 Oct | 12.0   | 16.0    | UF2  | L    | HUMAN ERROR DURING MAINTENANCE                             |
| 13 Oct | 863.0  | 6.0     | UP2  | A16  | BLOWDOWNS AND MISCELLANEOUS SYSTEM                         |
| 19 Nov | 60.0   | 9.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 01 Dec | 72.0   | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCOMAX   |
| 01 Dec | 299.0  | 91.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 25 Dec | 15.0   | 20.0    | UF2  | L    | HUMAN OPERATING ERRORS                                     |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1993 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 66        |          |  | 344       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 2531            |           |          | 643                                      | 3         |          |
| E. Testing of plant systems or components  | 29              |           |          | 65                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 62        |          |
| L. Human factor related  |                 | 27        |          |  |           |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 17       |
| S. Fuel management limitation (including high flux tilt, stretch out or coast-down operation)  |                 |           |          |  | 7         |          |
| Subtotal   | 2560            | 93        | 0        | 708                                      | 418       | 17       |
| Total  |                 | 2653      |          |  | 1143      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1993 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             | 16              | 49                                       |
| 13. Reactor Auxiliary Systems       |                 | 6  |
| 15. Reactor Cooling Systems         |                 | 14                                       |
| 16. Steam generation systems        |                 | 4  |
| 31. Turbine and auxiliaries         |                 | 13                                       |
| 32. Feedwater and Main Steam System |                 | 1  |
| 33. Circulating Water System        | 24              | 2  |
| 41. Main Generator Systems          |                 | 209                                      |
| 42. Electrical Power Supply Systems |                 | 18                                       |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 40              | 318                                      |

# FR-20 GRAVELINES-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 910.0 MW(e)  
**Design Net RUP:** 910.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6213.9 GW(e).h  
**Energy Availability Factor:** 86.2%  
**Load Factor:** 77.7%  
**Operating Factor:** 87.2%  
**Energy Unavailability Factor:** 13.8%  
**Total Off-line Time:** 1120 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 562.2 | 599.5 | 642.0 | 602.0 | 562.9 | 616.3 | 542.9 | 0.0   | 305.7 | 606.2 | 561.7 | 612.5 | 6213.9 |
| <b>EAF (%)</b>  | 99.3  | 99.8  | 99.9  | 98.8  | 93.4  | 99.4  | 96.3  | 0.0   | 49.8  | 99.5  | 99.7  | 99.8  | 86.2   |
| <b>UCF (%)</b>  | 99.6  | 99.8  | 99.9  | 99.2  | 93.4  | 99.4  | 96.3  | 0.0   | 50.2  | 99.9  | 99.7  | 99.8  | 86.4   |
| <b>LF (%)</b>   | 83.0  | 94.7  | 95.0  | 91.9  | 83.1  | 94.1  | 80.2  | 0.0   | 46.7  | 89.4  | 85.7  | 90.5  | 77.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 87.6  | 100.0 | 97.0  | 0.0   | 63.6  | 100.0 | 100.0 | 100.0 | 87.2   |
| <b>EUF (%)</b>  | 0.7   | 0.2   | 0.1   | 1.2   | 6.6   | 0.6   | 3.7   | 100.0 | 50.2  | 0.5   | 0.3   | 0.2   | 13.8   |
| <b>PUF (%)</b>  | 0.4   | 0.0   | 0.1   | 0.1   | 0.0   | 0.0   | 3.3   | 92.2  | 11.0  | 0.0   | 0.0   | 0.0   | 9.0    |
| <b>UCLF (%)</b> | 0.0   | 0.2   | 0.0   | 0.7   | 6.6   | 0.6   | 0.4   | 7.8   | 38.9  | 0.1   | 0.3   | 0.1   | 4.6    |
| <b>XUF (%)</b>  | 0.3   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 0.4   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1975      **Lifetime Generation:** 134353.8 GW(e).h  
**Date of First Criticality:** 21 Feb 1980      **Cumulative Energy Availability Factor:** 75.2%  
**Date of Grid Connection:** 13 Mar 1980      **Cumulative Load Factor:** 69.2%  
**Date of Commercial Operation:** 25 Nov 1980      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 24.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5537.0         | 910.0          | 69.9   | 57.2   | 69.9                              | 57.2   | 69.5               | 56.4   | 6237               | 71.2   |
| 1984 | 6617.0         | 910.0          | 86.2   | 64.4   | 86.2                              | 64.4   | 82.8               | 63.0   | 7654               | 87.1   |
| 1985 | 6211.7         | 910.0          | 81.3   | 67.8   | 80.3                              | 67.6   | 77.9               | 65.9   | 7218               | 82.4   |
| 1986 | 5725.5         | 910.0          | 74.8   | 69.0   | 73.4                              | 68.6   | 71.8               | 66.9   | 6508               | 74.3   |
| 1987 | 4650.1         | 910.0          | 89.3   | 71.9   | 89.0                              | 71.5   | 58.3               | 65.7   | 5895               | 67.3   |
| 1988 | 4289.0         | 910.0          | 57.6   | 70.1   | 57.0                              | 69.7   | 53.7               | 64.2   | 5306               | 60.4   |
| 1989 | 5109.6         | 910.0          | 67.7   | 69.8   | 67.7                              | 69.4   | 64.1               | 64.2   | 6224               | 71.1   |
| 1990 | 4463.6         | 910.0          | 61.3   | 69.0   | 59.2                              | 68.4   | 56.0               | 63.4   | 5425               | 61.9   |
| 1991 | 5675.0         | 910.0          | 74.0   | 69.4   | 73.4                              | 68.9   | 71.2               | 64.1   | 6619               | 75.6   |
| 1992 | 5834.7         | 910.0          | 84.0   | 70.6   | 80.7                              | 69.8   | 73.0               | 64.8   | 7250               | 82.5   |
| 1993 | 5866.9         | 910.0          | 93.8   | 72.4   | 80.5                              | 70.7   | 73.6               | 65.5   | 7794               | 89.0   |
| 1994 | 4657.7         | 910.0          | 68.6   | 72.1   | 67.7                              | 70.5   | 58.4               | 65.0   | 5729               | 65.4   |
| 1995 | 6123.1         | 910.0          | 83.8   | 72.9   | 82.8                              | 71.3   | 76.8               | 65.8   | 7461               | 85.2   |
| 1996 | 6089.2         | 910.0          | 83.5   | 73.6   | 80.3                              | 71.8   | 76.2               | 66.4   | 7357               | 83.8   |
| 1997 | 5860.4         | 910.0          | 82.9   | 74.1   | 81.7                              | 72.4   | 73.5               | 66.8   | 7236               | 82.6   |
| 1998 | 6321.4         | 910.0          | 87.0   | 74.8   | 83.7                              | 73.0   | 79.3               | 67.5   | 7622               | 87.0   |
| 1999 | 5841.3         | 910.0          | 80.3   | 75.1   | 78.6                              | 73.3   | 73.3               | 67.8   | 7116               | 81.2   |
| 2000 | 6531.9         | 910.0          | 88.2   | 75.8   | 88.1                              | 74.1   | 81.7               | 68.5   | 7705               | 87.7   |
| 2001 | 5289.4         | 910.0          | 67.6   | 75.4   | 66.7                              | 73.7   | 66.4               | 68.4   | 6034               | 68.9   |
| 2002 | 5769.3         | 915.0          | 88.7   | 76.0   | 86.4                              | 74.3   | 72.0               | 68.6   | 7057               | 80.6   |
| 2003 | 5919.5         | 910.0          | 85.7   | 76.4   | 85.1                              | 74.8   | 74.3               | 68.8   | 7420               | 84.7   |
| 2004 | 6213.9         | 910.0          | 86.3   | 76.8   | 86.2                              | 75.2   | 77.7               | 69.2   | 7664               | 87.2   |

## FR-20 GRAVELINES-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 178.0  | 106.0   | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                    |
| 10 Jan | 11.0   | 3.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 11 Jan | 24.0   | 5.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Feb | 77.0   | 34.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                    |
| 01 Mar | 49.0   | 35.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                    |
| 01 Apr | 80.0   | 35.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                    |
| 15 Apr | 1050.0 | 9.0     | UP2  | A31  | MAIN CONDENSER   |
| 22 May | 42.0   | 38.0    | UF2  | A15  | PRIMARY SYSTEM   |
| 01 Jun | 216.0  | 2.0     | UP2  | A31  | MAIN CONDENSER   |
| 10 Jun | 1223.0 | 5.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)            |
| 30 Jul | 707.0  | 644.0   | PF   | C    | REFUELLING WITH NO INSPECTION                              |
| 28 Aug | 24.0   | 22.0    | PF   | C    | REFUELLING AND INSPECTION                                  |
| 29 Aug | 33.0   | 30.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                        |
| 30 Aug | 100.0  | 91.0    | UF2  | A11  | REACTOR EXTERNAL EQUIPMENT                                 |
| 04 Sep | 171.0  | 155.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                        |
| 11 Sep | 125.0  | 56.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 11 Sep | 17.0   | 15.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                            |
| 17 Sep | 176.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 23 Sep | 47.0   | 11.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 24 Sep | 39.0   | 16.0    | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 01 Oct | 194.0  | 16.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 01 Nov | 686.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)            |
| 27 Dec | 46.0   | 3.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 142       |          |  | 534       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 731             |           |          | 1163                                     | 19        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 13                                       | 5         |          |
| E. Testing of plant systems or components  | 17              |           |          | 14                                       | 6         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 6         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 35        | 12       |
| Z. Others  |                 | 204       |          |  |           |          |
| Subtotal   | 748             | 346       | 0        | 1190                                     | 606       | 12       |
| Total  |                 | 1094      |          |  | 1808      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004       | 1980 to 2004                |
|-------------------------------------|------------|-----------------------------|
|                                     | Hours Lost | Average Hours Lost Per Year |
| 11. Reactor and Accessories         | 100        | 173                         |
| 12. Reactor I&C Systems             |            | 2                           |
| 13. Reactor Auxiliary Systems       |            | 17                          |
| 14. Safety Systems                  |            | 9                           |
| 15. Reactor Cooling Systems         | 42         | 118                         |
| 16. Steam generation systems        |            | 112                         |
| 31. Turbine and auxiliaries         |            | 23                          |
| 32. Feedwater and Main Steam System |            | 22                          |
| 33. Circulating Water System        |            | 1                           |
| 41. Main Generator Systems          |            | 11                          |
| 42. Electrical Power Supply Systems |            | 38                          |
| Total                               | 142        | 526                         |

# FR-21 GRAVELINES-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 910.0 MW(e)  
**Design Net RUP:** 910.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6009.0 GW(e).h  
**Energy Availability Factor:** 80.4%  
**Load Factor:** 75.2%  
**Operating Factor:** 82.7%  
**Energy Unavailability Factor:** 19.6%  
**Total Off-line Time:** 1522 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 645.5 | 626.9 | 674.1 | 431.2 | 493.4 | 0.0   | 266.5 | 602.5 | 586.6 | 538.3 | 544.2 | 599.9 | 6009.0 |
| <b>EAF (%)</b>  | 99.9  | 99.0  | 99.9  | 67.0  | 74.1  | 0.0   | 41.6  | 98.7  | 98.7  | 98.0  | 91.9  | 95.6  | 80.4   |
| <b>UCF (%)</b>  | 99.9  | 99.1  | 100.0 | 70.6  | 85.6  | 0.0   | 42.1  | 99.1  | 98.7  | 98.0  | 91.9  | 95.6  | 81.8   |
| <b>LF (%)</b>   | 95.3  | 99.0  | 99.7  | 65.8  | 72.9  | 0.0   | 39.4  | 89.0  | 89.5  | 79.4  | 83.1  | 88.6  | 75.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 71.5  | 87.9  | 0.0   | 49.2  | 100.0 | 100.0 | 93.2  | 92.4  | 96.9  | 82.7   |
| <b>EUF (%)</b>  | 0.1   | 1.0   | 0.1   | 33.0  | 25.9  | 100.0 | 58.4  | 1.3   | 1.3   | 2.0   | 8.1   | 4.4   | 19.6   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.0   | 0.0   | 10.2  | 100.0 | 40.8  | 0.0   | 0.0   | 0.0   | 0.4   | 0.3   | 12.6   |
| <b>UCLF (%)</b> | 0.1   | 0.8   | 0.0   | 29.4  | 4.1   | 0.0   | 17.1  | 0.9   | 1.3   | 2.0   | 7.7   | 4.1   | 5.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.1   | 3.6   | 11.5  | 0.0   | 0.5   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 1.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1975  
**Date of First Criticality:** 02 Aug 1980  
**Date of Grid Connection:** 26 Aug 1980  
**Date of Commercial Operation:** 01 Dec 1980

**Lifetime Generation:** 140222.9 GW(e).h  
**Cumulative Energy Availability Factor:** 78.7%  
**Cumulative Load Factor:** 72.6%  
**Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 21.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6130.0         | 910.0          | 78.6   | 69.4   | 77.9                              | 62.8   | 76.9               | 59.2   | 6917               | 79.0   |
| 1984 | 5749.0         | 910.0          | 82.0   | 72.5   | 82.0                              | 67.6   | 71.9               | 62.3   | 6751               | 76.9   |
| 1985 | 6829.7         | 910.0          | 90.2   | 76.1   | 89.7                              | 72.0   | 85.7               | 67.0   | 7950               | 90.8   |
| 1986 | 6422.0         | 910.0          | 96.6   | 79.5   | 96.4                              | 76.1   | 80.6               | 69.3   | 7956               | 90.8   |
| 1987 | 5357.9         | 910.0          | 77.4   | 79.2   | 75.2                              | 76.0   | 67.2               | 69.0   | 6807               | 77.7   |
| 1988 | 5577.0         | 910.0          | 81.3   | 79.4   | 77.2                              | 76.1   | 69.8               | 69.1   | 7227               | 82.3   |
| 1989 | 6412.9         | 910.0          | 84.6   | 80.0   | 83.6                              | 76.9   | 80.4               | 70.3   | 7460               | 85.2   |
| 1990 | 6143.1         | 910.0          | 80.6   | 80.1   | 79.6                              | 77.2   | 77.1               | 71.0   | 7164               | 81.8   |
| 1991 | 4915.9         | 910.0          | 63.5   | 78.6   | 63.0                              | 75.9   | 61.7               | 70.2   | 5648               | 64.5   |
| 1992 | 6124.2         | 910.0          | 80.6   | 78.7   | 78.2                              | 76.1   | 76.6               | 70.7   | 7149               | 81.4   |
| 1993 | 6219.9         | 910.0          | 82.3   | 79.0   | 79.3                              | 76.3   | 78.0               | 71.3   | 7297               | 83.3   |
| 1994 | 6293.7         | 910.0          | 86.3   | 79.5   | 82.7                              | 76.8   | 79.0               | 71.8   | 7638               | 87.2   |
| 1995 | 5599.7         | 910.0          | 75.6   | 79.3   | 74.6                              | 76.7   | 70.2               | 71.7   | 6735               | 76.9   |
| 1996 | 5235.9         | 910.0          | 70.7   | 78.7   | 69.7                              | 76.2   | 65.5               | 71.3   | 6361               | 72.4   |
| 1997 | 6641.2         | 910.0          | 98.0   | 79.9   | 97.8                              | 77.5   | 83.3               | 72.0   | 8006               | 91.4   |
| 1998 | 5531.4         | 910.0          | 82.2   | 80.0   | 82.1                              | 77.7   | 69.4               | 71.9   | 6896               | 78.7   |
| 1999 | 6394.4         | 910.0          | 87.8   | 80.4   | 85.3                              | 78.1   | 80.2               | 72.3   | 7705               | 88.0   |
| 2000 | 5582.7         | 910.0          | 80.5   | 80.4   | 77.3                              | 78.1   | 69.8               | 72.2   | 6952               | 79.1   |
| 2001 | 5984.5         | 910.0          | 85.5   | 80.7   | 85.0                              | 78.4   | 75.1               | 72.3   | 7601               | 86.8   |
| 2002 | 5254.3         | 915.0          | 74.4   | 80.4   | 72.4                              | 78.2   | 65.6               | 72.0   | 6658               | 76.0   |
| 2003 | 6553.9         | 910.0          | 89.6   | 80.8   | 89.2                              | 78.6   | 82.2               | 72.5   | 7986               | 91.2   |
| 2004 | 6009.0         | 910.0          | 81.8   | 80.8   | 80.4                              | 78.7   | 75.2               | 72.6   | 7262               | 82.7   |

## FR-21 GRAVELINES-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 149.0  | 30.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX                  |
| 18 Feb | 10.0   | 4.0     | UP2  | A33  | CIRCULATING PUMP  |
| 01 Mar | 454.0  | 1.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER                |
| 01 Apr | 487.0  | 24.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT  |
| 17 Apr | 95.0   | 87.0    | UF2  | A14  | HP SAFETY INJECTION SYSTEM ACCUMULATORS (EXCL. CHARGING PUMP)             |
| 25 Apr | 20.0   | 1.0     | UP2  | A32  | MAIN DRAIN RECOVERY PUMP  |
| 01 May | 599.0  | 78.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT  |
| 25 May | 17.0   | 16.0    | UF2  | A42  | MAIN TRANSFORMER WITH FIRE PROTECTION                                     |
| 25 May | 51.0   | 12.0    | UP2  | A42  | MAIN TRANSFORMER WITH FIRE PROTECTION                                     |
| 28 May | 995.0  | 906.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION   |
| 09 Jul | 48.0   | 44.0    | PF   | C    | REFUELLING AND INSPECTION   |
| 11 Jul | 126.0  | 115.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                                       |
| 16 Jul | 91.0   | 35.0    | PP   | E    | START-UP TESTS AFTER REFUELLING   |
| 16 Jul | 14.0   | 13.0    | PF   | E    | START-UP TESTS AFTER REFUELLING   |
| 21 Jul | 184.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS                     |
| 26 Jul | 70.0   | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX                   |
| 01 Aug | 79.0   | 28.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                                   |
| 01 Aug | 119.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS                     |
| 14 Aug | 1853.0 | 18.0    | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                           |
| 03 Oct | 11.0   | 1.0     | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                                       |
| 18 Oct | 5.0    | 5.0     | UF2  | A31  | CONTROL FLUID SYSTEM  |
| 01 Nov | 268.0  | 11.0    | UP2  | A32  | HIGH-PRESSURE HEATING   |
| 01 Nov | 38.0   | 34.0    | UF2  | A32  | HIGH-PRESSURE HEATING   |
| 01 Nov | 378.0  | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                           |
| 01 Dec | 292.0  | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                           |
| 08 Dec | 3.0    | 2.0     | UF2  | A41  | HYDROGEN COOLING SYSTEM   |
| 10 Dec | 13.0   | 1.0     | UP2  | A31  | STEAM VALVES  |
| 10 Dec | 19.0   | 17.0    | UF2  | A31  | STEAM VALVES  |
| 12 Dec | 5.0    | 1.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS  |
| 12 Dec | 2.0    | 2.0     | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS  |
| 12 Dec | 67.0   | 23.0    | XP   | K    | LOAD VARIATION WITH REMOTE LOAD DISPATCH CONTROL AT REQUEST OF DISPATCHER |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 179       |          |   | 154       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1043            |           |          | 1077  | 50        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 77  |           |          |
| E. Testing of plant systems or components  | 14              |           |          | 30  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 24  | 54        | 65       |
| Z. Others  |                 | 126       |          |   |           |          |
| Subtotal   | 1057            | 305       | 0        | 1208  | 258       | 67       |
| Total  |                 | 1362      |          |   | 1533      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004<br>Hours Lost | 1980 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 8   |
| 12. Reactor I&C Systems                  |                    | 8   |
| 13. Reactor Auxiliary Systems            |                    | 7   |
| 14. Safety Systems                       | 95                 | 3   |
| 15. Reactor Cooling Systems              |                    | 28  |
| 16. Steam generation systems             |                    | 26  |
| 21. Fuel Handling and Storage Facilities |                    | 0   |
| 31. Turbine and auxiliaries              | 26                 | 12  |
| 32. Feedwater and Main Steam System      | 38                 | 8   |
| 41. Main Generator Systems               | 3                  | 27  |
| 42. Electrical Power Supply Systems      | 17                 | 11  |
| Total                                    | 179                | 138   |

**FR-27 GRAVELINES-3**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 910.0 MW(e)  
 Design Net RUP: 910.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6393.1 GW(e).h  
 Energy Availability Factor: 83.8%  
 Load Factor: 80.0%  
 Operating Factor: 85.4%  
 Energy Unavailability Factor: 16.2%  
 Total Off-line Time: 1285 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 596.3 | 392.8 | 214.2 | 51.1 | 657.0 | 620.8 | 637.6 | 639.5 | 621.4 | 662.3 | 637.6 | 662.5 | 6393.1 |
| EAF (%)  | 90.3  | 70.5  | 38.8  | 9.4  | 99.4  | 99.3  | 99.3  | 99.7  | 99.5  | 99.3  | 99.2  | 98.9  | 83.8   |
| UCF (%)  | 90.3  | 70.5  | 38.8  | 9.4  | 99.4  | 99.7  | 99.8  | 99.7  | 99.5  | 99.4  | 99.2  | 98.9  | 83.9   |
| LF (%)   | 88.1  | 62.0  | 31.7  | 7.8  | 97.0  | 94.7  | 94.2  | 94.4  | 94.8  | 97.7  | 97.3  | 97.9  | 80.0   |
| OF (%)   | 91.3  | 72.0  | 39.0  | 20.6 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 85.4   |
| EUF (%)  | 9.7   | 29.5  | 61.2  | 90.6 | 0.6   | 0.8   | 0.7   | 0.3   | 0.5   | 0.7   | 0.8   | 1.1   | 16.2   |
| PUF (%)  | 0.0   | 0.0   | 61.0  | 59.5 | 0.3   | 0.0   | 0.1   | 0.1   | 0.0   | 0.0   | 0.1   | 0.6   | 10.1   |
| UCLF (%) | 9.7   | 29.5  | 0.2   | 31.2 | 0.3   | 0.3   | 0.1   | 0.2   | 0.5   | 0.7   | 0.7   | 0.5   | 6.0    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.5   | 0.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Dec 1975      Lifetime Generation: 140298.2 GW(e).h  
 Date of First Criticality: 30 Nov 1980      Cumulative Energy Availability Factor: 79.4%  
 Date of Grid Connection: 12 Dec 1980      Cumulative Load Factor: 73.6%  
 Date of Commercial Operation: 01 Jun 1981      Cumulative Unit Capability Factor: 77.8%  
    Cumulative Energy Unavailability Factor: 20.6%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 6006.0            | 910.0             | 81.3   | 64.5   | 81.4                                 | 64.5   | 75.3               | 59.3   | 7194                  | 82.1   |
| 1984 | 6746.0            | 910.0             | 83.9   | 71.0   | 83.9                                 | 71.0   | 84.4               | 67.7   | 7505                  | 85.4   |
| 1985 | 6294.4            | 910.0             | 80.1   | 73.3   | 80.1                                 | 73.2   | 79.0               | 70.5   | 7151                  | 81.6   |
| 1986 | 6504.5            | 910.0             | 81.7   | 74.9   | 81.7                                 | 74.9   | 81.6               | 72.7   | 7335                  | 83.7   |
| 1987 | 5382.9            | 910.0             | 75.5   | 75.0   | 74.3                                 | 74.8   | 67.5               | 71.8   | 6188                  | 70.6   |
| 1988 | 4819.0            | 910.0             | 96.2   | 78.1   | 95.4                                 | 77.8   | 60.3               | 70.2   | 6724                  | 76.5   |
| 1989 | 6307.7            | 910.0             | 82.3   | 78.6   | 79.5                                 | 78.0   | 79.1               | 71.3   | 7320                  | 83.6   |
| 1990 | 6121.5            | 910.0             | 80.7   | 78.8   | 77.6                                 | 78.0   | 76.8               | 71.9   | 7114                  | 81.2   |
| 1991 | 6306.3            | 910.0             | 81.3   | 79.1   | 80.5                                 | 78.2   | 79.1               | 72.6   | 7086                  | 80.9   |
| 1992 | 4772.4            | 910.0             | 60.4   | 77.4   | 60.0                                 | 76.5   | 59.7               | 71.5   | 5388                  | 61.3   |
| 1993 | 6588.1            | 910.0             | 85.2   | 78.0   | 82.9                                 | 77.1   | 82.6               | 72.4   | 7567                  | 86.4   |
| 1994 | 6308.9            | 910.0             | 83.8   | 78.5   | 83.0                                 | 77.5   | 79.1               | 72.9   | 7116                  | 81.2   |
| 1995 | 6221.7            | 910.0             | 84.3   | 78.9   | 83.0                                 | 77.9   | 78.0               | 73.3   | 7326                  | 83.6   |
| 1996 | 5937.2            | 910.0             | 85.9   | 79.4   | 83.0                                 | 78.3   | 74.3               | 73.3   | 7377                  | 84.0   |
| 1997 | 5752.7            | 910.0             | 81.1   | 79.5   | 78.9                                 | 78.3   | 72.2               | 73.3   | 6938                  | 79.2   |
| 1998 | 6152.4            | 910.0             | 83.9   | 79.7   | 83.0                                 | 78.6   | 77.2               | 73.5   | 7330                  | 83.7   |
| 1999 | 5412.9            | 910.0             | 79.1   | 79.7   | 76.9                                 | 78.5   | 67.9               | 73.2   | 6709                  | 76.6   |
| 2000 | 6112.4            | 910.0             | 84.6   | 80.0   | 82.9                                 | 78.7   | 76.5               | 73.4   | 7396                  | 84.2   |
| 2001 | 6198.0            | 910.0             | 92.6   | 80.6   | 83.9                                 | 79.0   | 77.8               | 73.6   | 7597                  | 86.7   |
| 2002 | 5282.5            | 915.0             | 76.8   | 80.4   | 76.8                                 | 78.9   | 65.9               | 73.2   | 6401                  | 73.1   |
| 2003 | 6045.5            | 910.0             | 85.8   | 80.7   | 85.8                                 | 79.2   | 75.8               | 73.3   | 7482                  | 85.4   |
| 2004 | 6393.1            | 910.0             | 83.9   | 80.8   | 83.8                                 | 79.4   | 80.0               | 73.6   | 7499                  | 85.4   |

## FR-27 GRAVELINES-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 667.0  | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 22 Jan | 22.0   | 20.0    | UF2  | A13  | PREPARATION OF PRIMARY COOLANT                                |
| 22 Jan | 11.0   | 3.0     | UP2  | A13  | PREPARATION OF PRIMARY COOLANT                                |
| 30 Jan | 43.0   | 39.0    | UF2  | A13  | COMPONENT COOLING SYSTEM                                      |
| 01 Feb | 25.0   | 7.0     | UP2  | A13  | COMPONENT COOLING SYSTEM                                      |
| 01 Feb | 194.0  | 177.0   | UF2  | A13  | COMPONENT COOLING SYSTEM                                      |
| 10 Feb | 766.0  | 3.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 13 Mar | 764.0  | 696.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 15 Apr | 224.0  | 204.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                           |
| 24 Apr | 293.0  | 41.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 24 Apr | 38.0   | 35.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 10 May | 1040.0 | 4.0     | UP2  | A31  | MAIN CONDENSER  |
| 08 Jun | 19.0   | 1.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 08 Jun | 149.0  | 2.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 16 Jul | 27.0   | 2.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 16 Jul | 176.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 17 Jul | 67.0   | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Sep | 2826.0 | 15.0    | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)               |
| 26 Dec | 16.0   | 4.0     | PP   | E    | EQUIPMENT PERFORMANCE TEST (SPECIAL)                          |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 259       |          |  | 305       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 764             |           |          | 1037                                     | 32        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 1  |           |          |
| E. Testing of plant systems or components  | 38              |           |          | 7  | 1         | 3        |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 1        |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 9        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 29        | 74       |
| Z. Others  |                 | 224       |          |  |           |          |
| Subtotal   | 802             | 483       | 0        | 1045                                     | 369       | 87       |
| Total  |                 | 1285      |          |  | 1501      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 14                                       |
| 12. Reactor I&C Systems             |                 | 9  |
| 13. Reactor Auxiliary Systems       | 259             | 13                                       |
| 14. Safety Systems                  |                 | 5  |
| 15. Reactor Cooling Systems         |                 | 34                                       |
| 16. Steam generation systems        |                 | 50                                       |
| 31. Turbine and auxiliaries         |                 | 25                                       |
| 32. Feedwater and Main Steam System |                 | 13                                       |
| 41. Main Generator Systems          |                 | 82                                       |
| 42. Electrical Power Supply Systems |                 | 19                                       |
| XX. Miscellaneous Systems           |                 | 7  |
| Total                               | 259             | 271                                      |

# FR-28 GRAVELINES-4

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 910.0 MW(e)  
**Design Net RUP:** 910.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6544.6 GW(e).h  
**Energy Availability Factor:** 85.4%  
**Load Factor:** 81.9%  
**Operating Factor:** 87.6%  
**Energy Unavailability Factor:** 14.6%  
**Total Off-line Time:** 1091 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 651.1 | 604.5 | 625.7 | 618.0 | 644.6 | 618.5 | 659.1 | 625.8 | 51.9 | 321.8 | 456.6 | 667.2 | 6544.6 |
| <b>EAF (%)</b>  | 99.8  | 99.6  | 99.9  | 99.1  | 99.1  | 98.4  | 99.1  | 98.8  | 9.8  | 48.7  | 71.7  | 99.8  | 85.4   |
| <b>UCF (%)</b>  | 99.8  | 99.6  | 99.9  | 99.1  | 99.1  | 98.4  | 99.1  | 98.8  | 9.8  | 48.7  | 71.7  | 99.8  | 85.4   |
| <b>LF (%)</b>   | 96.2  | 95.4  | 92.5  | 94.3  | 95.2  | 94.4  | 97.3  | 92.4  | 7.9  | 47.5  | 69.7  | 98.5  | 81.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 10.3 | 66.3  | 73.1  | 100.0 | 87.6   |
| <b>EUF (%)</b>  | 0.2   | 0.4   | 0.1   | 0.9   | 0.9   | 1.6   | 0.9   | 1.2   | 90.2 | 51.3  | 28.3  | 0.2   | 14.6   |
| <b>PUF (%)</b>  | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.1   | 0.0   | 90.2 | 27.1  | 0.0   | 0.0   | 9.7    |
| <b>UCLF (%)</b> | 0.2   | 0.4   | 0.1   | 0.9   | 0.9   | 1.5   | 0.9   | 1.2   | 0.1  | 24.1  | 28.3  | 0.2   | 4.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1976  
**Date of First Criticality:** 31 May 1981  
**Date of Grid Connection:** 14 Jun 1981  
**Date of Commercial Operation:** 01 Oct 1981

**Lifetime Generation:** 136440.7 GW(e).h  
**Cumulative Energy Availability Factor:** 78.1%  
**Cumulative Load Factor:** 73.0%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 21.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4062.0         | 910.0          | 55.4   | 68.1   | 55.4                              | 68.1   | 51.0               | 60.0   | 4986               | 56.9   |
| 1984 | 6006.0         | 910.0          | 82.8   | 73.0   | 82.8                              | 73.0   | 75.1               | 65.0   | 7173               | 81.7   |
| 1985 | 6178.8         | 910.0          | 83.6   | 75.6   | 80.9                              | 74.9   | 77.5               | 68.1   | 7387               | 84.3   |
| 1986 | 6556.6         | 910.0          | 88.7   | 78.2   | 88.6                              | 77.7   | 82.2               | 71.0   | 7862               | 89.7   |
| 1987 | 5472.8         | 910.0          | 77.2   | 78.1   | 75.8                              | 77.4   | 68.7               | 70.6   | 6787               | 77.5   |
| 1988 | 6221.0         | 910.0          | 87.8   | 79.5   | 85.9                              | 78.6   | 77.8               | 71.6   | 7789               | 88.7   |
| 1989 | 4982.3         | 910.0          | 67.4   | 78.0   | 66.9                              | 77.1   | 62.5               | 70.5   | 6025               | 68.8   |
| 1990 | 6151.7         | 910.0          | 79.4   | 78.1   | 77.2                              | 77.1   | 77.2               | 71.2   | 7058               | 80.6   |
| 1991 | 6262.0         | 910.0          | 81.8   | 78.5   | 80.5                              | 77.5   | 78.6               | 72.0   | 7067               | 80.7   |
| 1992 | 6419.8         | 910.0          | 81.0   | 78.7   | 80.2                              | 77.7   | 80.3               | 72.7   | 7137               | 81.3   |
| 1993 | 4680.6         | 910.0          | 76.5   | 78.5   | 75.3                              | 77.5   | 58.7               | 71.6   | 6112               | 69.8   |
| 1994 | 6039.3         | 910.0          | 83.3   | 78.9   | 82.5                              | 77.9   | 75.8               | 71.9   | 6824               | 77.9   |
| 1995 | 6289.5         | 910.0          | 86.4   | 79.4   | 85.4                              | 78.4   | 78.9               | 72.4   | 7313               | 83.5   |
| 1996 | 6288.4         | 910.0          | 85.5   | 79.8   | 83.2                              | 78.7   | 78.7               | 72.8   | 7552               | 86.0   |
| 1997 | 5986.7         | 910.0          | 81.3   | 79.9   | 80.5                              | 78.9   | 75.1               | 72.9   | 7206               | 82.3   |
| 1998 | 6519.3         | 910.0          | 85.4   | 80.3   | 84.1                              | 79.2   | 81.8               | 73.5   | 7570               | 86.4   |
| 1999 | 5550.9         | 910.0          | 76.4   | 80.0   | 74.3                              | 78.9   | 69.6               | 73.2   | 6734               | 76.9   |
| 2000 | 4563.6         | 910.0          | 69.5   | 79.5   | 57.7                              | 77.8   | 57.1               | 72.4   | 5453               | 62.1   |
| 2001 | 5990.7         | 910.0          | 79.8   | 79.5   | 78.3                              | 77.8   | 75.2               | 72.5   | 7094               | 81.0   |
| 2002 | 6028.1         | 915.0          | 81.2   | 79.6   | 80.1                              | 77.9   | 75.2               | 72.7   | 7219               | 82.4   |
| 2003 | 5701.9         | 910.0          | 74.2   | 79.3   | 74.2                              | 77.7   | 71.5               | 72.6   | 6589               | 75.2   |
| 2004 | 6544.6         | 910.0          | 85.4   | 79.6   | 85.4                              | 78.1   | 81.9               | 73.0   | 7693               | 87.6   |



## FR-28 GRAVELINES-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 02 Jan | 129.0  | 15.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 11 Jan | 15.0   | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 01 Feb | 391.0  | 2.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 10 Mar | 87.0   | 49.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Apr | 43.0   | 3.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 04 Apr | 3.0    | 2.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 05 Apr | 549.0  | 5.0     | UP2  | A31  | MAIN CONDENSER   |
| 01 May | 2884.0 | 27.0    | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 01 Aug | 39.0   | 3.0     | UP2  | A31  | STEAM VALVES   |
| 03 Sep | 672.0  | 611.0   | PF   | C    | REFUELLING WITH NO INSPECTION                                  |
| 03 Sep | 3.0    | 2.0     | PP   | C    | REFUELLING WITH NO INSPECTION                                  |
| 02 Oct | 24.0   | 22.0    | PF   | C    | REFUELLING AND INSPECTION                                      |
| 03 Oct | 90.0   | 82.0    | UF2  | A    | NON-RETURN AND STOP VALVES                                     |
| 06 Oct | 73.0   | 67.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                                |
| 06 Oct | 317.0  | 71.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 11 Oct | 55.0   | 50.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 11 Oct | 4.0    | 3.0     | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 18 Oct | 52.0   | 27.0    | UP2  | A31  | BYPASS DEPRESSURIZATION COOLING                                |
| 27 Oct | 95.0   | 1.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 31 Oct | 4.0    | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 01 Nov | 510.0  | 5.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |
| 20 Nov | 177.0  | 161.0   | UF2  | A14  | SPRINKLER CIRCUIT  |
| 20 Nov | 5.0    | 3.0     | UP2  | A14  | SPRINKLER CIRCUIT  |
| 01 Dec | 324.0  | 1.0     | UP2  | A    | VARIOUS, SECONDARY CIRCUIT (SOME NOT EXPLAINED)                |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 322       |          |  | 402       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 696             |           |          | 1110                                     | 12        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 8  | 15        |          |
| E. Testing of plant systems or components  | 73              |           |          | 3  | 1         | 1        |
| H. Nuclear regulatory requirements   |                 |           |          |  | 12        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 13        | 39       |
| L. Human factor related  |                 |           |          |  | 0         |          |
| Subtotal   | 769             | 322       | 0        | 1121                                     | 455       | 42       |
| Total  |                 | 1091      |          |  | 1618      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 24                                       |
| 12. Reactor I&C Systems                  | 55              | 61                                       |
| 13. Reactor Auxiliary Systems            |                 | 4  |
| 14. Safety Systems                       | 177             | 11                                       |
| 15. Reactor Cooling Systems              |                 | 40                                       |
| 16. Steam generation systems             |                 | 75                                       |
| 21. Fuel Handling and Storage Facilities |                 | 3  |
| 31. Turbine and auxiliaries              |                 | 35                                       |
| 32. Feedwater and Main Steam System      |                 | 29                                       |
| 33. Circulating Water System             |                 | 0  |
| 41. Main Generator Systems               |                 | 39                                       |
| 42. Electrical Power Supply Systems      |                 | 68                                       |
| Total                                    | 232             | 389                                      |

**FR-51 GRAVELINES-5**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 910.0 MW(e)  
 Design Net RUP: 910.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6613.5 GW(e).h  
 Energy Availability Factor: 86.2%  
 Load Factor: 82.7%  
 Operating Factor: 89.2%  
 Energy Unavailability Factor: 13.8%  
 Total Off-line Time: 948 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 567.3 | 609.2 | 653.8 | 536.0 | 101.1 | 320.5 | 642.2 | 631.6 | 626.4 | 647.8 | 630.8 | 646.7 | 6613.5 |
| EAF (%)  | 99.5  | 96.3  | 96.4  | 81.8  | 15.7  | 50.0  | 98.5  | 99.3  | 99.5  | 98.8  | 99.7  | 99.7  | 86.2   |
| UCF (%)  | 99.5  | 96.3  | 100.0 | 100.0 | 22.5  | 50.0  | 98.9  | 100.0 | 99.9  | 99.0  | 100.0 | 99.7  | 88.8   |
| LF (%)   | 83.8  | 96.2  | 96.7  | 81.8  | 14.9  | 48.9  | 94.9  | 93.3  | 95.6  | 95.6  | 96.3  | 95.5  | 82.7   |
| OF (%)   | 88.8  | 96.8  | 100.0 | 100.0 | 22.8  | 62.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.2   |
| EUF (%)  | 0.5   | 3.7   | 3.6   | 18.2  | 84.3  | 50.0  | 1.5   | 0.7   | 0.5   | 1.2   | 0.3   | 0.3   | 13.8   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 77.5  | 33.2  | 1.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 9.4    |
| UCLF (%) | 0.5   | 3.7   | 0.0   | 0.0   | 0.0   | 16.8  | 0.1   | 0.0   | 0.0   | 1.0   | 0.0   | 0.2   | 1.8    |
| XUF (%)  | 0.0   | 0.0   | 3.6   | 18.2  | 6.8   | 0.1   | 0.4   | 0.7   | 0.5   | 0.2   | 0.3   | 0.0   | 2.5    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Oct 1979  
 Date of First Criticality: 05 Aug 1984  
 Date of Grid Connection: 28 Aug 1984  
 Date of Commercial Operation: 15 Jan 1985

Lifetime Generation: 119881.1 GW(e).h  
 Cumulative Energy Availability Factor: 80.8%  
 Cumulative Load Factor: 74.6%  
 Cumulative Unit Capability Factor: 78.1%  
 Cumulative Energy Unavailability Factor: 19.2%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1984 | 876.0             | 910.0             | 0.0  | 0.0    | 75.3                                 | 100.0  | 11.9               | 0.0    | 1573                  | 19.4   |
| 1985 | 6768.4            | 910.0             | 90.1   | 90.1   | 90.0                                 | 90.0   | 84.9               | 84.9   | 7785                  | 88.9   |
| 1986 | 5152.6            | 910.0             | 77.1   | 83.6   | 75.2                                 | 82.6   | 64.6               | 74.8   | 6673                  | 76.2   |
| 1987 | 5236.5            | 910.0             | 81.5   | 82.9   | 80.6                                 | 82.0   | 65.7               | 71.7   | 6818                  | 77.8   |
| 1988 | 4964.0            | 910.0             | 75.3   | 81.0   | 71.8                                 | 79.4   | 62.1               | 69.3   | 6306                  | 71.8   |
| 1989 | 6020.6            | 910.0             | 81.0   | 81.0   | 80.6                                 | 79.7   | 75.5               | 70.6   | 7198                  | 82.2   |
| 1990 | 5992.8            | 910.0             | 83.2   | 81.4   | 80.7                                 | 79.8   | 75.2               | 71.3   | 7367                  | 84.1   |
| 1991 | 5276.2            | 910.0             | 72.2   | 80.0   | 69.6                                 | 78.4   | 66.2               | 70.6   | 6352                  | 72.5   |
| 1992 | 6308.0            | 910.0             | 82.7   | 80.4   | 82.6                                 | 78.9   | 78.9               | 71.6   | 7361                  | 83.8   |
| 1993 | 6180.5            | 910.0             | 82.7   | 80.6   | 78.6                                 | 78.9   | 77.5               | 72.3   | 7290                  | 83.2   |
| 1994 | 5793.2            | 910.0             | 84.4   | 81.0   | 83.2                                 | 79.3   | 72.7               | 72.3   | 7147                  | 81.6   |
| 1995 | 6181.0            | 910.0             | 87.6   | 81.6   | 86.0                                 | 79.9   | 77.5               | 72.8   | 7704                  | 87.9   |
| 1996 | 5495.2            | 910.0             | 75.3   | 81.1   | 72.1                                 | 79.3   | 68.7               | 72.5   | 6652                  | 75.7   |
| 1997 | 6429.9            | 910.0             | 87.6   | 81.6   | 86.1                                 | 79.8   | 80.7               | 73.1   | 7586                  | 86.6   |
| 1998 | 6884.3            | 910.0             | 97.3   | 82.7   | 95.8                                 | 80.9   | 86.4               | 74.0   | 8286                  | 94.6   |
| 1999 | 5124.3            | 910.0             | 68.1   | 81.7   | 67.0                                 | 80.0   | 64.3               | 73.4   | 6127                  | 69.9   |
| 2000 | 5985.5            | 910.0             | 84.4   | 81.9   | 81.4                                 | 80.1   | 74.9               | 73.5   | 7444                  | 84.7   |
| 2001 | 5762.6            | 910.0             | 80.2   | 81.8   | 78.2                                 | 80.0   | 72.3               | 73.4   | 6990                  | 79.8   |
| 2002 | 6423.4            | 915.0             | 85.9   | 82.0   | 84.8                                 | 80.2   | 80.1               | 73.8   | 7662                  | 87.5   |
| 2003 | 6473.4            | 910.0             | 85.1   | 82.2   | 84.3                                 | 80.5   | 81.2               | 74.2   | 7518                  | 85.8   |
| 2004 | 6613.5            | 910.0             | 88.8   | 82.5   | 86.2                                 | 80.8   | 82.7               | 74.6   | 7836                  | 89.2   |

## FR-51 GRAVELINES-5

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 270.0  | 103.0   | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 09 Jan | 23.0   | 3.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                         |
| 15 Jan | 25.0   | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Feb | 10.0   | 2.0     | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 01 Feb | 22.0   | 20.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 11 Feb | 53.0   | 4.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 11 Mar | 1390.0 | 189.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 07 May | 682.0  | 622.0   | PF   | C    | REFUELLING WITH NO INSPECTION                                  |
| 05 Jun | 24.0   | 22.0    | PF   | C    | REFUELLING AND INSPECTION                                      |
| 06 Jun | 109.0  | 99.0    | UF2  | A11  | VESSEL AND VESSEL HEAD   |
| 11 Jun | 224.0  | 69.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 11 Jun | 29.0   | 26.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                                |
| 12 Jun | 12.0   | 11.0    | UF2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                         |
| 01 Jul | 371.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 10 Jul | 10.0   | 6.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 12 Jul | 173.0  | 24.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Aug | 282.0  | 40.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 01 Aug | 281.0  | 5.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Sep | 343.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 04 Sep | 251.0  | 25.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Oct | 211.0  | 22.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Oct | 325.0  | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 17 Oct | 11.0   | 6.0     | UP2  | A31  | BYPASS DEPRESSURIZATION COOLING                                |
| 01 Nov | 206.0  | 15.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Nov | 100.0  | 7.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 01 Dec | 222.0  | 23.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 24 Dec | 18.0   | 6.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 143       |          |  | 326       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 706             |           |          | 931                                      | 30        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 4  |           |          |
| E. Testing of plant systems or components  | 29              |           |          | 2  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 12        | 0        |
| Subtotal   | 735             | 143       | 0        | 937                                      | 369       | 1        |
| Total  |                 | 878       |          |  | 1307      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              | 109             | 15                                       |
| 12. Reactor I&C Systems                  | 22              | 11                                       |
| 13. Reactor Auxiliary Systems            |                 | 21                                       |
| 14. Safety Systems                       |                 | 1  |
| 15. Reactor Cooling Systems              |                 | 107                                      |
| 16. Steam generation systems             | 12              | 9  |
| 21. Fuel Handling and Storage Facilities |                 | 1  |
| 31. Turbine and auxiliaries              |                 | 18                                       |
| 32. Feedwater and Main Steam System      |                 | 11                                       |
| 33. Circulating Water System             |                 | 2  |
| 41. Main Generator Systems               |                 | 48                                       |
| 42. Electrical Power Supply Systems      |                 | 48                                       |
| Total                                    | 143             | 292                                      |

# FR-52 GRAVELINES-6

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 910.0 MW(e)  
**Design Net RUP:** 910.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6936.1 GW(e).h  
**Energy Availability Factor:** 86.9%  
**Load Factor:** 86.8%  
**Operating Factor:** 89.4%  
**Energy Unavailability Factor:** 13.1%  
**Total Off-line Time:** 934 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 659.7 | 632.2 | 675.9 | 623.3 | 687.3 | 666.7 | 684.0 | 666.4 | 560.9 | 9.9  | 427.7 | 642.2 | 6936.1 |
| <b>EAF (%)</b>  | 99.7  | 100.0 | 99.9  | 96.2  | 99.9  | 100.0 | 99.9  | 97.9  | 85.6  | 2.4  | 65.1  | 96.6  | 86.9   |
| <b>UCF (%)</b>  | 99.8  | 100.0 | 99.9  | 96.7  | 99.9  | 100.0 | 99.9  | 100.0 | 100.0 | 3.1  | 65.2  | 96.6  | 88.3   |
| <b>LF (%)</b>   | 97.4  | 99.8  | 100.0 | 95.1  | 101.5 | 101.7 | 101.0 | 98.4  | 85.6  | 1.5  | 65.3  | 94.9  | 86.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 97.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 3.5  | 76.0  | 97.2  | 89.4   |
| <b>EUF (%)</b>  | 0.3   | 0.0   | 0.1   | 3.8   | 0.1   | 0.0   | 0.1   | 2.1   | 14.4  | 97.6 | 34.9  | 3.4   | 13.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.0   | 0.1   | 0.0   | 0.1   | 0.0   | 0.0   | 80.3 | 10.8  | 3.3   | 8.0    |
| <b>UCLF (%)</b> | 0.2   | 0.0   | 0.0   | 3.3   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 16.6 | 24.1  | 0.1   | 3.7    |
| <b>XUF (%)</b>  | 0.1   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.0   | 2.1   | 14.4  | 0.7  | 0.0   | 0.0   | 1.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1979  
**Date of First Criticality:** 21 Jul 1985  
**Date of Grid Connection:** 01 Aug 1985  
**Date of Commercial Operation:** 25 Oct 1985

**Lifetime Generation:** 117040.4 GW(e).h  
**Cumulative Energy Availability Factor:** 80.2%  
**Cumulative Load Factor:** 75.7%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 19.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 2337.1         | 910.0          | 0.0  | 0.0    | 88.0                              | 100.0  | 29.3               | 0.0    | 3111               | 35.5   |
| 1986 | 5540.4         | 910.0          | 76.3   | 76.3   | 75.9                              | 75.9   | 69.5               | 69.5   | 6677               | 76.2   |
| 1987 | 5583.9         | 910.0          | 80.6   | 78.4   | 80.1                              | 78.0   | 70.0               | 69.8   | 7031               | 80.3   |
| 1988 | 6490.0         | 910.0          | 83.8   | 80.2   | 81.4                              | 79.2   | 81.2               | 73.6   | 7453               | 84.8   |
| 1989 | 5177.3         | 910.0          | 71.2   | 78.0   | 71.1                              | 77.1   | 64.9               | 71.4   | 6274               | 71.6   |
| 1990 | 6120.3         | 910.0          | 87.6   | 79.9   | 87.1                              | 79.1   | 76.8               | 72.5   | 7553               | 86.2   |
| 1991 | 5888.2         | 910.0          | 78.5   | 79.7   | 77.5                              | 78.8   | 73.9               | 72.7   | 6953               | 79.4   |
| 1992 | 5085.1         | 910.0          | 70.3   | 78.3   | 69.0                              | 77.4   | 63.6               | 71.4   | 6246               | 71.1   |
| 1993 | 5293.6         | 910.0          | 82.0   | 78.8   | 73.4                              | 76.9   | 66.4               | 70.8   | 6751               | 77.1   |
| 1994 | 6053.7         | 910.0          | 86.0   | 79.6   | 83.9                              | 77.7   | 75.9               | 71.4   | 7487               | 85.5   |
| 1995 | 6769.4         | 910.0          | 89.8   | 80.6   | 88.8                              | 78.8   | 84.9               | 72.7   | 7922               | 90.4   |
| 1996 | 6609.5         | 910.0          | 86.8   | 81.2   | 86.4                              | 79.5   | 82.7               | 73.6   | 7755               | 88.3   |
| 1997 | 4545.4         | 910.0          | 60.6   | 79.5   | 59.5                              | 77.8   | 57.0               | 72.2   | 5437               | 62.1   |
| 1998 | 6531.8         | 910.0          | 88.5   | 80.2   | 86.1                              | 78.5   | 81.9               | 73.0   | 7746               | 88.4   |
| 1999 | 6141.4         | 910.0          | 80.9   | 80.2   | 80.3                              | 78.6   | 77.0               | 73.3   | 7222               | 82.4   |
| 2000 | 6720.9         | 910.0          | 88.7   | 80.8   | 87.0                              | 79.2   | 84.1               | 74.0   | 7887               | 89.8   |
| 2001 | 6148.7         | 910.0          | 82.2   | 80.9   | 80.2                              | 79.2   | 77.1               | 74.2   | 7265               | 82.9   |
| 2002 | 6690.9         | 915.0          | 87.5   | 81.3   | 86.0                              | 79.6   | 83.5               | 74.7   | 7784               | 88.9   |
| 2003 | 6462.6         | 910.0          | 83.3   | 81.4   | 82.5                              | 79.8   | 81.1               | 75.1   | 7410               | 84.6   |
| 2004 | 6936.1         | 910.0          | 88.3   | 81.7   | 86.9                              | 80.2   | 86.8               | 75.7   | 7850               | 89.4   |

## FR-52 GRAVELINES-6

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 199.0  | 27.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 10 Jan | 13.0   | 1.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                         |
| 01 Feb | 209.0  | 13.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Mar | 191.0  | 12.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Apr | 264.0  | 13.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 14 Apr | 12.0   | 3.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 25 Apr | 9.0    | 8.0     | UF2  | A21  | FUEL   |
| 25 Apr | 12.0   | 11.0    | UF2  | A12  | REACTOR CONTROL  |
| 25 Apr | 7.0    | 2.0     | UP2  | A12  | REACTOR CONTROL  |
| 01 May | 61.0   | 3.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 13 Aug | 1156.0 | 113.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 01 Oct | 589.0  | 536.0   | PF   | C    | REFUELLING WITH NO INSPECTION                                  |
| 01 Oct | 3.0    | 2.0     | PP   | C    | REFUELLING WITH NO INSPECTION                                  |
| 24 Oct | 76.0   | 69.0    | UF3  | H    | SHUTDOWN PROLONGATION AWAITING SAFETY AUTHORITY                |
| 29 Oct | 7.0    | 6.0     | PF   | C    | REFUELLING AND INSPECTION                                      |
| 30 Oct | 47.0   | 43.0    | UF3  | H    | SHUTDOWN PROLONGATION AWAITING SAFETY AUTHORITY                |
| 01 Nov | 172.0  | 157.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                            |
| 08 Nov | 148.0  | 71.0    | PP   | C    | START-UP TESTS AFTER REFUELLING                                |
| 22 Nov | 85.0   | 3.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Dec | 250.0  | 11.0    | XP   | K    | LOAD VARIATION OF DISPATCHER                                   |
| 02 Dec | 9.0    | 2.0     | PP   | E    | EQUIPMENT PERFORMANCE TEST (SPECIAL)                           |
| 04 Dec | 21.0   | 19.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 04 Dec | 7.0    | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 08 Dec | 39.0   | 10.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 21        |          |  | 334       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 596             |           |          | 918                                      | 37        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          |  | 26        |          |
| E. Testing of plant systems or components  | 21              |           |          | 10                                       |           |          |
| H. Nuclear regulatory requirements   |                 | 123       |          |  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 43        | 3        |
| Z. Others  |                 | 172       |          |  |           |          |
| Subtotal   | 617             | 316       | 0        | 928                                      | 443       | 3        |
| Total  |                 | 933       |          |  | 1374      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 2  |
| 12. Reactor I&C Systems                  | 12              | 20                                       |
| 13. Reactor Auxiliary Systems            |                 | 12                                       |
| 14. Safety Systems                       |                 | 19                                       |
| 15. Reactor Cooling Systems              |                 | 41                                       |
| 16. Steam generation systems             |                 | 2  |
| 21. Fuel Handling and Storage Facilities | 9               |  |
| 31. Turbine and auxiliaries              |                 | 97                                       |
| 32. Feedwater and Main Steam System      |                 | 19                                       |
| 33. Circulating Water System             |                 | 0  |
| 41. Main Generator Systems               |                 | 26                                       |
| 42. Electrical Power Supply Systems      |                 | 53                                       |
| XX. Miscellaneous Systems                |                 | 0  |
| Total                                    | 21              | 291                                      |

# FR-58 NOGENT-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1310.0 MW(e)  
**Design Net RUP:** 1310.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8535.3 GW(e).h  
**Energy Availability Factor:** 77.8%  
**Load Factor:** 74.2%  
**Operating Factor:** 81.4%  
**Energy Unavailability Factor:** 22.2%  
**Total Off-line Time:** 1632 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 816.5 | 874.8 | 600.1 | 44.7 | 122.3 | 618.6 | 882.9 | 900.5 | 855.5 | 908.4 | 937.1 | 974.1 | 8535.3 |
| <b>EAF (%)</b>  | 88.4  | 97.1  | 71.4  | 6.5  | 14.2  | 69.2  | 97.6  | 98.3  | 95.5  | 95.7  | 99.9  | 100.0 | 77.8   |
| <b>UCF (%)</b>  | 90.0  | 99.9  | 71.9  | 6.5  | 17.5  | 99.4  | 97.6  | 98.3  | 95.5  | 95.7  | 99.9  | 100.0 | 81.0   |
| <b>LF (%)</b>   | 83.8  | 95.9  | 61.7  | 4.7  | 12.5  | 65.6  | 90.6  | 92.4  | 90.7  | 93.1  | 99.4  | 99.9  | 74.2   |
| <b>OF (%)</b>   | 88.7  | 100.0 | 72.3  | 6.9  | 29.7  | 90.4  | 98.3  | 98.5  | 95.7  | 96.6  | 100.0 | 100.0 | 81.4   |
| <b>EUF (%)</b>  | 11.6  | 2.9   | 28.6  | 93.5 | 85.8  | 30.8  | 2.4   | 1.7   | 4.5   | 4.3   | 0.1   | 0.0   | 22.2   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.0   | 93.5 | 73.7  | 0.5   | 0.0   | 1.7   | 3.1   | 0.1   | 0.1   | 0.0   | 14.4   |
| <b>UCLF (%)</b> | 10.0  | 0.0   | 28.1  | 0.0  | 8.8   | 0.1   | 2.4   | 0.0   | 1.4   | 4.2   | 0.1   | 0.0   | 4.7    |
| <b>XUF (%)</b>  | 1.5   | 2.8   | 0.5   | 0.0  | 3.2   | 30.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 26 May 1981  
**Date of First Criticality:** 12 Sep 1987  
**Date of Grid Connection:** 21 Oct 1987  
**Date of Commercial Operation:** 24 Feb 1988

**Lifetime Generation:** 134640.1 GW(e).h  
**Cumulative Energy Availability Factor:** 75.1%  
**Cumulative Load Factor:** 68.9%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 24.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 486.0          | 1310.0         | 0.0  | 0.0    | 84.5                              | 100.0  | 4.5                | 0.0    | 893                | 10.8   |
| 1988 | 7715.0         | 1310.0         | 0.0  | 0.0    | 86.2                              | 100.0  | 67.0               | 0.0    | 7324               | 83.4   |
| 1989 | 3172.7         | 1310.0         | 30.3   | 30.3   | 28.3                              | 28.3   | 27.6               | 27.6   | 2663               | 30.4   |
| 1990 | 6614.1         | 1310.0         | 67.7   | 49.0   | 67.5                              | 47.9   | 57.6               | 42.6   | 5590               | 63.8   |
| 1991 | 6868.6         | 1310.0         | 64.2   | 54.0   | 62.9                              | 52.9   | 59.9               | 48.4   | 5768               | 65.8   |
| 1992 | 7812.5         | 1310.0         | 71.5   | 58.4   | 70.4                              | 57.3   | 67.9               | 53.3   | 6386               | 72.7   |
| 1993 | 7705.6         | 1310.0         | 72.2   | 61.2   | 68.5                              | 59.5   | 67.1               | 56.0   | 6432               | 73.4   |
| 1994 | 8292.3         | 1310.0         | 83.2   | 64.8   | 80.1                              | 62.9   | 72.3               | 58.7   | 7429               | 84.8   |
| 1995 | 7358.3         | 1310.0         | 84.3   | 67.6   | 83.9                              | 65.9   | 64.1               | 59.5   | 6946               | 79.3   |
| 1996 | 8227.9         | 1310.0         | 81.1   | 69.3   | 79.6                              | 67.6   | 71.5               | 61.0   | 7222               | 82.2   |
| 1997 | 8571.6         | 1310.0         | 83.7   | 70.9   | 81.1                              | 69.1   | 74.7               | 62.5   | 7488               | 85.5   |
| 1998 | 6585.5         | 1310.0         | 59.2   | 69.7   | 57.2                              | 67.9   | 57.4               | 62.0   | 5334               | 60.9   |
| 1999 | 9705.0         | 1310.0         | 92.5   | 71.8   | 91.8                              | 70.1   | 84.6               | 64.1   | 8284               | 94.6   |
| 2000 | 9088.3         | 1310.0         | 85.2   | 72.9   | 83.0                              | 71.2   | 79.0               | 65.3   | 7626               | 86.8   |
| 2001 | 9142.7         | 1310.0         | 84.7   | 73.8   | 83.8                              | 72.2   | 79.7               | 66.4   | 7580               | 86.5   |
| 2002 | 9011.0         | 1310.0         | 87.3   | 74.8   | 87.1                              | 73.2   | 78.5               | 67.3   | 7738               | 88.3   |
| 2003 | 9974.4         | 1310.0         | 98.3   | 76.3   | 98.0                              | 74.9   | 86.9               | 68.6   | 8621               | 98.4   |
| 2004 | 8535.3         | 1310.0         | 81.0   | 76.6   | 77.8                              | 75.1   | 74.2               | 68.9   | 7152               | 81.4   |

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## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 346.0  | 41.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 17 Jan | 73.0   | 95.0    | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                   |
| 20 Jan | 11.0   | 15.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 Feb | 252.0  | 9.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 12 Feb | 452.0  | 31.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 03 Mar | 281.0  | 369.0   | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                   |
| 12 Mar | 476.0  | 87.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 01 Apr | 44.0   | 11.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 02 Apr | 1128.0 | 1478.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 20 May | 65.0   | 86.0    | UF2  | A41  | STATIC EXCITATION SYSTEM                                      |
| 22 May | 5.0    | 6.0     | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 30 May | 180.0  | 121.0   | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 06 Jun | 24.0   | 1.0     | UP2  | A    | GENERAL CONTROL AND REGULATION CHANNELS                       |
| 07 Jun | 72.0   | 4.0     | PP   | E    | PERIODIC TESTING WITHOUT LOAD REDUCTION OR SHUTDOWN           |
| 10 Jun | 157.0  | 30.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 14 Jun | 384.0  | 165.0   | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 Jul | 317.0  | 59.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 05 Jul | 84.0   | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 08 Jul | 13.0   | 17.0    | UF2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT    |
| 01 Aug | 423.0  | 55.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 15 Aug | 10.0   | 13.0    | PF   | E    | VARIOUS, TESTS  |
| 01 Sep | 357.0  | 12.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 02 Sep | 166.0  | 13.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 03 Sep | 156.0  | 19.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 03 Sep | 21.0   | 28.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 19 Sep | 8.0    | 10.0    | UF2  | A    | ROTATING BUTTERFLY VALVES                                     |
| 01 Oct | 502.0  | 24.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 24 Oct | 25.0   | 33.0    | UF2  | A21  | FUEL  |
| 24 Oct | 55.0   | 3.0     | UP2  | A21  | FUEL  |
| 01 Nov | 505.0  | 6.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 01 Dec | 166.0  | 5.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 465       |          |  | 582       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1128            |           |          | 917                                      | 1         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 97                                       |           |          |
| E. Testing of plant systems or components  | 36              |           |          | 80                                       |           | 3        |
| H. Nuclear regulatory requirements   |                 |           |          |  | 15        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 22        |          |
| Subtotal   | 1164            | 465       | 0        | 1094                                     | 633       | 3        |
| Total  |                 | 1629      |          |  | 1730      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 92                                       |
| 12. Reactor I&C Systems                  | 354             | 55                                       |
| 13. Reactor Auxiliary Systems            |                 | 0  |
| 14. Safety Systems                       |                 | 1  |
| 15. Reactor Cooling Systems              |                 | 34                                       |
| 16. Steam generation systems             |                 | 143                                      |
| 21. Fuel Handling and Storage Facilities | 25              |  |
| 31. Turbine and auxiliaries              | 13              | 66                                       |
| 32. Feedwater and Main Steam System      |                 | 21                                       |
| 33. Circulating Water System             |                 | 57                                       |
| 41. Main Generator Systems               | 65              | 64                                       |
| 42. Electrical Power Supply Systems      |                 | 5  |
| Total                                    | 457             | 538                                      |

# FR-59 NOGENT-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1310.0 MW(e)  
**Design Net RUP:** 1310.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8216.7 GW(e).h  
**Energy Availability Factor:** 75.1%  
**Load Factor:** 71.4%  
**Operating Factor:** 80.2%  
**Energy Unavailability Factor:** 24.9%  
**Total Off-line Time:** 1740 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 936.0 | 842.4 | 851.9 | 869.8 | 825.2 | 263.5 | 0.0   | 20.7 | 847.4 | 910.5 | 883.8 | 965.6 | 8216.7 |
| <b>EAF (%)</b>  | 99.7  | 95.5  | 92.0  | 99.9  | 99.7  | 29.1  | 0.0   | 3.4  | 92.8  | 96.6  | 95.0  | 99.9  | 75.1   |
| <b>UCF (%)</b>  | 100.0 | 99.1  | 100.0 | 99.9  | 99.7  | 59.9  | 0.0   | 3.4  | 92.8  | 96.6  | 95.0  | 99.9  | 78.7   |
| <b>LF (%)</b>   | 96.0  | 92.4  | 87.5  | 92.2  | 84.7  | 27.9  | 0.0   | 2.1  | 89.8  | 93.3  | 93.7  | 99.1  | 71.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 60.7  | 0.0   | 11.6 | 100.0 | 96.8  | 95.8  | 100.0 | 80.2   |
| <b>EUF (%)</b>  | 0.3   | 4.5   | 8.0   | 0.1   | 0.3   | 70.9  | 100.0 | 96.6 | 7.2   | 3.4   | 5.0   | 0.1   | 24.9   |
| <b>PUF (%)</b>  | 0.1   | 0.1   | 0.0   | 0.1   | 0.0   | 40.1  | 100.0 | 15.0 | 3.4   | 0.1   | 0.1   | 0.1   | 13.3   |
| <b>UCLF (%)</b> | 0.0   | 0.8   | 0.0   | 0.1   | 0.3   | 0.0   | 0.0   | 81.7 | 3.8   | 3.3   | 4.9   | 0.1   | 8.0    |
| <b>XUF (%)</b>  | 0.3   | 3.6   | 8.0   | 0.0   | 0.0   | 30.8  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 3.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1982  
**Date of First Criticality:** 04 Oct 1988  
**Date of Grid Connection:** 14 Dec 1988  
**Date of Commercial Operation:** 01 May 1989

**Lifetime Generation:** 133837.4 GW(e).h  
**Cumulative Energy Availability Factor:** 81.2%  
**Cumulative Load Factor:** 73.4%  
**Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 18.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 50.0           | 1310.0         | 0.0  | 0.0    | 95.5                              | 100.0  | 0.5                | 0.0    | 198                | 2.3    |
| 1989 | 7470.1         | 1310.0         | 0.0  | 0.0    | 69.4                              | 100.0  | 65.1               | 0.0    | 6660               | 76.0   |
| 1990 | 7532.9         | 1310.0         | 69.4   | 69.4   | 68.3                              | 68.3   | 65.6               | 65.6   | 6094               | 69.6   |
| 1991 | 8331.1         | 1310.0         | 78.8   | 74.1   | 73.5                              | 70.9   | 72.6               | 69.1   | 7008               | 80.0   |
| 1992 | 8312.3         | 1310.0         | 77.4   | 75.2   | 74.1                              | 72.0   | 72.2               | 70.2   | 6937               | 79.0   |
| 1993 | 9191.7         | 1310.0         | 85.8   | 77.9   | 80.8                              | 74.2   | 80.1               | 72.6   | 7594               | 86.7   |
| 1994 | 6483.0         | 1310.0         | 98.0   | 81.9   | 94.8                              | 78.3   | 56.5               | 69.4   | 6027               | 68.8   |
| 1995 | 7545.4         | 1310.0         | 78.5   | 81.3   | 75.9                              | 77.9   | 65.8               | 68.8   | 6862               | 78.3   |
| 1996 | 8477.0         | 1310.0         | 80.5   | 81.2   | 77.0                              | 77.8   | 73.7               | 69.5   | 7229               | 82.3   |
| 1997 | 8925.8         | 1310.0         | 86.0   | 81.8   | 82.0                              | 78.3   | 77.8               | 70.5   | 7656               | 87.4   |
| 1998 | 8830.0         | 1310.0         | 98.0   | 83.6   | 97.8                              | 80.4   | 76.9               | 71.2   | 7386               | 84.3   |
| 1999 | 7957.3         | 1310.0         | 76.2   | 82.9   | 74.7                              | 79.9   | 69.3               | 71.1   | 6732               | 76.8   |
| 2000 | 9672.1         | 1310.0         | 85.9   | 83.1   | 84.6                              | 80.3   | 84.1               | 72.2   | 7654               | 87.1   |
| 2001 | 9379.0         | 1310.0         | 85.2   | 83.3   | 83.4                              | 80.6   | 81.7               | 73.0   | 7589               | 86.6   |
| 2002 | 8205.5         | 1310.0         | 84.2   | 83.4   | 84.2                              | 80.8   | 71.5               | 72.9   | 7241               | 82.7   |
| 2003 | 9447.1         | 1310.0         | 91.5   | 84.0   | 91.5                              | 81.6   | 82.3               | 73.6   | 7954               | 90.8   |
| 2004 | 8216.7         | 1310.0         | 78.7   | 83.6   | 75.1                              | 81.2   | 71.4               | 73.4   | 7044               | 80.2   |



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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 712.0  | 34.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 31 Jan | 11.0   | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 01 Feb | 17.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 01 Feb | 125.0  | 33.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 06 Feb | 514.0  | 27.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 19 Feb | 30.0   | 2.0     | UP2  | A33  | AIR COOLANT  |
| 01 Mar | 351.0  | 43.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 18 Mar | 234.0  | 78.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 01 Apr | 409.0  | 61.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 08 May | 7.0    | 2.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                             |
| 01 Jun | 82.0   | 23.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 04 Jun | 336.0  | 267.0   | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 18 Jun | 1027.0 | 1346.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 01 Aug | 50.0   | 66.0    | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 03 Aug | 607.0  | 796.0   | UF3  | K    | INDUSTRIAL ACTION DURING PROGRAMMED OUTAGE, EXTENSION      |
| 28 Aug | 177.0  | 108.0   | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 02 Sep | 55.0   | 21.0    | UP2  | A12  | MISCELLANEOUS INDEPENDENT MEASUREMENTS                     |
| 06 Sep | 17.0   | 6.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 07 Sep | 29.0   | 5.0     | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT |
| 09 Sep | 411.0  | 28.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 19 Sep | 3.0    | 3.0     | UP2  | A    | VALVE ACCESSORIES  |
| 01 Oct | 615.0  | 31.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 31 Oct | 9.0    | 12.0    | UF2  | A34  | FIRE SYSTEM  |
| 31 Oct | 4.0    | 5.0     | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                             |
| 31 Oct | 4.0    | 5.0     | UF2  | A41  | STATIC EXCITATION SYSTEM                                   |
| 31 Oct | 7.0    | 9.0     | UF2  | A15  | STEAM CIRCUIT WITHOUT INLET VALVES                         |
| 01 Nov | 532.0  | 9.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 06 Nov | 29.0   | 38.0    | UF2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)    |
| 08 Nov | 6.0    | 3.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 23 Nov | 52.0   | 1.0     | UP2  | A33  | AIR COOLANT  |
| 01 Dec | 349.0  | 9.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 24        |          |  | 249       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1077            |           |          | 861                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 29                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 | 607       |          |  | 28        |          |
| Z. Others  |                 | 29        |          |  |           |          |
| Subtotal   | 1077            | 660       | 0        | 890                                      | 279       | 0        |
| Total  |                 | 1737      |          |  | 1169      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 12                                       |
| 12. Reactor I&C Systems                        |                 | 26                                       |
| 13. Reactor Auxiliary Systems                  |                 | 11                                       |
| 14. Safety Systems                             |                 | 44                                       |
| 15. Reactor Cooling Systems                    | 7               | 26                                       |
| 16. Steam generation systems                   |                 | 47                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    | 4               | 27                                       |
| 32. Feedwater and Main Steam System            |                 | 13                                       |
| 33. Circulating Water System                   |                 | 8  |
| 41. Main Generator Systems                     | 4               | 13                                       |
| 42. Electrical Power Supply Systems            |                 | 7  |
| XX. Miscellaneous Systems                      | 9               | 1  |
| Total  | 24              | 235                                      |

# FR-36 PALUEL-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1330.0 MW(e)  
**Design Net RUP:** 1330.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8596.3 GW(e).h  
**Energy Availability Factor:** 77.4%  
**Load Factor:** 73.6%  
**Operating Factor:** 80.9%  
**Energy Unavailability Factor:** 22.6%  
**Total Off-line Time:** 1681 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 934.3 | 815.6 | 949.7 | 883.4 | 868.8 | 817.0 | 810.9 | 857.6 | 912.0 | 243.4 | 0.0   | 503.6 | 8596.3 |
| <b>EAF (%)</b>  | 97.7  | 91.7  | 99.7  | 96.9  | 91.5  | 93.6  | 87.8  | 92.6  | 99.6  | 25.8  | 0.0   | 52.1  | 77.4   |
| <b>UCF (%)</b>  | 100.0 | 91.7  | 99.7  | 100.0 | 93.9  | 99.7  | 95.5  | 94.8  | 99.7  | 25.8  | 0.0   | 52.1  | 79.4   |
| <b>LF (%)</b>   | 94.4  | 88.1  | 96.1  | 92.3  | 87.8  | 85.3  | 82.0  | 86.7  | 95.2  | 24.6  | 0.0   | 50.9  | 73.6   |
| <b>OF (%)</b>   | 100.0 | 92.1  | 99.9  | 100.0 | 95.2  | 98.9  | 93.7  | 94.5  | 100.0 | 26.0  | 0.0   | 70.2  | 80.9   |
| <b>EUF (%)</b>  | 2.3   | 8.3   | 0.3   | 3.1   | 8.5   | 6.4   | 12.2  | 7.4   | 0.4   | 74.2  | 100.0 | 47.9  | 22.6   |
| <b>PUF (%)</b>  | 0.0   | 5.4   | 0.0   | 0.0   | 5.9   | 0.0   | 0.0   | 0.0   | 0.4   | 74.2  | 90.0  | 16.0  | 16.0   |
| <b>UCLF (%)</b> | 0.0   | 2.9   | 0.3   | 0.0   | 0.3   | 0.3   | 4.5   | 5.1   | 0.0   | 0.0   | 10.0  | 31.9  | 4.6    |
| <b>XUF (%)</b>  | 2.3   | 0.0   | 0.0   | 3.0   | 2.3   | 6.0   | 7.7   | 2.3   | 0.1   | 0.0   | 0.0   | 0.0   | 2.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 15 Aug 1977  
**Date of First Criticality:** 13 May 1984  
**Date of Grid Connection:** 22 Jun 1984  
**Date of Commercial Operation:** 01 Dec 1985

**Lifetime Generation:** 158756.2 GW(e).h  
**Cumulative Energy Availability Factor:** 75.2%  
**Cumulative Load Factor:** 69.0%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 24.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 1805.0         | 1306.0         | 0.0  | 0.0    | 61.9                              | 100.0  | 16.7               | 0.0    | 2608               | 31.6   |
| 1985 | 4685.8         | 1290.0         | 0.0  | 0.0    | 41.0                              | 100.0  | 41.5               | 0.0    | 4104               | 46.8   |
| 1986 | 5169.7         | 1290.0         | 52.3   | 52.3   | 50.2                              | 50.2   | 45.7               | 45.7   | 4455               | 50.9   |
| 1987 | 8184.8         | 1330.0         | 77.0   | 64.8   | 76.6                              | 63.6   | 70.3               | 58.2   | 6527               | 74.5   |
| 1988 | 9291.0         | 1330.0         | 96.8   | 75.6   | 95.3                              | 74.3   | 79.5               | 65.4   | 7332               | 83.5   |
| 1989 | 7902.8         | 1330.0         | 72.6   | 74.8   | 70.4                              | 73.3   | 67.8               | 66.0   | 6567               | 75.0   |
| 1990 | 7323.9         | 1330.0         | 70.1   | 73.9   | 66.4                              | 71.9   | 62.9               | 65.4   | 6288               | 71.8   |
| 1991 | 7159.9         | 1330.0         | 66.7   | 72.7   | 63.2                              | 70.5   | 61.5               | 64.7   | 5987               | 68.3   |
| 1992 | 8640.4         | 1330.0         | 76.6   | 73.3   | 76.6                              | 71.3   | 74.0               | 66.0   | 6858               | 78.1   |
| 1993 | 8068.1         | 1330.0         | 77.2   | 73.8   | 70.9                              | 71.3   | 69.2               | 66.4   | 6906               | 78.8   |
| 1994 | 6549.9         | 1330.0         | 77.1   | 74.1   | 76.9                              | 71.9   | 56.2               | 65.3   | 5790               | 66.1   |
| 1995 | 8768.2         | 1330.0         | 82.2   | 74.9   | 79.6                              | 72.7   | 75.3               | 66.3   | 7292               | 83.2   |
| 1996 | 5483.2         | 1330.0         | 52.7   | 72.9   | 48.7                              | 70.5   | 46.9               | 64.5   | 4763               | 54.2   |
| 1997 | 9019.7         | 1330.0         | 84.5   | 73.9   | 83.8                              | 71.6   | 77.4               | 65.6   | 7537               | 86.0   |
| 1998 | 9718.1         | 1330.0         | 91.3   | 75.2   | 91.2                              | 73.1   | 83.4               | 67.0   | 8132               | 92.8   |
| 1999 | 8181.9         | 1330.0         | 78.6   | 75.5   | 76.2                              | 73.3   | 70.2               | 67.2   | 6938               | 79.2   |
| 2000 | 9089.0         | 1330.0         | 84.0   | 76.0   | 83.5                              | 74.0   | 77.8               | 67.9   | 7533               | 85.8   |
| 2001 | 9752.2         | 1330.0         | 98.3   | 77.4   | 97.6                              | 75.5   | 83.7               | 68.9   | 8382               | 95.7   |
| 2002 | 7153.9         | 1330.0         | 68.3   | 76.9   | 66.6                              | 75.0   | 61.4               | 68.5   | 6081               | 69.4   |
| 2003 | 8526.2         | 1330.0         | 77.6   | 76.9   | 77.2                              | 75.1   | 73.2               | 68.7   | 6882               | 78.6   |
| 2004 | 8596.3         | 1330.0         | 79.4   | 77.0   | 77.4                              | 75.2   | 73.6               | 69.0   | 7103               | 80.9   |

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## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 471.0  | 31.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 01 Feb | 408.0  | 29.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 07 Feb | 35.0   | 47.0    | PF   | D    | WORK SCHEDULED FOR 01/01                                   |
| 09 Feb | 20.0   | 27.0    | UF2  | A13  | CHEMICAL AND VOLUME CONTROL SYSTEM WITHOUT PUMP            |
| 01 Mar | 448.0  | 34.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Apr | 304.0  | 45.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |
| 01 May | 465.0  | 35.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |
| 22 May | 36.0   | 48.0    | PF   | E    | EQUIPMENT PERFORMANCE TEST (SPECIAL)                       |
| 26 May | 25.0   | 23.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 01 Jun | 240.0  | 64.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |
| 08 Jun | 220.0  | 49.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 01 Jul | 278.0  | 55.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 02 Jul | 112.0  | 76.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 12 Jul | 46.0   | 28.0    | UP2  | A34  | VARIOUS DAMP AUXILIARIES                                   |
| 26 Jul | 12.0   | 16.0    | UF2  | A    | GENERAL CONTROL AND REGULATION CHANNELS                    |
| 01 Aug | 269.0  | 56.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 03 Aug | 14.0   | 19.0    | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                |
| 04 Aug | 22.0   | 30.0    | UF2  | A42  | LETDOWN AUXILIARY TRANSFORMER                              |
| 05 Aug | 191.0  | 23.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 01 Sep | 571.0  | 41.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 09 Oct | 1198.0 | 1596.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 28 Nov | 55.0   | 73.0    | UF2  | A13  | COMPONENT COOLING SYSTEM                                   |
| 30 Nov | 82.0   | 109.0   | UF2  | A22  | FRESH AND IRRADIATED FUEL HANDLING                         |
| 03 Dec | 56.0   | 75.0    | UF2  | A15  | PRIMARY SYSTEM   |
| 07 Dec | 24.0   | 23.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 08 Dec | 21.0   | 27.0    | UF2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                     |
| 09 Dec | 51.0   | 68.0    | UF2  | A14  | STEAM GENERATOR EMERGENCY FEED SYSTEMS                     |
| 12 Dec | 15.0   | 18.0    | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT |
| 26 Dec | 121.0  | 2.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 333       |          |  | 448       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1198            |           |          | 1014                                     | 66        |          |
| D. Inspection, maintenance or repair without refuelling                              | 35              |           |          | 170                                      |           |          |
| E. Testing of plant systems or components  | 36              |           |          | 30                                       | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 18        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 59        | 1        |
| Z. Others  |                 |           |          |  | 1         |          |
| Subtotal   | 1269            | 333       | 0        | 1214                                     | 596       | 2        |
| Total  |                 | 1602      |          |  | 1812      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 28                                       |
| 12. Reactor I&C Systems             | 14              | 60                                       |
| 13. Reactor Auxiliary Systems       | 75              | 35                                       |
| 14. Safety Systems                  | 51              | 2  |
| 15. Reactor Cooling Systems         | 56              | 11                                       |
| 16. Steam generation systems        | 21              | 17                                       |
| 31. Turbine and auxiliaries         |                 | 43                                       |
| 32. Feedwater and Main Steam System |                 | 42                                       |
| 33. Circulating Water System        |                 | 24                                       |
| 41. Main Generator Systems          |                 | 143                                      |
| 42. Electrical Power Supply Systems | 22              | 17                                       |
| XX. Miscellaneous Systems           |                 | 2  |
| Total                               | 239             | 424                                      |

# FR-37 PALUEL-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1330.0 MW(e)  
**Design Net RUP:** 1330.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9562.7 GW(e).h  
**Energy Availability Factor:** 89.9%  
**Load Factor:** 81.9%  
**Operating Factor:** 91.5%  
**Energy Unavailability Factor:** 10.1%  
**Total Off-line Time:** 745 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 878.3 | 790.5 | 939.3 | 867.4 | 839.4 | 651.4 | 330.9 | 569.3 | 909.9 | 938.3 | 898.7 | 949.3 | 9562.7 |
| <b>EAF (%)</b>  | 92.0  | 90.5  | 99.9  | 96.0  | 91.5  | 74.8  | 62.2  | 76.5  | 99.3  | 97.6  | 99.0  | 99.4  | 89.9   |
| <b>UCF (%)</b>  | 92.7  | 90.5  | 99.9  | 100.0 | 93.5  | 99.0  | 62.2  | 76.7  | 100.0 | 98.1  | 99.2  | 99.9  | 92.6   |
| <b>LF (%)</b>   | 88.8  | 85.4  | 95.1  | 90.6  | 84.8  | 68.0  | 33.4  | 57.5  | 95.0  | 94.7  | 93.9  | 95.9  | 81.9   |
| <b>OF (%)</b>   | 97.0  | 91.5  | 100.0 | 100.0 | 94.0  | 76.4  | 67.1  | 74.7  | 100.0 | 100.0 | 97.8  | 100.0 | 91.5   |
| <b>EUF (%)</b>  | 8.0   | 9.5   | 0.1   | 4.0   | 8.5   | 25.2  | 37.8  | 23.5  | 0.7   | 2.4   | 1.0   | 0.6   | 10.1   |
| <b>PUF (%)</b>  | 3.8   | 7.8   | 0.1   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.2   | 0.0   | 1.0    |
| <b>UCLF (%)</b> | 3.5   | 1.6   | 0.0   | 0.0   | 6.4   | 1.0   | 37.8  | 23.2  | 0.0   | 1.8   | 0.6   | 0.1   | 6.4    |
| <b>XUF (%)</b>  | 0.7   | 0.0   | 0.0   | 3.9   | 2.0   | 24.2  | 0.0   | 0.2   | 0.7   | 0.5   | 0.2   | 0.5   | 2.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1978  
**Date of First Criticality:** 11 Aug 1984  
**Date of Grid Connection:** 14 Sep 1984  
**Date of Commercial Operation:** 01 Dec 1985

**Lifetime Generation:** 157051.0 GW(e).h  
**Cumulative Energy Availability Factor:** 73.9%  
**Cumulative Load Factor:** 68.1%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 26.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 1000.0         | 1316.0         | 0.0  | 0.0    | 79.4                              | 100.0  | 9.0                | 0.0    | 1785               | 21.1   |
| 1985 | 5997.8         | 1290.0         | 0.0  | 0.0    | 52.5                              | 100.0  | 53.1               | 0.0    | 5548               | 63.3   |
| 1986 | 6040.9         | 1290.0         | 52.3   | 52.3   | 52.2                              | 52.2   | 53.5               | 53.5   | 4804               | 54.8   |
| 1987 | 8859.6         | 1290.0         | 77.3   | 64.8   | 76.8                              | 64.5   | 78.4               | 65.9   | 6837               | 78.0   |
| 1988 | 7725.0         | 1330.0         | 75.5   | 68.5   | 73.5                              | 67.6   | 66.1               | 66.0   | 6017               | 68.5   |
| 1989 | 8956.4         | 1330.0         | 83.3   | 72.2   | 80.1                              | 70.8   | 76.9               | 68.8   | 7358               | 84.0   |
| 1990 | 6496.3         | 1330.0         | 59.1   | 69.6   | 59.1                              | 68.4   | 55.8               | 66.1   | 5328               | 60.8   |
| 1991 | 6140.3         | 1330.0         | 55.1   | 67.1   | 54.9                              | 66.1   | 52.7               | 63.9   | 4996               | 57.0   |
| 1992 | 6906.9         | 1330.0         | 63.6   | 66.6   | 61.7                              | 65.5   | 59.1               | 63.2   | 5618               | 64.0   |
| 1993 | 7954.4         | 1330.0         | 87.9   | 69.3   | 76.9                              | 66.9   | 68.3               | 63.8   | 7217               | 82.4   |
| 1994 | 7115.2         | 1330.0         | 77.6   | 70.2   | 74.5                              | 67.8   | 61.1               | 63.5   | 6671               | 76.2   |
| 1995 | 6934.5         | 1330.0         | 70.5   | 70.3   | 65.8                              | 67.6   | 59.5               | 63.1   | 6252               | 71.4   |
| 1996 | 8407.4         | 1330.0         | 83.8   | 71.5   | 78.5                              | 68.6   | 72.0               | 63.9   | 7195               | 81.9   |
| 1997 | 8139.8         | 1330.0         | 83.9   | 72.5   | 83.5                              | 69.8   | 69.9               | 64.4   | 7182               | 82.0   |
| 1998 | 7300.4         | 1330.0         | 73.1   | 72.6   | 69.1                              | 69.8   | 62.7               | 64.3   | 6583               | 75.1   |
| 1999 | 9243.8         | 1330.0         | 85.6   | 73.5   | 84.1                              | 70.8   | 79.3               | 65.4   | 7705               | 88.0   |
| 2000 | 9849.9         | 1330.0         | 96.0   | 75.0   | 94.4                              | 72.4   | 84.3               | 66.6   | 8271               | 94.2   |
| 2001 | 7843.1         | 1330.0         | 76.7   | 75.1   | 76.0                              | 72.6   | 67.3               | 66.7   | 6861               | 78.3   |
| 2002 | 7984.4         | 1330.0         | 73.2   | 75.0   | 72.0                              | 72.6   | 68.5               | 66.8   | 6569               | 75.0   |
| 2003 | 8814.9         | 1330.0         | 82.1   | 75.4   | 81.1                              | 73.0   | 75.7               | 67.3   | 7490               | 85.5   |
| 2004 | 9562.7         | 1330.0         | 92.6   | 76.3   | 89.9                              | 73.9   | 81.9               | 68.1   | 8039               | 91.5   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 66.0   | 29.0    | UP2  | A31  | MAIN CONDENSER   |
| 03 Jan | 19.0   | 25.0    | PF   | D    | WORK SCHEDULED FOR 01/01                                     |
| 03 Jan | 127.0  | 10.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                              |
| 09 Jan | 465.0  | 25.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER   |
| 25 Jan | 3.0    | 4.0     | UF3  | A31  | TURNING AND LIFTING  |
| 01 Feb | 139.0  | 45.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX     |
| 13 Feb | 53.0   | 70.0    | PF   | D    | WORK SCHEDULED FOR 01/01                                     |
| 16 Feb | 7.0    | 9.0     | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                               |
| 01 Mar | 602.0  | 99.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER   |
| 07 Apr | 49.0   | 38.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION      |
| 01 May | 255.0  | 46.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER   |
| 05 May | 14.0   | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN             |
| 30 May | 45.0   | 60.0    | UF2  | A41  | HYDROGEN COOLING SYSTEM                                      |
| 01 Jun | 282.0  | 56.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX      |
| 30 Jun | 19.0   | 26.0    | UF2  | A33  | VARIOUS, PUMPHOUSE-CIRCULATING WATER                         |
| 01 Jul | 225.0  | 300.0   | UF2  | A33  | VARIOUS, PUMPHOUSE-CIRCULATING WATER                         |
| 31 Jul | 43.0   | 57.0    | UF2  | A21  | FUEL   |
| 02 Aug | 55.0   | 50.0    | UP2  | A33  | VARIOUS, PUMPHOUSE-CIRCULATING WATER                         |
| 14 Aug | 72.0   | 95.0    | UF2  | H    | UNPLANNED OUTAGE WHILE AWAITING ACTION FROM SAFETY AUTHORITY |
| 17 Aug | 312.0  | 37.0    | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                          |
| 30 Aug | 131.0  | 8.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS        |
| 03 Sep | 1059.0 | 75.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER   |
| 01 Nov | 639.0  | 20.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER   |
| 01 Dec | 581.0  | 38.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 342       |          |  | 615       |          |
| B. Refuelling without a maintenance  |                 |           |          | 43                                       | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 947                                      | 138       |          |
| D. Inspection, maintenance or repair without refuelling                              | 72              |           |          | 51                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 23                                       | 1         |          |
| H. Nuclear regulatory requirements   |                 | 72        |          |  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 29        | 0        |
| M. Governmental requirements or court decisions                                      |                 |           |          |  | 1         |          |
| Subtotal   | 72              | 414       | 0        | 1064                                     | 790       | 0        |
| Total  |                 | 486       |          |  | 1854      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 23                                       |
| 12. Reactor I&C Systems                        |                 | 120                                      |
| 13. Reactor Auxiliary Systems                  |                 | 9  |
| 14. Safety Systems                             |                 | 25                                       |
| 15. Reactor Cooling Systems                    |                 | 90                                       |
| 16. Steam generation systems                   |                 | 41                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 21. Fuel Handling and Storage Facilities       | 43              |  |
| 31. Turbine and auxiliaries                    | 10              | 40                                       |
| 32. Feedwater and Main Steam System            |                 | 8  |
| 33. Circulating Water System                   | 244             | 76                                       |
| 41. Main Generator Systems                     | 45              | 119                                      |
| 42. Electrical Power Supply Systems            |                 | 22                                       |
| Total  | 342             | 574                                      |

**FR-38 PALUEL-3**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1330.0 MW(e)  
 Design Net RUP: 1330.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6395.5 GW(e).h  
 Energy Availability Factor: 56.0%  
 Load Factor: 54.7%  
 Operating Factor: 58.6%  
 Energy Unavailability Factor: 44.0%  
 Total Off-line Time: 3637 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 945.8 | 897.6 | 957.5 | 256.5 | 0.0   | 0.0   | 0.0   | 0.0   | 652.9 | 945.2 | 778.9 | 961.2 | 6395.5 |
| EAF (%)  | 97.9  | 99.8  | 98.0  | 27.8  | 0.0   | 0.0   | 0.0   | 0.0   | 69.4  | 97.9  | 83.4  | 99.6  | 56.0   |
| UCF (%)  | 98.7  | 99.8  | 100.0 | 30.1  | 0.0   | 0.0   | 0.0   | 0.0   | 75.4  | 98.3  | 83.8  | 99.6  | 57.0   |
| LF (%)   | 95.6  | 97.0  | 96.9  | 26.8  | 0.0   | 0.0   | 0.0   | 0.0   | 68.2  | 95.4  | 81.3  | 97.1  | 54.7   |
| OF (%)   | 98.8  | 100.0 | 100.0 | 30.3  | 0.0   | 0.0   | 0.0   | 0.0   | 90.4  | 100.0 | 85.4  | 100.0 | 58.6   |
| EUF (%)  | 2.1   | 0.2   | 2.0   | 72.2  | 100.0 | 100.0 | 100.0 | 100.0 | 30.6  | 2.1   | 16.6  | 0.4   | 44.0   |
| PUF (%)  | 0.0   | 0.1   | 0.0   | 69.9  | 100.0 | 1.7   | 0.0   | 2.7   | 20.1  | 0.4   | 0.1   | 0.0   | 16.3   |
| UCLF (%) | 1.3   | 0.1   | 0.0   | 0.0   | 0.0   | 98.3  | 100.0 | 97.3  | 4.5   | 1.3   | 16.1  | 0.4   | 26.7   |
| XUF (%)  | 0.7   | 0.0   | 2.0   | 2.3   | 0.0   | 0.0   | 0.0   | 0.0   | 5.9   | 0.4   | 0.4   | 0.0   | 1.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Feb 1979      Lifetime Generation: 152679.1 GW(e).h  
 Date of First Criticality: 07 Aug 1985      Cumulative Energy Availability Factor: 74.1%  
 Date of Grid Connection: 30 Sep 1985      Cumulative Load Factor: 68.3%  
 Date of Commercial Operation: 01 Feb 1986      Cumulative Unit Capability Factor: 78.4%  
    Cumulative Energy Unavailability Factor: 25.9%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1985 | 1605.4            | 1316.0            | 0.0  | 0.0    | 88.1                                 | 100.0  | 15.1               | 0.0    | 1747                  | 21.7   |
| 1986 | 8321.7            | 1290.0            | 0.0  | 0.0    | 73.9                                 | 100.0  | 73.6               | 0.0    | 6503                  | 74.2   |
| 1987 | 7716.6            | 1290.0            | 78.3   | 78.3   | 78.3                                 | 78.3   | 68.3               | 68.3   | 6104                  | 69.7   |
| 1988 | 6763.0            | 1330.0            | 68.7   | 73.5   | 59.2                                 | 68.6   | 57.9               | 63.0   | 5413                  | 61.6   |
| 1989 | 8124.4            | 1330.0            | 70.7   | 72.5   | 70.2                                 | 69.1   | 69.7               | 65.3   | 6288                  | 71.8   |
| 1990 | 7322.0            | 1330.0            | 67.2   | 71.2   | 66.2                                 | 68.4   | 62.8               | 64.7   | 6008                  | 68.6   |
| 1991 | 9587.1            | 1330.0            | 86.5   | 74.3   | 86.3                                 | 72.0   | 82.3               | 68.2   | 7634                  | 87.1   |
| 1992 | 6886.6            | 1330.0            | 63.2   | 72.4   | 63.0                                 | 70.5   | 58.9               | 66.6   | 5671                  | 64.6   |
| 1993 | 8459.0            | 1330.0            | 77.5   | 73.1   | 73.4                                 | 70.9   | 72.6               | 67.5   | 6951                  | 79.3   |
| 1994 | 6703.6            | 1330.0            | 63.4   | 71.9   | 61.8                                 | 69.8   | 57.5               | 66.3   | 5590                  | 63.8   |
| 1995 | 8733.3            | 1330.0            | 85.5   | 73.4   | 84.1                                 | 71.4   | 75.0               | 67.2   | 7598                  | 86.7   |
| 1996 | 8027.7            | 1330.0            | 84.9   | 74.6   | 84.6                                 | 72.7   | 68.7               | 67.4   | 7261                  | 82.7   |
| 1997 | 7618.8            | 1330.0            | 73.2   | 74.5   | 72.8                                 | 72.7   | 65.4               | 67.2   | 6494                  | 74.1   |
| 1998 | 8327.0            | 1330.0            | 77.6   | 74.7   | 76.1                                 | 73.0   | 71.5               | 67.5   | 6913                  | 78.9   |
| 1999 | 7636.7            | 1330.0            | 76.1   | 74.8   | 73.7                                 | 73.0   | 65.5               | 67.4   | 6505                  | 74.3   |
| 2000 | 9819.8            | 1330.0            | 94.7   | 76.3   | 94.4                                 | 74.6   | 84.1               | 68.6   | 8199                  | 93.3   |
| 2001 | 7815.9            | 1330.0            | 81.6   | 76.6   | 79.6                                 | 74.9   | 67.1               | 68.5   | 6796                  | 77.6   |
| 2002 | 8900.5            | 1330.0            | 82.3   | 77.0   | 80.4                                 | 75.2   | 76.4               | 69.0   | 7366                  | 84.1   |
| 2003 | 8181.7            | 1330.0            | 74.9   | 76.8   | 74.3                                 | 75.2   | 70.2               | 69.1   | 6567                  | 75.0   |
| 2004 | 6395.5            | 1330.0            | 57.0   | 75.7   | 56.0                                 | 74.1   | 54.7               | 68.3   | 5147                  | 58.6   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 428.0  | 22.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 17 Jan | 9.0    | 11.0    | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                             |
| 19 Jan | 24.0   | 7.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION    |
| 01 Feb | 690.0  | 37.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 25 Feb | 14.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 14 Mar | 499.0  | 41.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 10 Apr | 1258.0 | 1674.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 01 Jun | 288.0  | 383.0   | UF2  | A21  | REFUELLING MACHINE   |
| 13 Jun | 72.0   | 96.0    | UF2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                     |
| 16 Jun | 84.0   | 112.0   | UF2  | A13  | NUCLEAR SAMPLING SYSTEM                                    |
| 20 Jun | 48.0   | 64.0    | UF3  | Z    | INDUSTRIAL ACTION DURING PROGRAMMED OUTAGE, EXTENSION      |
| 22 Jun | 96.0   | 127.0   | UF2  | A15  | PRIMARY PUMP   |
| 26 Jun | 60.0   | 79.0    | UF2  | A11  | VESSEL AND VESSEL HEAD                                     |
| 29 Jun | 1296.0 | 1723.0  | UF2  | A33  | VARIOUS, PUMPHOUSE-CIRCULATING WATER                       |
| 22 Aug | 159.0  | 211.0   | UF2  | A12  | MAIN CONDENSER   |
| 29 Aug | 28.0   | 38.0    | UF2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 30 Aug | 32.0   | 27.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 03 Sep | 100.0  | 79.0    | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 16 Sep | 27.0   | 36.0    | UF3  | A12  | REACTOR INSTRUMENTATION AND CONTROL                        |
| 24 Sep | 119.0  | 7.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 01 Oct | 422.0  | 18.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 06 Oct | 127.0  | 10.0    | UP2  | A32  | HIGH-PRESSURE HEATING                                      |
| 01 Nov | 387.0  | 15.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX   |
| 08 Nov | 22.0   | 29.0    | UF2  | L    | HUMAN OPERATING ERRORS                                     |
| 11 Nov | 80.0   | 107.0   | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                        |
| 01 Dec | 570.0  | 23.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 2199      |          |  | 604       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1258            |           |          | 979                                      | 48        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 49                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 42                                       | 1         | 12       |
| H. Nuclear regulatory requirements   |                 |           |          |  | 6         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         | 24       |
| L. Human factor related  |                 | 22        |          |  |           |          |
| Z. Others  |                 | 48        |          |  |           |          |
| Subtotal   | 1258            | 2269      | 0        | 1070                                     | 667       | 36       |
| Total  |                 | 3527      |          |  | 1773      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    | 60              | 53                                       |
| 12. Reactor I&C Systems                        | 266             | 85                                       |
| 13. Reactor Auxiliary Systems                  | 84              | 46                                       |
| 14. Safety Systems                             |                 | 43                                       |
| 15. Reactor Cooling Systems                    | 96              | 92                                       |
| 16. Steam generation systems                   | 72              | 3  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 21. Fuel Handling and Storage Facilities       | 288             |  |
| 31. Turbine and auxiliaries                    | 9               | 28                                       |
| 32. Feedwater and Main Steam System            | 28              | 88                                       |
| 33. Circulating Water System                   | 1296            | 0  |
| 41. Main Generator Systems                     |                 | 61                                       |
| 42. Electrical Power Supply Systems            |                 | 46                                       |
| XX. Miscellaneous Systems                      |                 | 1  |
| Total  | 2199            | 547                                      |

**FR-39 PALUEL-4**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1330.0 MW(e)  
 Design Net RUP: 1330.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 7138.6 GW(e).h  
 Energy Availability Factor: 64.6%  
 Load Factor: 61.1%  
 Operating Factor: 68.6%  
 Energy Unavailability Factor: 35.4%  
 Total Off-line Time: 2757 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 866.7 | 878.6 | 898.3 | 920.9 | 806.3 | 523.6 | 0.0   | 0.0   | 0.0   | 467.3 | 884.5 | 892.4 | 7138.6 |
| EAF (%)  | 96.8  | 99.8  | 96.0  | 99.1  | 82.5  | 55.3  | 0.0   | 0.0   | 0.0   | 49.0  | 99.3  | 100.0 | 64.6   |
| UCF (%)  | 98.4  | 99.8  | 96.0  | 99.8  | 97.2  | 77.7  | 0.0   | 0.0   | 0.0   | 49.0  | 99.3  | 100.0 | 67.9   |
| LF (%)   | 87.6  | 94.9  | 90.9  | 96.2  | 81.5  | 54.7  | 0.0   | 0.0   | 0.0   | 47.2  | 92.4  | 90.2  | 61.1   |
| OF (%)   | 99.9  | 100.0 | 100.0 | 100.0 | 94.1  | 70.4  | 0.0   | 0.0   | 0.0   | 60.9  | 100.0 | 100.0 | 68.6   |
| EUF (%)  | 3.2   | 0.2   | 4.0   | 0.9   | 17.5  | 44.7  | 100.0 | 100.0 | 100.0 | 51.0  | 0.7   | 0.0   | 35.4   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 16.4  | 100.0 | 64.5  | 5.5   | 9.1   | 0.0   | 0.0   | 16.5   |
| UCLF (%) | 1.6   | 0.2   | 4.0   | 0.1   | 2.8   | 5.9   | 0.0   | 35.5  | 94.6  | 41.9  | 0.7   | 0.0   | 15.6   |
| XUF (%)  | 1.5   | 0.0   | 0.0   | 0.6   | 14.7  | 22.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.3    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Feb 1980  
 Date of First Criticality: 29 Mar 1986  
 Date of Grid Connection: 11 Apr 1986  
 Date of Commercial Operation: 01 Jun 1986

Lifetime Generation: 151133.7 GW(e).h  
 Cumulative Energy Availability Factor: 75.3%  
 Cumulative Load Factor: 69.2%  
 Cumulative Unit Capability Factor: 78.4%  
 Cumulative Energy Unavailability Factor: 24.7%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1986 | 6118.6            | 1300.0            | 0.0  | 0.0    | 85.4                                 | 100.0  | 55.2               | 0.0    | 5343                  | 62.7   |
| 1987 | 8014.6            | 1290.0            | 69.8   | 69.8   | 69.7                                 | 69.7   | 70.9               | 70.9   | 6289                  | 71.8   |
| 1988 | 5909.0            | 1330.0            | 54.0   | 61.8   | 53.6                                 | 61.5   | 50.6               | 60.6   | 4812                  | 54.8   |
| 1989 | 8268.3            | 1330.0            | 72.1   | 65.3   | 71.0                                 | 64.7   | 71.0               | 64.1   | 6349                  | 72.5   |
| 1990 | 8067.7            | 1330.0            | 78.7   | 68.7   | 78.5                                 | 68.2   | 69.2               | 65.4   | 6770                  | 77.3   |
| 1991 | 8325.6            | 1330.0            | 74.5   | 69.8   | 74.2                                 | 69.4   | 71.5               | 66.6   | 6677                  | 76.2   |
| 1992 | 5553.3            | 1330.0            | 48.9   | 66.3   | 48.6                                 | 65.9   | 47.5               | 63.4   | 4529                  | 51.6   |
| 1993 | 8683.8            | 1330.0            | 77.8   | 68.0   | 75.3                                 | 67.3   | 74.5               | 65.0   | 6938                  | 79.2   |
| 1994 | 8329.7            | 1330.0            | 77.3   | 69.1   | 76.5                                 | 68.4   | 71.5               | 65.8   | 6945                  | 79.3   |
| 1995 | 8346.8            | 1330.0            | 88.5   | 71.3   | 88.1                                 | 70.6   | 71.6               | 66.5   | 7354                  | 83.9   |
| 1996 | 7848.1            | 1330.0            | 75.2   | 71.7   | 72.4                                 | 70.8   | 67.2               | 66.5   | 6745                  | 76.8   |
| 1997 | 8633.7            | 1330.0            | 81.9   | 72.6   | 78.2                                 | 71.5   | 74.1               | 67.2   | 7219                  | 82.4   |
| 1998 | 7776.7            | 1330.0            | 71.2   | 72.5   | 68.3                                 | 71.2   | 66.7               | 67.2   | 6506                  | 74.3   |
| 1999 | 9879.7            | 1330.0            | 96.1   | 74.3   | 94.6                                 | 73.0   | 84.8               | 68.5   | 8345                  | 95.3   |
| 2000 | 8358.8            | 1330.0            | 86.0   | 75.2   | 84.4                                 | 73.8   | 71.5               | 68.8   | 7532                  | 85.7   |
| 2001 | 8581.0            | 1330.0            | 84.5   | 75.8   | 82.1                                 | 74.4   | 73.7               | 69.1   | 7489                  | 85.5   |
| 2002 | 9303.3            | 1330.0            | 95.7   | 77.0   | 92.7                                 | 75.5   | 79.9               | 69.8   | 8216                  | 93.8   |
| 2003 | 7960.7            | 1330.0            | 82.8   | 77.4   | 81.9                                 | 75.9   | 68.3               | 69.7   | 7307                  | 83.4   |
| 2004 | 7138.6            | 1330.0            | 67.9   | 76.8   | 64.6                                 | 75.3   | 61.1               | 69.2   | 6027                  | 68.6   |



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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 47.0   | 13.0    | UP2  | A41  | STATOR BAR WATER COOLING CIRCUIT                           |
| 02 Jan | 436.0  | 92.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |
| 01 Feb | 499.0  | 44.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                    |
| 01 Mar | 284.0  | 47.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                    |
| 13 Mar | 71.0   | 40.0    | UP2  | A31  | MAIN CONDENSER   |
| 01 Apr | 308.0  | 27.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 15 Apr | 18.0   | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN           |
| 20 Apr | 676.0  | 86.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 03 May | 60.0   | 7.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |
| 08 May | 81.0   | 65.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 29 May | 45.0   | 19.0    | UP2  | A33  | RAW WATER SYSTEM   |
| 29 May | 6.0    | 8.0     | UF2  | A33  | RAW WATER SYSTEM   |
| 01 Jun | 41.0   | 54.0    | UF2  | A33  | RAW WATER SYSTEM   |
| 02 Jun | 504.0  | 142.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                         |
| 23 Jun | 55.0   | 72.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS      |
| 26 Jun | 1341.0 | 1784.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                          |
| 25 Aug | 120.0  | 159.0   | UF2  | A21  | REFUELLING MACHINE   |
| 30 Aug | 24.0   | 32.0    | UF2  | A11  | VESSEL AND VESSEL HEAD                                     |
| 31 Aug | 240.0  | 319.0   | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                        |
| 10 Sep | 39.0   | 51.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                            |
| 11 Sep | 144.0  | 191.0   | UF2  | A42  | LETDOWN AUXILIARY TRANSFORMER                              |
| 17 Sep | 288.0  | 383.0   | UF2  | A15  | PRIMARY PUMP   |
| 29 Sep | 267.0  | 356.0   | UF2  | A42  | MAIN TRANSFORMER WITH FIRE PROTECTION                      |
| 10 Oct | 327.0  | 89.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                            |
| 21 Oct | 30.0   | 24.0    | UP2  | A31  | VACUUM CIRCUIT   |
| 21 Oct | 24.0   | 32.0    | UF2  | A31  | VACUUM CIRCUIT   |
| 23 Oct | 46.0   | 61.0    | UF2  | A31  | MOISTURE SEPARATOR-REHEATERS                               |
| 28 Oct | 352.0  | 61.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER |
| 21 Nov | 12.0   | 6.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)   |
| 01 Dec | 281.0  | 97.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX    |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 960       |          |  | 591       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1341            |           |          | 963                                      | 16        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 46                                       |           |          |
| E. Testing of plant systems or components  | 39              |           |          | 23                                       | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 7        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 30        | 1        |
| Z. Others  |                 | 240       |          |  | 8         |          |
| Subtotal   | 1380            | 1200      | 0        | 1032                                     | 649       | 8        |
| Total  |                 | 2580      |          |  | 1689      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              | 24              | 115                                      |
| 12. Reactor I&C Systems                  |                 | 17                                       |
| 13. Reactor Auxiliary Systems            |                 | 10                                       |
| 14. Safety Systems                       |                 | 20                                       |
| 15. Reactor Cooling Systems              | 288             | 29                                       |
| 16. Steam generation systems             |                 | 90                                       |
| 21. Fuel Handling and Storage Facilities | 120             | 66                                       |
| 31. Turbine and auxiliaries              | 70              | 39                                       |
| 32. Feedwater and Main Steam System      |                 | 13                                       |
| 33. Circulating Water System             | 47              |  |
| 41. Main Generator Systems               |                 | 143                                      |
| 42. Electrical Power Supply Systems      | 411             | 22                                       |
| Total                                    | 960             | 564                                      |

# FR-63 PENLY-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1330.0 MW(e)  
**Design Net RUP:** 1330.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10500.2 GW(e).h  
**Energy Availability Factor:** 98.6%  
**Load Factor:** 89.9%  
**Operating Factor:** 99.4%  
**Energy Unavailability Factor:** 1.4%  
**Total Off-line Time:** 51 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 880.3 | 839.8 | 919.8 | 824.7 | 869.6 | 823.5 | 848.9 | 852.1 | 855.3 | 926.8 | 907.4 | 952.2 | 10500.2 |
| <b>EAF (%)</b>  | 99.9  | 99.7  | 100.0 | 97.3  | 99.8  | 98.9  | 96.3  | 97.0  | 97.0  | 99.2  | 99.6  | 98.2  | 98.6    |
| <b>UCF (%)</b>  | 99.9  | 99.7  | 100.0 | 99.9  | 99.8  | 99.9  | 96.3  | 97.0  | 97.0  | 99.2  | 99.6  | 99.0  | 98.9    |
| <b>LF (%)</b>   | 89.0  | 90.7  | 93.1  | 86.1  | 87.9  | 86.0  | 85.8  | 86.1  | 89.3  | 93.5  | 94.8  | 96.2  | 89.9    |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.6  | 98.0  | 98.6  | 100.0 | 100.0 | 99.9  | 99.4    |
| <b>EUF (%)</b>  | 0.1   | 0.3   | 0.0   | 2.7   | 0.2   | 1.1   | 3.7   | 3.0   | 3.0   | 0.8   | 0.4   | 1.8   | 1.4     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.5   | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.3     |
| <b>UCLF (%)</b> | 0.1   | 0.3   | 0.0   | 0.2   | 0.2   | 0.1   | 0.2   | 3.0   | 3.0   | 0.6   | 0.4   | 1.0   | 0.7     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 2.6   | 0.0   | 1.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8   | 0.4     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1982      **Lifetime Generation:** 125001.1 GW(e).h  
**Date of First Criticality:** 01 Apr 1990      **Cumulative Energy Availability Factor:** 81.2%  
**Date of Grid Connection:** 04 May 1990      **Cumulative Load Factor:** 74.9%  
**Date of Commercial Operation:** 01 Dec 1990      **Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 18.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 2887.1         | 1330.0         | 0.0  | 0.0    | 59.2                              | 100.0  | 24.8               | 0.0    | 3100               | 35.4   |
| 1991 | 8436.7         | 1330.0         | 74.3   | 74.3   | 74.2                              | 74.2   | 72.4               | 72.4   | 6645               | 75.9   |
| 1992 | 7922.2         | 1330.0         | 71.2   | 72.8   | 70.9                              | 72.6   | 67.8               | 70.1   | 6315               | 71.9   |
| 1993 | 8023.9         | 1330.0         | 84.6   | 76.7   | 71.9                              | 72.3   | 68.9               | 69.7   | 7298               | 83.3   |
| 1994 | 7969.1         | 1330.0         | 86.1   | 79.0   | 85.0                              | 75.5   | 68.4               | 69.4   | 6654               | 76.0   |
| 1995 | 8879.1         | 1330.0         | 81.9   | 79.6   | 80.8                              | 76.6   | 76.2               | 70.7   | 7248               | 82.7   |
| 1996 | 9530.8         | 1330.0         | 85.7   | 80.6   | 85.2                              | 78.0   | 81.6               | 72.5   | 7625               | 86.8   |
| 1997 | 8503.4         | 1330.0         | 77.5   | 80.2   | 76.7                              | 77.8   | 73.0               | 72.6   | 6872               | 78.4   |
| 1998 | 9965.7         | 1330.0         | 98.0   | 82.4   | 97.9                              | 80.3   | 85.5               | 74.2   | 8140               | 92.9   |
| 1999 | 7998.5         | 1330.0         | 74.4   | 81.5   | 71.5                              | 79.4   | 68.7               | 73.6   | 6633               | 75.7   |
| 2000 | 8271.7         | 1330.0         | 73.8   | 80.7   | 73.7                              | 78.8   | 70.8               | 73.3   | 6640               | 75.6   |
| 2001 | 9825.8         | 1330.0         | 98.7   | 82.4   | 98.4                              | 80.6   | 84.3               | 74.3   | 8304               | 94.8   |
| 2002 | 7146.7         | 1330.0         | 67.2   | 81.1   | 66.9                              | 79.4   | 61.3               | 73.2   | 5948               | 67.9   |
| 2003 | 9290.8         | 1330.0         | 84.6   | 81.4   | 84.6                              | 79.8   | 79.7               | 73.7   | 7525               | 85.9   |
| 2004 | 10500.2        | 1330.0         | 98.9   | 82.6   | 98.6                              | 81.2   | 89.9               | 74.9   | 8733               | 99.4   |

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## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 173.0  | 60.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                        |
| 01 Feb | 696.0  | 3.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                   |
| 04 Mar | 226.0  | 32.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 14 Mar | 65.0   | 28.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |
| 03 Apr | 123.0  | 44.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 04 Apr | 263.0  | 1.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                   |
| 20 Apr | 68.0   | 31.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |
| 01 May | 26.0   | 7.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 03 May | 694.0  | 2.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                   |
| 08 Jun | 162.0  | 90.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 18 Jun | 12.0   | 10.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Jul | 178.0  | 46.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 03 Jul | 25.0   | 33.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN               |
| 13 Jul | 187.0  | 1.0     | UP2  | A32  | HIGH-PRESSURE HEATING  |
| 01 Aug | 15.0   | 20.0    | UF2  | A41  | STATOR BAR WATER COOLING CIRCUIT                               |
| 01 Aug | 5.0    | 5.0     | UP2  | A41  | STATOR BAR WATER COOLING CIRCUIT                               |
| 01 Aug | 144.0  | 51.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 11 Aug | 3013.0 | 21.0    | UP2  | A31  | MAIN CONDENSER   |
| 23 Sep | 5.0    | 7.0     | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                                 |
| 23 Sep | 5.0    | 4.0     | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                 |
| 29 Sep | 5.0    | 6.0     | UF2  | A12  | MISCELLANEOUS INDEPENDENT MEASUREMENTS                         |
| 13 Dec | 100.0  | 8.0     | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 22 Dec | 23.0   | 7.0     | UP2  | L    | HUMAN OPERATING ERRORS   |
| 22 Dec | 1.0    | 1.0     | UF2  | L    | HUMAN OPERATING ERRORS   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 25        |          |  | 312       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 833                                      | 2         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 258                                      |           |          |
| E. Testing of plant systems or components  | 25              |           |          | 27                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 5         |          |
| L. Human factor related  |                 | 1         |          |  |           |          |
| Subtotal   | 25              | 26        | 0        | 1118                                     | 322       | 0        |
| Total  |                 | 51        |          |  | 1440      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1990 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 51                                       |
| 12. Reactor I&C Systems                        | 5               | 10                                       |
| 13. Reactor Auxiliary Systems                  |                 | 26                                       |
| 14. Safety Systems                             |                 | 17                                       |
| 15. Reactor Cooling Systems                    |                 | 44                                       |
| 16. Steam generation systems                   |                 | 54                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 6  |
| 31. Turbine and auxiliaries                    | 5               | 18                                       |
| 32. Feedwater and Main Steam System            |                 | 14                                       |
| 33. Circulating Water System                   |                 | 3  |
| 41. Main Generator Systems                     | 15              | 36                                       |
| 42. Electrical Power Supply Systems            |                 | 1  |
| Total  | 25              | 280                                      |

# FR-64 PENLY-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1330.0 MW(e)  
**Design Net RUP:** 1330.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7225.8 GW(e).h  
**Energy Availability Factor:** 69.1%  
**Load Factor:** 61.9%  
**Operating Factor:** 70.9%  
**Energy Unavailability Factor:** 30.9%  
**Total Off-line Time:** 2553 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 877.7 | 331.2 | 0.0   | 0.0   | 45.5 | 836.9 | 865.5 | 843.8 | 866.0 | 930.4 | 770.5 | 858.3 | 7225.8 |
| <b>EAF (%)</b>  | 99.8  | 45.1  | 0.0   | 0.0   | 6.1  | 97.1  | 98.7  | 96.6  | 98.8  | 99.5  | 86.7  | 99.3  | 69.1   |
| <b>UCF (%)</b>  | 99.8  | 45.1  | 0.0   | 0.0   | 6.1  | 98.3  | 98.8  | 96.6  | 98.8  | 99.5  | 86.7  | 99.3  | 69.2   |
| <b>LF (%)</b>   | 88.7  | 35.8  | 0.0   | 0.0   | 4.6  | 87.4  | 87.5  | 85.3  | 90.4  | 93.9  | 80.5  | 86.7  | 61.9   |
| <b>OF (%)</b>   | 100.0 | 45.1  | 0.0   | 0.0   | 18.7 | 100.0 | 100.0 | 98.0  | 100.0 | 100.0 | 87.8  | 100.0 | 70.9   |
| <b>EUF (%)</b>  | 0.2   | 54.9  | 100.0 | 100.0 | 93.9 | 2.9   | 1.3   | 3.4   | 1.2   | 0.5   | 13.3  | 0.7   | 30.9   |
| <b>PUF (%)</b>  | 0.0   | 54.9  | 100.0 | 100.0 | 92.3 | 1.4   | 0.0   | 0.2   | 0.0   | 0.0   | 4.7   | 0.1   | 29.4   |
| <b>UCLF (%)</b> | 0.2   | 0.1   | 0.0   | 0.0   | 1.6  | 0.3   | 1.2   | 3.3   | 1.2   | 0.5   | 8.6   | 0.6   | 1.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 1.3   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1984  
**Date of First Criticality:** 10 Jan 1992  
**Date of Grid Connection:** 04 Feb 1992  
**Date of Commercial Operation:** 01 Nov 1992

**Lifetime Generation:** 110250.7 GW(e).h  
**Cumulative Energy Availability Factor:** 81.8%  
**Cumulative Load Factor:** 75.2%  
**Cumulative Unit Capability Factor:** 80.7%  
**Cumulative Energy Unavailability Factor:** 18.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1992 | 5149.8         | 1330.0         | 0.0  | 0.0    | 53.7                              | 100.0  | 44.1               | 0.0    | 4796               | 54.6   |
| 1993 | 8611.8         | 1330.0         | 75.2   | 75.2   | 74.4                              | 74.4   | 73.9               | 73.9   | 6658               | 76.0   |
| 1994 | 8759.7         | 1330.0         | 81.3   | 78.2   | 77.6                              | 76.0   | 75.2               | 74.6   | 7228               | 82.5   |
| 1995 | 8169.7         | 1330.0         | 74.0   | 76.8   | 73.8                              | 75.2   | 70.1               | 73.1   | 6574               | 75.0   |
| 1996 | 9758.0         | 1330.0         | 91.3   | 80.4   | 89.3                              | 78.8   | 83.5               | 75.7   | 8025               | 91.4   |
| 1997 | 8068.9         | 1330.0         | 84.3   | 81.2   | 82.9                              | 79.6   | 69.3               | 74.4   | 7186               | 82.0   |
| 1998 | 8877.5         | 1330.0         | 82.9   | 81.5   | 81.1                              | 79.8   | 76.2               | 74.7   | 7318               | 83.5   |
| 1999 | 8637.0         | 1330.0         | 81.3   | 81.5   | 79.4                              | 79.8   | 74.1               | 74.6   | 7203               | 82.2   |
| 2000 | 9584.5         | 1330.0         | 97.1   | 83.4   | 96.8                              | 81.9   | 82.0               | 75.6   | 8393               | 95.5   |
| 2001 | 8816.2         | 1330.0         | 82.1   | 83.3   | 80.2                              | 81.7   | 75.7               | 75.6   | 7333               | 83.7   |
| 2002 | 8464.3         | 1330.0         | 79.1   | 82.9   | 79.0                              | 81.5   | 72.6               | 75.3   | 6890               | 78.7   |
| 2003 | 10207.8        | 1330.0         | 97.7   | 84.2   | 97.6                              | 82.9   | 87.6               | 76.4   | 8603               | 98.2   |
| 2004 | 7225.8         | 1330.0         | 69.2   | 83.0   | 69.1                              | 81.8   | 61.9               | 75.2   | 6231               | 70.9   |

## FR-64 PENLY-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 729.0  | 2.0     | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 14 Feb | 2357.0 | 3134.0  | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                           |
| 24 May | 46.0   | 62.0    | PF   | C    | REFUELLING AND INSPECTION                                     |
| 26 May | 74.0   | 46.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 26 May | 47.0   | 62.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 29 May | 18.0   | 15.0    | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)      |
| 01 Jun | 132.0  | 13.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 06 Jun | 457.0  | 85.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 18 Jun | 14.0   | 11.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 22 Jun | 27.0   | 3.0     | UP2  | A32  | LOW-PRESSURE HEATING  |
| 01 Jul | 76.0   | 20.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 08 Jul | 554.0  | 11.0    | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 01 Aug | 15.0   | 20.0    | UF2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 01 Aug | 407.0  | 12.0    | UP2  | A31  | MOISTURE SEPARATOR-REHEATERS                                  |
| 15 Aug | 143.0  | 55.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 01 Sep | 1765.0 | 13.0    | UP2  | A31  | MAIN CONDENSER  |
| 09 Nov | 32.0   | 42.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 11 Nov | 254.0  | 4.0     | UP2  | A    | VIBRATION OF TURBOGENERATOR SET WITHOUT DAMAGE                |
| 21 Nov | 56.0   | 75.0    | UF2  | A42  | MAIN TRANSFORMER WITH FIRE PROTECTION                         |
| 01 Dec | 531.0  | 1.0     | UP2  | A31  | MAIN CONDENSER  |
| 03 Dec | 32.0   | 18.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 15 Dec | 64.0   | 5.0     | UP2  | A32  | LOW-PRESSURE HEATING  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1992 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 71        |          |  | 530       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 2403            |           |          | 721                                      |           |          |
| E. Testing of plant systems or components  | 79              |           |          | 59                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         |          |
| Z. Others  |                 |           |          |  | 0         |          |
| Subtotal   | 2482            | 71        | 0        | 780                                      | 537       | 0        |
| Total  |                 | 2553      |          |  | 1317      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1992 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 51                                       |
| 12. Reactor I&C Systems                  |                 | 28                                       |
| 13. Reactor Auxiliary Systems            |                 | 18                                       |
| 14. Safety Systems                       |                 | 6  |
| 15. Reactor Cooling Systems              |                 | 64                                       |
| 16. Steam generation systems             |                 | 17                                       |
| 21. Fuel Handling and Storage Facilities |                 | 1  |
| 31. Turbine and auxiliaries              | 15              | 42                                       |
| 32. Feedwater and Main Steam System      |                 | 18                                       |
| 33. Circulating Water System             |                 | 1  |
| 41. Main Generator Systems               |                 | 2  |
| 42. Electrical Power Supply Systems      | 56              | 239                                      |
| Total                                    | 71              | 487                                      |

# FR-48 ST. ALBAN-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1335.0 MW(e)  
**Design Net RUP:** 1335.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10127.4 GW(e).h  
**Energy Availability Factor:** 95.3%  
**Load Factor:** 86.4%  
**Operating Factor:** 94.3%  
**Energy Unavailability Factor:** 4.7%  
**Total Off-line Time:** 501 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 938.1 | 686.5 | 911.1 | 927.2 | 878.2 | 739.8 | 678.6 | 656.4 | 882.8 | 971.9 | 950.0 | 907.0 | 10127.4 |
| <b>EAF (%)</b>  | 97.4  | 75.3  | 93.2  | 98.8  | 97.9  | 95.7  | 98.1  | 98.7  | 97.4  | 99.3  | 99.3  | 91.3  | 95.3    |
| <b>UCF (%)</b>  | 97.4  | 75.3  | 93.2  | 99.8  | 99.9  | 99.8  | 98.8  | 98.7  | 97.4  | 99.3  | 99.8  | 99.0  | 96.6    |
| <b>LF (%)</b>   | 94.5  | 73.9  | 91.9  | 96.5  | 88.4  | 77.0  | 68.3  | 66.1  | 91.8  | 97.7  | 98.8  | 91.3  | 86.4    |
| <b>OF (%)</b>   | 98.3  | 77.0  | 96.9  | 100.0 | 100.0 | 100.0 | 86.0  | 73.8  | 99.2  | 100.0 | 100.0 | 100.0 | 94.3    |
| <b>EUF (%)</b>  | 2.6   | 24.7  | 6.8   | 1.2   | 2.1   | 4.3   | 1.9   | 1.3   | 2.6   | 0.7   | 0.7   | 8.7   | 4.7     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 2.6   | 24.7  | 6.7   | 0.1   | 0.1   | 0.2   | 1.2   | 1.3   | 2.6   | 0.7   | 0.2   | 1.1   | 3.4     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 1.0   | 2.1   | 4.1   | 0.8   | 0.0   | 0.0   | 0.0   | 0.4   | 7.6   | 1.3     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 29 Jan 1979  
**Date of First Criticality:** 04 Aug 1985  
**Date of Grid Connection:** 30 Aug 1985  
**Date of Commercial Operation:** 01 May 1986

**Lifetime Generation:** 146877.6 GW(e).h  
**Cumulative Energy Availability Factor:** 75.6%  
**Cumulative Load Factor:** 66.1%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 24.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 1290.3         | 1320.0         | 0.0  | 0.0    | 76.1                              | 100.0  | 12.1               | 0.0    | 1698               | 21.1   |
| 1986 | 6722.9         | 1300.0         | 0.0  | 0.0    | 69.1                              | 100.0  | 59.0               | 0.0    | 5449               | 62.2   |
| 1987 | 6101.6         | 1300.0         | 56.6   | 56.6   | 56.2                              | 56.2   | 53.6               | 53.6   | 4944               | 56.4   |
| 1988 | 4562.0         | 1335.0         | 83.4   | 70.2   | 82.4                              | 69.5   | 38.9               | 46.1   | 3721               | 42.4   |
| 1989 | 6781.3         | 1335.0         | 70.7   | 70.4   | 63.5                              | 67.5   | 58.0               | 50.1   | 5907               | 67.4   |
| 1990 | 7799.1         | 1335.0         | 70.4   | 70.4   | 68.6                              | 67.8   | 66.7               | 54.3   | 6295               | 71.9   |
| 1991 | 7935.3         | 1335.0         | 74.4   | 71.2   | 73.3                              | 68.9   | 67.9               | 57.0   | 6380               | 72.8   |
| 1992 | 4812.2         | 1335.0         | 42.1   | 66.3   | 42.1                              | 64.4   | 41.0               | 54.3   | 3775               | 43.0   |
| 1993 | 7376.0         | 1335.0         | 68.2   | 66.6   | 65.7                              | 64.6   | 63.1               | 55.6   | 6010               | 68.6   |
| 1994 | 7575.6         | 1335.0         | 94.5   | 70.1   | 93.8                              | 68.3   | 64.8               | 56.7   | 6777               | 77.4   |
| 1995 | 8535.7         | 1335.0         | 81.1   | 71.3   | 78.2                              | 69.4   | 73.0               | 58.5   | 7197               | 82.2   |
| 1996 | 8126.6         | 1335.0         | 83.7   | 72.5   | 83.1                              | 70.7   | 69.3               | 59.6   | 6950               | 79.1   |
| 1997 | 7112.8         | 1335.0         | 65.5   | 71.9   | 63.6                              | 70.1   | 60.8               | 59.7   | 5833               | 66.6   |
| 1998 | 8255.9         | 1335.0         | 90.6   | 73.5   | 89.9                              | 71.7   | 70.6               | 60.6   | 6802               | 77.6   |
| 1999 | 9240.6         | 1335.0         | 86.3   | 74.5   | 85.7                              | 72.8   | 79.0               | 62.1   | 7656               | 87.4   |
| 2000 | 8027.8         | 1335.0         | 72.2   | 74.3   | 71.4                              | 72.7   | 68.5               | 62.5   | 6494               | 73.9   |
| 2001 | 9298.5         | 1335.0         | 89.8   | 75.3   | 89.6                              | 73.8   | 79.5               | 63.7   | 7843               | 89.5   |
| 2002 | 8768.8         | 1335.0         | 81.0   | 75.7   | 79.6                              | 74.2   | 75.0               | 64.4   | 7275               | 83.0   |
| 2003 | 8691.9         | 1335.0         | 80.6   | 76.0   | 78.0                              | 74.4   | 74.3               | 64.9   | 7029               | 80.2   |
| 2004 | 10127.4        | 1335.0         | 96.6   | 77.1   | 95.3                              | 75.6   | 86.4               | 66.1   | 8283               | 94.3   |

## FR-48 ST. ALBAN-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 161.0  | 10.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX  |
| 03 Jan | 318.0  | 3.0     | UP2  | A12  | REACTOR CONTROL   |
| 06 Jan | 14.0   | 18.0    | UF2  | Z    | MALFUNCTION OF REGULATION, CONTROL AND PROTECTION SYSTEM  |
| 01 Feb | 49.0   | 5.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX  |
| 02 Feb | 145.0  | 194.0   | UF2  | A31  | MAIN CONDENSER  |
| 02 Feb | 302.0  | 14.0    | UP2  | A31  | MAIN CONDENSER  |
| 27 Feb | 14.0   | 19.0    | UF2  | L    | HUMAN ERROR DURING MAINTENANCE                            |
| 01 Mar | 23.0   | 31.0    | UF2  | A31  | MAIN CONDENSER  |
| 01 Mar | 281.0  | 33.0    | UP2  | A31  | MAIN CONDENSER  |
| 07 Mar | 47.0   | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX   |
| 08 Mar | 333.0  | 3.0     | UP2  | A12  | REACTOR CONTROL   |
| 01 Apr | 163.0  | 1.0     | UP2  | A12  | REACTOR CONTROL   |
| 01 Apr | 146.0  | 17.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX  |
| 02 May | 175.0  | 64.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                   |
| 01 Jun | 182.0  | 177.0   | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX   |
| 02 Jun | 119.0  | 2.0     | UP2  | A12  | REACTOR CONTROL   |
| 14 Jun | 46.0   | 38.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION   |
| 01 Jul | 61.0   | 57.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES |
| 01 Jul | 81.0   | 2.0     | UP2  | A12  | REACTOR CONTROL   |
| 13 Jul | 2539.0 | 43.0    | UP2  | A31  | MAIN CONDENSER  |
| 16 Nov | 91.0   | 2.0     | UP2  | Z    | MALFUNCTION OF REGULATION, PROTECTION AND CONTROL SYSTEMS |
| 25 Nov | 843.0  | 80.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                        |
| 25 Dec | 27.0   | 10.0    | UP2  | Z    | MALFUNCTION OF REGULATION, CONTROL AND PROTECTION SYSTEM  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 168       |          |  | 671       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 995                                      | 11        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 81                                       | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 34                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 45        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 35        | 1        |
| L. Human factor related  |                 | 14        |          |  |           |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 5        |
| Z. Others  |                 | 14        |          |  |           |          |
| Subtotal   | 0               | 196       | 0        | 1110                                     | 766       | 6        |
| Total  |                 | 196       |          |  | 1882      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 62                                       |
| 12. Reactor I&C Systems                  |                 | 19                                       |
| 13. Reactor Auxiliary Systems            |                 | 14                                       |
| 14. Safety Systems                       |                 | 14                                       |
| 15. Reactor Cooling Systems              |                 | 142                                      |
| 16. Steam generation systems             |                 | 6  |
| 21. Fuel Handling and Storage Facilities |                 | 7  |
| 31. Turbine and auxiliaries              | 168             | 122                                      |
| 32. Feedwater and Main Steam System      |                 | 47                                       |
| 33. Circulating Water System             |                 | 3  |
| 35. All other I&C Systems                |                 | 1  |
| 41. Main Generator Systems               |                 | 103                                      |
| 42. Electrical Power Supply Systems      |                 | 74                                       |
| XX. Miscellaneous Systems                |                 | 7  |
| Total                                    | 168             | 621                                      |

# FR-49 ST. ALBAN-2

Operator: EDF (ELECTRICITE DE FRANCE)  
 Contractor: FRAM (FRAMATOME)

## 1. Station Details

Type: PWR  
 Net Reference Unit Power at the beginning of 2004: 1335.0 MW(e)  
 Design Net RUP: 1335.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

## 2. Production Summary 2004

Energy Production: 10476.5 GW(e).h  
 Energy Availability Factor: 97.7%  
 Load Factor: 89.3%  
 Operating Factor: 99.1%  
 Energy Unavailability Factor: 2.3%  
 Total Off-line Time: 75 hours

## 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| GW(e).h  | 863.3 | 879.9 | 921.9 | 817.6 | 863.0 | 782.0 | 842.2 | 847.8 | 797.4 | 953.3 | 937.4 | 970.7 | 10476.5 |
| EAF (%)  | 99.8  | 99.9  | 99.3  | 92.7  | 95.9  | 94.7  | 99.3  | 99.5  | 93.5  | 99.3  | 99.4  | 99.3  | 97.7    |
| UCF (%)  | 99.8  | 99.9  | 99.4  | 92.8  | 96.0  | 94.7  | 99.3  | 99.5  | 93.5  | 99.3  | 99.8  | 99.3  | 97.8    |
| LF (%)   | 86.9  | 94.7  | 92.9  | 85.1  | 86.9  | 81.4  | 84.8  | 85.4  | 83.0  | 95.8  | 97.5  | 97.7  | 89.3    |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 97.7  | 97.4  | 100.0 | 100.0 | 94.6  | 100.0 | 100.0 | 100.0 | 99.1    |
| EUF (%)  | 0.2   | 0.1   | 0.7   | 7.3   | 4.1   | 5.3   | 0.7   | 0.5   | 6.5   | 0.7   | 0.6   | 0.7   | 2.3     |
| PUF (%)  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.7   | 0.0   | 0.0   | 0.0   | 0.5     |
| UCLF (%) | 0.2   | 0.0   | 0.6   | 7.2   | 4.0   | 5.3   | 0.7   | 0.5   | 0.8   | 0.6   | 0.2   | 0.7   | 1.7     |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

Date of Construction Start: 31 Jul 1979  
 Date of First Criticality: 07 Jun 1986  
 Date of Grid Connection: 03 Jul 1986  
 Date of Commercial Operation: 01 Mar 1987  
 Lifetime Generation: 137781.1 GW(e).h  
 Cumulative Energy Availability Factor: 74.2%  
 Cumulative Load Factor: 65.3%  
 Cumulative Unit Capability Factor: 78.6%  
 Cumulative Energy Unavailability Factor: 25.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 1084.6         | 1317.0         | 0.0  | 0.0    | 60.4                              | 100.0  | 9.5                | 0.0    | 1485               | 17.1   |
| 1987 | 6952.2         | 1300.0         | 0.0  | 0.0    | 77.6                              | 100.0  | 61.0               | 0.0    | 6094               | 69.6   |
| 1988 | 5185.0         | 1335.0         | 47.3   | 47.3   | 46.5                              | 46.5   | 44.2               | 44.2   | 4308               | 49.0   |
| 1989 | 6126.5         | 1335.0         | 57.5   | 52.4   | 56.2                              | 51.3   | 52.4               | 48.3   | 4806               | 54.9   |
| 1990 | 6070.6         | 1335.0         | 60.3   | 55.0   | 56.5                              | 53.1   | 51.9               | 49.5   | 5146               | 58.7   |
| 1991 | 7962.6         | 1335.0         | 73.3   | 59.6   | 71.1                              | 57.6   | 68.1               | 54.1   | 6484               | 74.0   |
| 1992 | 6375.1         | 1335.0         | 64.3   | 60.5   | 62.3                              | 58.5   | 54.4               | 54.2   | 5405               | 61.5   |
| 1993 | 6433.1         | 1335.0         | 90.9   | 65.6   | 83.1                              | 62.6   | 55.0               | 54.3   | 6121               | 69.9   |
| 1994 | 7125.8         | 1335.0         | 74.9   | 66.9   | 73.0                              | 64.1   | 60.9               | 55.3   | 6074               | 69.3   |
| 1995 | 7751.4         | 1335.0         | 76.1   | 68.0   | 72.7                              | 65.2   | 66.3               | 56.6   | 6763               | 77.2   |
| 1996 | 8344.6         | 1335.0         | 81.5   | 69.5   | 79.7                              | 66.8   | 71.2               | 58.3   | 7247               | 82.5   |
| 1997 | 8049.7         | 1335.0         | 92.3   | 71.8   | 91.8                              | 69.3   | 68.8               | 59.3   | 7072               | 80.7   |
| 1998 | 6555.7         | 1335.0         | 66.7   | 71.4   | 63.2                              | 68.7   | 56.1               | 59.0   | 5654               | 64.5   |
| 1999 | 8607.0         | 1335.0         | 80.3   | 72.1   | 79.3                              | 69.6   | 73.6               | 60.2   | 7188               | 82.1   |
| 2000 | 8729.6         | 1335.0         | 86.5   | 73.2   | 79.0                              | 70.3   | 74.4               | 61.3   | 7202               | 82.0   |
| 2001 | 8654.8         | 1335.0         | 91.4   | 74.5   | 91.3                              | 71.8   | 74.0               | 62.2   | 7657               | 87.4   |
| 2002 | 8290.6         | 1335.0         | 77.3   | 74.7   | 75.2                              | 72.1   | 70.9               | 62.8   | 6950               | 79.3   |
| 2003 | 9254.8         | 1335.0         | 87.8   | 75.5   | 83.0                              | 72.7   | 79.1               | 63.8   | 7558               | 86.3   |
| 2004 | 10476.5        | 1335.0         | 97.8   | 76.8   | 97.7                              | 74.2   | 89.3               | 65.3   | 8709               | 99.1   |



## FR-49 ST. ALBAN-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 313.0  | 108.0   | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                       |
| 05 Jan | 46.0   | 3.0     | UP2  | A12  | REACTOR CONTROL   |
| 11 Jan | 55.0   | 15.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 01 Feb | 227.0  | 49.0    | XP   | K    | LOAD VARIATION AT REQUEST OF DISPATCHER                       |
| 01 Mar | 155.0  | 26.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 14 Mar | 65.0   | 24.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 17 Mar | 5.0    | 5.0     | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT    |
| 01 Apr | 182.0  | 52.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX       |
| 07 Apr | 128.0  | 67.0    | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)      |
| 01 May | 265.0  | 1.0     | UP2  | A31  | MAIN CONDENSER  |
| 06 May | 136.0  | 27.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 26 May | 746.0  | 5.0     | UP2  | A31  | VARIOUS CONDENSERS  |
| 30 May | 17.0   | 23.0    | UF2  | A31  | VACUUM CIRCUIT  |
| 31 May | 38.0   | 25.0    | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)      |
| 01 Jun | 19.0   | 25.0    | UF2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)      |
| 03 Jun | 11.0   | 11.0    | UP2  | A    | CONTROL AND ISOLATING VALVES                                  |
| 01 Jul | 2056.0 | 16.0    | UP2  | A31  | MAIN CONDENSER  |
| 02 Jul | 10.0   | 1.0     | UP2  | A13  | CHEMICAL AND VOLUME CONTROL SYSTEM WITHOUT PUMP               |
| 04 Sep | 39.0   | 52.0    | PF   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 07 Sep | 93.0   | 2.0     | UP2  | A12  | REACTOR CONTROL   |
| 01 Oct | 716.0  | 6.0     | UP2  | A31  | MAIN CONDENSER  |
| 14 Nov | 33.0   | 9.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX      |
| 02 Dec | 104.0  | 13.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 28 Dec | 70.0   | 5.0     | UP2  | A32  | HIGH-PRESSURE HEATING   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 36        |          |  | 757       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 940                                      | 32        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 102                                      |           |          |
| E. Testing of plant systems or components  | 39              |           |          | 68                                       | 2         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 15        | 34       |
| L. Human factor related  |                 |           |          |  | 0         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 8        |
| Subtotal   | 39              | 36        | 0        | 1110                                     | 812       | 42       |
| Total  |                 | 75        |          |  | 1964      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 56                                       |
| 12. Reactor I&C Systems                  |                 | 65                                       |
| 13. Reactor Auxiliary Systems            |                 | 16                                       |
| 14. Safety Systems                       |                 | 5  |
| 15. Reactor Cooling Systems              |                 | 64                                       |
| 16. Steam generation systems             |                 | 129                                      |
| 21. Fuel Handling and Storage Facilities |                 | 0  |
| 31. Turbine and auxiliaries              | 17              | 143                                      |
| 32. Feedwater and Main Steam System      | 19              | 50                                       |
| 33. Circulating Water System             |                 | 1  |
| 35. All other I&C Systems                |                 | 0  |
| 41. Main Generator Systems               |                 | 131                                      |
| 42. Electrical Power Supply Systems      |                 | 17                                       |
| XX. Miscellaneous Systems                |                 | 3  |
| Total                                    | 36              | 680                                      |

# FR-17 ST. LAURENT-B-1

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 915.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6364.2 GW(e).h  
**Energy Availability Factor:** 80.4%  
**Load Factor:** 79.2%  
**Operating Factor:** 83.7%  
**Energy Unavailability Factor:** 19.6%  
**Total Off-line Time:** 1428 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 658.2 | 620.5 | 665.2 | 595.1 | 250.5 | 0.0   | 325.7 | 652.2 | 637.6 | 648.2 | 645.6 | 665.3 | 6364.2 |
| <b>EAF (%)</b>  | 96.7  | 97.4  | 97.9  | 90.3  | 37.4  | 0.0   | 50.8  | 99.9  | 99.9  | 97.6  | 99.0  | 98.1  | 80.4   |
| <b>UCF (%)</b>  | 99.8  | 99.1  | 99.9  | 99.9  | 45.1  | 0.0   | 50.8  | 99.9  | 99.9  | 97.6  | 99.0  | 98.1  | 82.4   |
| <b>LF (%)</b>   | 96.7  | 97.4  | 97.8  | 90.3  | 36.8  | 0.0   | 47.8  | 95.8  | 96.8  | 95.1  | 98.0  | 97.7  | 79.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 45.4  | 0.0   | 60.8  | 100.0 | 100.0 | 98.7  | 100.0 | 100.0 | 83.7   |
| <b>EUF (%)</b>  | 3.3   | 2.6   | 2.1   | 9.7   | 62.6  | 100.0 | 49.2  | 0.1   | 0.1   | 2.4   | 1.0   | 1.9   | 19.6   |
| <b>PUF (%)</b>  | 0.1   | 0.2   | 0.1   | 0.1   | 54.9  | 100.0 | 44.5  | 0.1   | 0.1   | 0.2   | 0.1   | 0.1   | 16.7   |
| <b>UCLF (%)</b> | 0.1   | 0.7   | 0.1   | 0.0   | 0.0   | 0.0   | 4.7   | 0.0   | 0.0   | 2.2   | 0.9   | 1.9   | 0.9    |
| <b>XUF (%)</b>  | 3.1   | 1.7   | 2.0   | 9.5   | 7.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1976  
**Date of First Criticality:** 04 Jan 1981  
**Date of Grid Connection:** 21 Jan 1981  
**Date of Commercial Operation:** 01 Aug 1983

**Lifetime Generation:** 123078.2 GW(e).h  
**Cumulative Energy Availability Factor:** 75.1%  
**Cumulative Load Factor:** 70.8%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 24.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3670.0         | 880.0          | 0.0  | 0.0    | 48.0                              | 100.0  | 47.6               | 0.0    | 4382               | 50.0   |
| 1984 | 4401.0         | 880.0          | 56.0   | 56.0   | 56.0                              | 56.0   | 56.9               | 56.9   | 5042               | 57.4   |
| 1985 | 5630.4         | 880.0          | 76.1   | 66.0   | 75.0                              | 65.5   | 73.0               | 65.0   | 6827               | 77.9   |
| 1986 | 5476.4         | 880.0          | 79.8   | 70.6   | 79.7                              | 70.2   | 71.0               | 67.0   | 7144               | 81.6   |
| 1987 | 5171.3         | 880.0          | 76.8   | 72.2   | 76.1                              | 71.7   | 67.1               | 67.0   | 6667               | 76.1   |
| 1988 | 5721.0         | 915.0          | 76.3   | 73.0   | 75.9                              | 72.6   | 71.2               | 67.9   | 6464               | 73.6   |
| 1989 | 6609.8         | 915.0          | 85.4   | 75.1   | 82.7                              | 74.3   | 82.5               | 70.4   | 7699               | 87.9   |
| 1990 | 6113.7         | 915.0          | 86.3   | 76.8   | 84.1                              | 75.7   | 76.3               | 71.2   | 7089               | 80.9   |
| 1991 | 4005.4         | 915.0          | 53.6   | 73.8   | 52.3                              | 72.7   | 50.0               | 68.5   | 4736               | 54.1   |
| 1992 | 5621.1         | 915.0          | 75.4   | 74.0   | 74.0                              | 72.9   | 69.9               | 68.7   | 6690               | 76.2   |
| 1993 | 5668.5         | 915.0          | 75.3   | 74.1   | 72.4                              | 72.8   | 70.7               | 68.9   | 6821               | 77.9   |
| 1994 | 6095.7         | 915.0          | 87.0   | 75.3   | 85.1                              | 74.0   | 76.1               | 69.6   | 7252               | 82.8   |
| 1995 | 4443.0         | 915.0          | 64.3   | 74.4   | 60.3                              | 72.8   | 55.4               | 68.4   | 5211               | 59.5   |
| 1996 | 5541.1         | 915.0          | 79.1   | 74.8   | 78.8                              | 73.3   | 68.9               | 68.4   | 6888               | 78.4   |
| 1997 | 5132.6         | 915.0          | 76.2   | 74.8   | 75.4                              | 73.4   | 64.0               | 68.1   | 6404               | 73.1   |
| 1998 | 6030.7         | 915.0          | 84.6   | 75.5   | 82.1                              | 74.0   | 75.2               | 68.6   | 7366               | 84.1   |
| 1999 | 5062.6         | 915.0          | 69.7   | 75.1   | 67.9                              | 73.6   | 63.2               | 68.2   | 6207               | 70.9   |
| 2000 | 5086.7         | 915.0          | 66.4   | 74.6   | 66.0                              | 73.2   | 63.3               | 67.9   | 5957               | 67.8   |
| 2001 | 6814.8         | 915.0          | 86.8   | 75.3   | 86.4                              | 73.9   | 85.0               | 68.9   | 7735               | 88.3   |
| 2002 | 6637.0         | 890.0          | 85.2   | 75.8   | 82.9                              | 74.4   | 85.1               | 69.7   | 7592               | 86.7   |
| 2003 | 6630.4         | 915.0          | 86.5   | 76.3   | 82.8                              | 74.8   | 82.7               | 70.4   | 7658               | 87.4   |
| 2004 | 6364.2         | 915.0          | 82.4   | 76.7   | 80.4                              | 75.1   | 79.2               | 70.8   | 7356               | 83.7   |

# FR-17 ST. LAURENT-B-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1900.0 | 35.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 20 Jan | 21.0   | 7.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION       |
| 01 Feb | 18.0   | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 11 Feb | 8.0    | 4.0     | UP2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT    |
| 24 Mar | 1204.0 | 119.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 02 May | 8.0    | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 15 May | 1393.0 | 1273.0  | PF   | C    | REFUELLING AND PARTIAL INSPECTION                             |
| 12 Jul | 97.0   | 39.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 12 Jul | 11.0   | 10.0    | PF   | E    | START-UP TESTS AFTER REFUELLING                               |
| 13 Jul | 5.0    | 5.0     | UF2  | A41  | EXCITER AND GENERATOR INSTRUMENTATION AND CONTROL             |
| 17 Jul | 9.0    | 8.0     | UF2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 17 Jul | 32.0   | 12.0    | UP2  | A31  | CONTROL AND PROTECTION SYSTEMS                                |
| 19 Jul | 277.0  | 11.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 21 Jul | 24.0   | 2.0     | UP2  | A12  | INSTRUMENTATION AND CONTROL OF PRIMARY CIRCUIT (INCLUDING SG) |
| 26 Jul | 3.0    | 1.0     | UP2  | A12  | REACTOR CONTROL   |
| 28 Jul | 7.0    | 3.0     | UP2  | A32  | FEEDWATER PUMP (EXCLUDING TURBINE-DRIVEN FEEDWATER PUMP)      |
| 01 Aug | 2785.0 | 72.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |
| 04 Oct | 10.0   | 9.0     | UF2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)       |
| 04 Oct | 3.0    | 2.0     | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)       |
| 10 Oct | 5.0    | 2.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 17 Oct | 7.0    | 4.0     | UP2  | A32  | FAULING OF EQUIPMENT, CLEANING FILTERS                        |
| 28 Nov | 40.0   | 19.0    | UP2  | A31  | MAIN CONDENSER  |
| 02 Dec | 460.0  | 3.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER    |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 14        |          |  | 556       |          |
| B. Refuelling without a maintenance  |                 |           |          | 40                                       | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1393            |           |          | 1144                                     | 23        |          |
| E. Testing of plant systems or components  | 11              |           |          | 11                                       | 2         | 0        |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 425       | 18       |
| R. External restrictions on supply and services (lack of funds due to delayed payments from customers, disputes in fuel industries, fuel-rationing, labour strike outside the plant , spare part delivery problems etc.) |                 |           |          |  | 2         |          |
| Z. Others  |                 | 10        |          |  |           |          |
| Subtotal   | 1404            | 24        | 0        | 1195                                     | 1013      | 18       |
| Total  |                 | 1428      |          |  | 2226      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 13                                       |
| 12. Reactor I&C Systems                  |                 | 45                                       |
| 13. Reactor Auxiliary Systems            |                 | 14                                       |
| 14. Safety Systems                       |                 | 41                                       |
| 15. Reactor Cooling Systems              |                 | 12                                       |
| 16. Steam generation systems             |                 | 93                                       |
| 21. Fuel Handling and Storage Facilities |                 | 1  |
| 31. Turbine and auxiliaries              | 9               | 54                                       |
| 32. Feedwater and Main Steam System      |                 | 17                                       |
| 33. Circulating Water System             |                 | 3  |
| 41. Main Generator Systems               | 5               | 188                                      |
| 42. Electrical Power Supply Systems      |                 | 13                                       |
| XX. Miscellaneous Systems                |                 | 15                                       |
| Total                                    | 14              | 509                                      |

# FR-23 ST. LAURENT-B-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 880.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6468.6 GW(e).h  
**Energy Availability Factor:** 85.6%  
**Load Factor:** 80.5%  
**Operating Factor:** 89.2%  
**Energy Unavailability Factor:** 14.4%  
**Total Off-line Time:** 946 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 529.0 | 599.6 | 559.7 | 549.6 | 505.0 | 549.0 | 607.7 | 613.8 | 650.5 | 639.1 | 665.5 | 6468.6 |
| <b>EAF (%)</b>  | 0.0   | 83.3  | 90.4  | 94.9  | 89.4  | 87.4  | 87.4  | 98.2  | 99.9  | 99.6  | 99.9  | 98.4  | 85.6   |
| <b>UCF (%)</b>  | 0.0   | 84.5  | 91.7  | 97.5  | 93.2  | 99.4  | 88.6  | 98.4  | 99.9  | 99.7  | 99.9  | 100.0 | 87.6   |
| <b>LF (%)</b>   | 0.0   | 83.1  | 88.2  | 85.0  | 80.7  | 76.7  | 80.6  | 89.3  | 93.2  | 95.4  | 97.0  | 97.8  | 80.5   |
| <b>OF (%)</b>   | 0.0   | 95.4  | 93.7  | 100.0 | 94.2  | 100.0 | 89.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.2   |
| <b>EUF (%)</b>  | 100.0 | 16.7  | 9.6   | 5.1   | 10.6  | 12.6  | 12.6  | 1.8   | 0.1   | 0.4   | 0.1   | 1.6   | 14.4   |
| <b>PUF (%)</b>  | 71.0  | 10.4  | 0.5   | 0.2   | 0.5   | 0.1   | 0.0   | 0.1   | 0.1   | 0.4   | 0.1   | 0.1   | 7.0    |
| <b>UCLF (%)</b> | 29.0  | 5.1   | 7.8   | 2.3   | 6.4   | 0.5   | 11.4  | 1.5   | 0.0   | 0.0   | 0.0   | 0.0   | 5.4    |
| <b>XUF (%)</b>  | 0.0   | 1.2   | 1.3   | 2.7   | 3.8   | 12.0  | 1.2   | 0.3   | 0.0   | 0.0   | 0.0   | 1.6   | 2.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1976  
**Date of First Criticality:** 12 May 1981  
**Date of Grid Connection:** 01 Jun 1981  
**Date of Commercial Operation:** 01 Aug 1983

**Lifetime Generation:** 123991.0 GW(e).h  
**Cumulative Energy Availability Factor:** 77.0%  
**Cumulative Load Factor:** 71.0%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 23.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4123.0         | 880.0          | 0.0  | 0.0    | 53.8                              | 100.0  | 53.5               | 0.0    | 4839               | 55.2   |
| 1984 | 5724.0         | 880.0          | 88.9   | 88.9   | 88.9                              | 88.9   | 74.0               | 74.0   | 7237               | 82.4   |
| 1985 | 5295.6         | 880.0          | 77.5   | 83.2   | 75.7                              | 82.3   | 68.7               | 71.4   | 6806               | 77.7   |
| 1986 | 5662.8         | 880.0          | 81.7   | 82.7   | 79.8                              | 81.5   | 73.5               | 72.1   | 7337               | 83.8   |
| 1987 | 5060.2         | 880.0          | 79.9   | 82.0   | 79.4                              | 80.9   | 65.6               | 70.5   | 6798               | 77.6   |
| 1988 | 5108.0         | 880.0          | 69.6   | 79.5   | 69.6                              | 78.7   | 66.1               | 69.6   | 6262               | 71.3   |
| 1989 | 5034.0         | 880.0          | 81.4   | 79.8   | 75.9                              | 78.2   | 65.3               | 68.9   | 6490               | 74.1   |
| 1990 | 5165.9         | 915.0          | 73.8   | 78.9   | 71.3                              | 77.2   | 64.4               | 68.2   | 6212               | 70.9   |
| 1991 | 6043.0         | 915.0          | 86.1   | 79.9   | 84.2                              | 78.1   | 75.4               | 69.1   | 7374               | 84.2   |
| 1992 | 5490.1         | 915.0          | 80.6   | 80.0   | 79.4                              | 78.2   | 68.3               | 69.0   | 6982               | 79.5   |
| 1993 | 5042.2         | 915.0          | 68.7   | 78.8   | 64.1                              | 76.8   | 62.9               | 68.4   | 6149               | 70.2   |
| 1994 | 6322.7         | 915.0          | 83.7   | 79.3   | 81.2                              | 77.2   | 78.9               | 69.4   | 7406               | 84.5   |
| 1995 | 5311.3         | 915.0          | 72.9   | 78.7   | 72.1                              | 76.8   | 66.3               | 69.1   | 6720               | 76.7   |
| 1996 | 6057.7         | 915.0          | 82.2   | 79.0   | 80.8                              | 77.1   | 75.4               | 69.6   | 7303               | 83.1   |
| 1997 | 5960.7         | 915.0          | 80.8   | 79.1   | 78.1                              | 77.2   | 74.4               | 70.0   | 7147               | 81.6   |
| 1998 | 6415.3         | 915.0          | 85.7   | 79.6   | 83.2                              | 77.6   | 80.0               | 70.6   | 7585               | 86.6   |
| 1999 | 5845.9         | 915.0          | 79.0   | 79.5   | 77.3                              | 77.6   | 72.9               | 70.8   | 7013               | 80.1   |
| 2000 | 5134.0         | 915.0          | 67.6   | 78.8   | 67.0                              | 76.9   | 63.9               | 70.4   | 6069               | 69.1   |
| 2001 | 6046.7         | 915.0          | 81.7   | 79.0   | 80.1                              | 77.1   | 75.4               | 70.7   | 7226               | 82.5   |
| 2002 | 6215.0         | 890.0          | 82.2   | 79.2   | 82.2                              | 77.4   | 79.7               | 71.1   | 7434               | 84.9   |
| 2003 | 4702.4         | 915.0          | 61.6   | 78.3   | 61.6                              | 76.6   | 58.7               | 70.5   | 5580               | 63.7   |
| 2004 | 6468.6         | 915.0          | 87.6   | 78.7   | 85.6                              | 77.0   | 80.5               | 71.0   | 7838               | 89.2   |

## FR-23 ST. LAURENT-B-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 527.0 | 483.0   | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                            |
| 23 Jan | 24.0  | 22.0    | UF2  | A41  | STATIC EXCITATION SYSTEM                                       |
| 24 Jan | 48.0  | 44.0    | UF2  | A34  | VARIOUS DAMP AUXILIARIES                                       |
| 01 Feb | 138.0 | 62.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 06 Feb | 915.0 | 17.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 16 Feb | 21.0  | 20.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 17 Feb | 10.0  | 9.0     | UF2  | A41  | GENERATOR ELECTRICAL PROTECTION                                |
| 02 Mar | 94.0  | 10.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 06 Mar | 35.0  | 32.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 09 Mar | 67.0  | 1.0     | UP2  | A12  | REACTOR CONTROL  |
| 22 Mar | 81.0  | 4.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCOMAX       |
| 28 Mar | 12.0  | 11.0    | UF2  | K    | MALFUNCTION OF REGULATION, CONTROL AND PROTECTION SYSTEM       |
| 01 Apr | 215.0 | 69.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 04 Apr | 17.0  | 9.0     | UP2  | A31  | MAIN CONDENSER   |
| 01 May | 188.0 | 19.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 May | 292.0 | 9.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 02 May | 121.0 | 36.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCOMAX       |
| 13 May | 43.0  | 39.0    | UF2  | A12  | CONTROL ROD ASSEMBLIES AND DRIVE MECHANISMS                    |
| 26 May | 25.0  | 16.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Jun | 167.0 | 70.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Jun | 159.0 | 7.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 14 Jun | 134.0 | 73.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Jul | 203.0 | 8.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Jul | 168.0 | 41.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCOMAX |
| 19 Jul | 77.0  | 70.0    | UF2  | A42  | ELECTRICAL PROTECTION SYSTEMS                                  |
| 01 Aug | 379.0 | 53.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Sep | 450.0 | 43.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Oct | 585.0 | 29.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Nov | 677.0 | 19.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Dec | 223.0 | 3.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 11 Dec | 478.0 | 11.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 258       |          |  | 656       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 527             |           |          | 1062                                     | 17        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 7  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 9  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 15        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 | 12        |          |  | 155       |          |
| Subtotal   | 527             | 270       | 0        | 1078                                     | 853       | 0        |
| Total  |                 | 797       |          |  | 1931      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 16                                       |
| 12. Reactor I&C Systems                  | 99              | 16                                       |
| 13. Reactor Auxiliary Systems            |                 | 12                                       |
| 14. Safety Systems                       |                 | 53                                       |
| 15. Reactor Cooling Systems              |                 | 56                                       |
| 16. Steam generation systems             |                 | 43                                       |
| 21. Fuel Handling and Storage Facilities |                 | 3  |
| 31. Turbine and auxiliaries              |                 | 261                                      |
| 32. Feedwater and Main Steam System      |                 | 15                                       |
| 41. Main Generator Systems               | 34              | 72                                       |
| 42. Electrical Power Supply Systems      | 77              | 25                                       |
| XX. Miscellaneous Systems                | 48              |  |
| Total                                    | 258             | 572                                      |

**FR-18 TRICASTIN-1**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 915.0 MW(e)  
 Design Net RUP: 915.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6832.5 GW(e).h  
 Energy Availability Factor: 89.0%  
 Load Factor: 85.0%  
 Operating Factor: 91.6%  
 Energy Unavailability Factor: 11.0%  
 Total Off-line Time: 735 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 660.9 | 624.1 | 657.5 | 315.9 | 310.6 | 603.0 | 598.5 | 556.2 | 606.9 | 649.6 | 623.8 | 625.8 | 6832.5 |
| EAF (%)  | 98.4  | 99.0  | 98.1  | 50.5  | 46.5  | 95.4  | 96.3  | 89.3  | 98.1  | 97.1  | 99.5  | 100.0 | 89.0   |
| UCF (%)  | 99.2  | 99.0  | 99.8  | 53.5  | 47.6  | 99.7  | 100.0 | 99.9  | 99.9  | 100.0 | 99.9  | 100.0 | 91.5   |
| LF (%)   | 97.1  | 98.0  | 96.7  | 47.9  | 45.6  | 91.5  | 87.9  | 81.7  | 92.1  | 95.3  | 94.7  | 91.9  | 85.0   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 53.6  | 52.8  | 100.0 | 100.0 | 96.5  | 100.0 | 100.0 | 100.0 | 96.8  | 91.6   |
| EUF (%)  | 1.6   | 1.0   | 1.9   | 49.5  | 53.5  | 4.6   | 3.7   | 10.7  | 1.9   | 2.9   | 0.5   | 0.0   | 11.0   |
| PUF (%)  | 0.0   | 0.1   | 0.0   | 46.5  | 52.4  | 0.3   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 8.3    |
| UCLF (%) | 0.8   | 0.9   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.2    |
| XUF (%)  | 0.8   | 0.0   | 1.7   | 3.0   | 1.1   | 4.3   | 3.7   | 10.6  | 1.8   | 2.9   | 0.4   | 0.0   | 2.5    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Nov 1974      Lifetime Generation: 140745.0 GW(e).h  
 Date of First Criticality: 21 Feb 1980      Cumulative Energy Availability Factor: 76.3%  
 Date of Grid Connection: 31 May 1980      Cumulative Load Factor: 71.9%  
 Date of Commercial Operation: 01 Dec 1980      Cumulative Unit Capability Factor: 77.7%  
    Cumulative Energy Unavailability Factor: 23.7%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 5111.0            | 915.0             | 68.8   | 71.8   | 67.2                                 | 68.5   | 63.8               | 64.1   | 6097                  | 69.6   |
| 1984 | 6468.0            | 915.0             | 86.7   | 75.5   | 86.7                                 | 73.0   | 80.5               | 68.2   | 7662                  | 87.2   |
| 1985 | 6217.9            | 915.0             | 86.0   | 77.6   | 81.6                                 | 74.7   | 77.6               | 70.1   | 7560                  | 86.3   |
| 1986 | 5880.3            | 915.0             | 79.4   | 77.9   | 77.0                                 | 75.1   | 73.4               | 70.6   | 7188                  | 82.1   |
| 1987 | 5978.1            | 915.0             | 83.5   | 78.7   | 78.2                                 | 75.6   | 74.6               | 71.2   | 7360                  | 84.0   |
| 1988 | 5836.0            | 915.0             | 79.8   | 78.8   | 76.7                                 | 75.7   | 72.6               | 71.4   | 7200                  | 82.0   |
| 1989 | 5830.2            | 915.0             | 83.3   | 79.3   | 83.2                                 | 76.5   | 72.7               | 71.5   | 7550                  | 86.2   |
| 1990 | 5099.7            | 915.0             | 68.8   | 78.3   | 65.1                                 | 75.4   | 63.6               | 70.7   | 6377                  | 72.8   |
| 1991 | 5909.1            | 915.0             | 83.2   | 78.7   | 77.0                                 | 75.5   | 73.7               | 71.0   | 7262                  | 82.9   |
| 1992 | 5659.3            | 915.0             | 85.3   | 79.3   | 83.0                                 | 76.2   | 70.4               | 70.9   | 7573                  | 86.2   |
| 1993 | 6134.8            | 915.0             | 83.9   | 79.6   | 77.7                                 | 76.3   | 76.5               | 71.4   | 7393                  | 84.4   |
| 1994 | 5008.4            | 915.0             | 75.4   | 79.3   | 70.3                                 | 75.8   | 62.5               | 70.7   | 6458                  | 73.7   |
| 1995 | 5372.7            | 915.0             | 71.3   | 78.8   | 70.6                                 | 75.5   | 67.0               | 70.5   | 6374                  | 72.8   |
| 1996 | 7302.1            | 915.0             | 94.5   | 79.8   | 93.8                                 | 76.6   | 90.9               | 71.8   | 8448                  | 96.2   |
| 1997 | 5548.3            | 915.0             | 73.1   | 79.4   | 72.5                                 | 76.4   | 69.2               | 71.6   | 6711                  | 76.6   |
| 1998 | 5503.7            | 915.0             | 71.0   | 78.9   | 71.0                                 | 76.1   | 68.7               | 71.5   | 7075                  | 80.8   |
| 1999 | 3426.7            | 915.0             | 44.9   | 77.1   | 44.5                                 | 74.4   | 42.8               | 69.9   | 4016                  | 45.8   |
| 2000 | 6644.9            | 915.0             | 87.7   | 77.7   | 87.1                                 | 75.1   | 82.7               | 70.6   | 7842                  | 89.3   |
| 2001 | 6053.3            | 915.0             | 83.2   | 77.9   | 82.0                                 | 75.4   | 75.5               | 70.8   | 7261                  | 82.9   |
| 2002 | 6384.6            | 880.0             | 87.2   | 78.3   | 86.1                                 | 75.9   | 82.8               | 71.3   | 7778                  | 88.8   |
| 2003 | 5670.1            | 915.0             | 85.2   | 78.6   | 73.0                                 | 75.8   | 70.7               | 71.3   | 7029                  | 80.2   |
| 2004 | 6832.5            | 915.0             | 91.5   | 79.2   | 89.0                                 | 76.3   | 85.0               | 71.9   | 8049                  | 91.6   |

# FR-18 TRICASTIN-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 102.0 | 9.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Jan | 601.0 | 5.0     | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)        |
| 17 Jan | 11.0  | 5.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Feb | 575.0 | 6.0     | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)        |
| 01 Feb | 90.0  | 6.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Mar | 96.0  | 1.0     | UP2  | K    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)        |
| 01 Mar | 162.0 | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 05 Mar | 714.0 | 32.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 02 Apr | 136.0 | 14.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 17 Apr | 683.0 | 626.0   | PF   | C    | REFUELLING AND PARTIAL INSPECTION                              |
| 15 May | 80.0  | 36.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 18 May | 648.0 | 13.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 05 Jun | 18.0  | 2.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 06 Jun | 201.0 | 20.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 09 Jun | 61.0  | 9.0     | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES      |
| 14 Jun | 28.0  | 13.0    | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 01 Jul | 235.0 | 11.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Jul | 234.0 | 57.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 08 Jul | 6.0   | 2.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 11 Jul | 30.0  | 12.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES      |
| 01 Aug | 138.0 | 113.0   | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES      |
| 04 Aug | 240.0 | 10.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Sep | 352.0 | 12.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Sep | 146.0 | 40.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Oct | 136.0 | 11.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Oct | 538.0 | 13.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 05 Oct | 40.0  | 6.0     | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES      |
| 01 Nov | 161.0 | 1.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Nov | 365.0 | 31.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 01 Dec | 508.0 | 22.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 23 Dec | 25.0  | 8.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 366       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 683             |           |          | 1097                                     | 12        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 24                                       | 2         |          |
| E. Testing of plant systems or components  |                 |           |          | 5  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 3        |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 34        |          |
| Subtotal   | 683             | 0         | 0        | 1126                                     | 420       | 4        |
| Total  |                 | 683       |          |  | 1550      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 104                                      |
| 12. Reactor I&C Systems                  |                 | 4  |
| 13. Reactor Auxiliary Systems            |                 | 2  |
| 14. Safety Systems                       |                 | 2  |
| 15. Reactor Cooling Systems              |                 | 21                                       |
| 16. Steam generation systems             |                 | 43                                       |
| 21. Fuel Handling and Storage Facilities |                 | 9  |
| 31. Turbine and auxiliaries              |                 | 34                                       |
| 32. Feedwater and Main Steam System      |                 | 6  |
| 41. Main Generator Systems               |                 | 95                                       |
| 42. Electrical Power Supply Systems      |                 | 16                                       |
| Total                                    | 0               | 336                                      |

# FR-19 TRICASTIN-2

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 915.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5684.2 GW(e).h  
**Energy Availability Factor:** 80.7%  
**Load Factor:** 70.7%  
**Operating Factor:** 82.8%  
**Energy Unavailability Factor:** 19.3%  
**Total Off-line Time:** 1513 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 559.7 | 559.0 | 644.1 | 572.5 | 403.8 | 530.5 | 480.1 | 491.8 | 344.8 | 0.0   | 440.6 | 657.3 | 5684.2 |
| <b>EAF (%)</b>  | 99.0  | 96.1  | 98.8  | 97.2  | 98.6  | 95.5  | 90.9  | 72.2  | 52.7  | 0.0   | 67.8  | 100.0 | 80.7   |
| <b>UCF (%)</b>  | 99.1  | 96.2  | 98.8  | 98.6  | 99.9  | 97.4  | 100.0 | 100.0 | 80.1  | 0.0   | 67.8  | 100.0 | 86.4   |
| <b>LF (%)</b>   | 82.2  | 87.8  | 94.7  | 86.9  | 59.3  | 80.5  | 70.5  | 72.2  | 52.3  | 0.0   | 66.9  | 96.6  | 70.7   |
| <b>OF (%)</b>   | 96.2  | 97.6  | 100.0 | 95.6  | 67.2  | 97.4  | 84.1  | 100.0 | 80.3  | 0.0   | 76.7  | 100.0 | 82.8   |
| <b>EUF (%)</b>  | 1.0   | 3.9   | 1.2   | 2.8   | 1.4   | 4.5   | 9.1   | 27.8  | 47.3  | 100.0 | 32.2  | 0.0   | 19.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 19.9  | 100.0 | 18.9  | 0.0   | 11.7   |
| <b>UCLF (%)</b> | 0.9   | 3.9   | 1.2   | 1.4   | 0.1   | 2.6   | 0.0   | 0.0   | 0.0   | 0.0   | 13.3  | 0.0   | 1.9    |
| <b>XUF (%)</b>  | 0.1   | 0.0   | 0.0   | 1.4   | 1.3   | 1.8   | 9.1   | 27.8  | 27.3  | 0.0   | 0.0   | 0.0   | 5.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1974  
**Date of First Criticality:** 22 Jul 1980  
**Date of Grid Connection:** 07 Aug 1980  
**Date of Commercial Operation:** 01 Dec 1980

**Lifetime Generation:** 139366.2 GW(e).h  
**Cumulative Energy Availability Factor:** 76.3%  
**Cumulative Load Factor:** 71.7%  
**Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 23.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5624.0         | 915.0          | 81.9   | 81.7   | 81.9                              | 75.8   | 70.2               | 65.7   | 7245               | 82.7   |
| 1984 | 6603.0         | 915.0          | 87.2   | 83.1   | 87.2                              | 78.6   | 82.2               | 69.8   | 7684               | 87.5   |
| 1985 | 6261.7         | 915.0          | 86.0   | 83.7   | 79.4                              | 78.8   | 78.1               | 71.5   | 7375               | 84.2   |
| 1986 | 6286.6         | 915.0          | 85.8   | 84.0   | 82.6                              | 79.4   | 78.4               | 72.6   | 7631               | 87.1   |
| 1987 | 5302.3         | 915.0          | 73.2   | 82.5   | 69.6                              | 78.0   | 66.2               | 71.7   | 6500               | 74.2   |
| 1988 | 4896.0         | 915.0          | 76.0   | 81.7   | 73.1                              | 77.4   | 60.9               | 70.4   | 6628               | 75.5   |
| 1989 | 5164.7         | 915.0          | 74.3   | 80.8   | 71.4                              | 76.7   | 64.4               | 69.7   | 6650               | 75.9   |
| 1990 | 5614.4         | 915.0          | 80.9   | 80.8   | 72.5                              | 76.3   | 70.0               | 69.7   | 7177               | 81.9   |
| 1991 | 4459.1         | 915.0          | 60.8   | 79.0   | 58.2                              | 74.7   | 55.6               | 68.5   | 5429               | 62.0   |
| 1992 | 6099.1         | 915.0          | 80.0   | 79.1   | 78.7                              | 75.0   | 75.9               | 69.1   | 7118               | 81.0   |
| 1993 | 5777.1         | 915.0          | 77.3   | 79.0   | 72.9                              | 74.8   | 72.1               | 69.3   | 6876               | 78.5   |
| 1994 | 6216.7         | 915.0          | 81.7   | 79.2   | 79.1                              | 75.1   | 77.6               | 69.9   | 7222               | 82.4   |
| 1995 | 6312.3         | 915.0          | 84.6   | 79.5   | 81.6                              | 75.6   | 78.8               | 70.5   | 7504               | 85.7   |
| 1996 | 6391.3         | 915.0          | 84.9   | 79.9   | 82.1                              | 76.0   | 79.5               | 71.1   | 7615               | 86.7   |
| 1997 | 5218.8         | 915.0          | 68.5   | 79.2   | 66.8                              | 75.4   | 65.1               | 70.7   | 6107               | 69.7   |
| 1998 | 6293.9         | 915.0          | 83.0   | 79.4   | 81.2                              | 75.8   | 78.5               | 71.1   | 7354               | 83.9   |
| 1999 | 5661.5         | 915.0          | 75.0   | 79.2   | 73.0                              | 75.6   | 70.6               | 71.1   | 6674               | 76.2   |
| 2000 | 4293.8         | 915.0          | 56.7   | 78.0   | 55.3                              | 74.6   | 53.4               | 70.2   | 5092               | 58.0   |
| 2001 | 6710.5         | 915.0          | 87.2   | 78.5   | 87.1                              | 75.2   | 83.7               | 70.9   | 7779               | 88.8   |
| 2002 | 6593.9         | 880.0          | 86.6   | 78.8   | 86.3                              | 75.7   | 85.5               | 71.5   | 7714               | 88.1   |
| 2003 | 6196.0         | 915.0          | 88.4   | 79.3   | 84.4                              | 76.1   | 77.3               | 71.8   | 7521               | 85.9   |
| 2004 | 5684.2         | 915.0          | 86.4   | 79.6   | 80.7                              | 76.3   | 70.7               | 71.7   | 7271               | 82.8   |



# FR-19 TRICASTIN-2

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 114.0  | 105.0   | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 05 Jan | 923.0  | 14.0    | UP2  | Z    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)        |
| 01 Feb | 158.0  | 45.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX  |
| 08 Feb | 17.0   | 16.0    | UF2  | A15  | PRIMARY PUMP   |
| 01 Mar | 101.0  | 18.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Mar | 951.0  | 13.0    | UP2  | K    | VARIOUS, UNIT OPERATIONAL PROBLEMS (SOME NOT EXPLAINED)        |
| 03 Apr | 159.0  | 40.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 08 Apr | 21.0   | 7.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 22 Apr | 146.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 25 Apr | 30.0   | 27.0    | XP   | K    | LOAD LIMITATION OR SHUTDOWN TO OPTIMIZE SHUTDOWN               |
| 26 Apr | 4.0    | 4.0     | UF2  | A41  | STATOR BAR WATER COOLING CIRCUIT                               |
| 01 May | 338.0  | 9.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 03 May | 65.0   | 29.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Jun | 362.0  | 10.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Jun | 270.0  | 95.0    | XP   | K    | LOAD LIMITATION OR SHUTDOWN TO OPTIMIZE SHUTDOWN               |
| 02 Jun | 16.0   | 15.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                            |
| 12 Jun | 32.0   | 3.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 14 Jun | 24.0   | 2.0     | XP   | R    | LOAD LIMITATION OR SHUTDOWN CAUSED BY INDUSTRIAL ACTION        |
| 08 Jul | 88.0   | 4.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 12 Jul | 1788.0 | 426.0   | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 25 Sep | 958.0  | 877.0   | PF   | C    | REFUELLING AND FULL INSPECTION                                 |
| 04 Nov | 24.0   | 22.0    | UF2  | A13  | BLOWDOWN, VENT AND DRAIN SYSTEM                                |
| 05 Nov | 48.0   | 44.0    | UF2  | A13  | SHUTDOWN COOLING CIRCUIT                                       |
| 07 Nov | 24.0   | 22.0    | UF3  | Z    | PROGRAMMED OUTAGE DURATION EXCEEDED                            |
| 07 Nov | 117.0  | 58.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 12 Nov | 309.0  | 1.0     | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |
| 01 Dec | 515.0  | 20.0    | XP   | K    | OPERATION WITH POWER LIMITER BELOW MAXIMUM AVAILABLE POWER     |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 109       |          |  | 330       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 958             |           |          | 1068                                     | 41        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 41                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 5  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 39        | 48       |
| L. Human factor related  |                 |           |          |  | 0         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 8        |
| Z. Others  |                 | 24        |          |  |           |          |
| Subtotal   | 958             | 133       | 0        | 1114                                     | 415       | 56       |
| Total  |                 | 1091      |          |  | 1585      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 5  |
| 12. Reactor I&C Systems                  | 16              | 43                                       |
| 13. Reactor Auxiliary Systems            | 72              | 6  |
| 14. Safety Systems                       |                 | 24                                       |
| 15. Reactor Cooling Systems              | 17              | 49                                       |
| 16. Steam generation systems             |                 | 11                                       |
| 21. Fuel Handling and Storage Facilities |                 | 25                                       |
| 31. Turbine and auxiliaries              |                 | 56                                       |
| 32. Feedwater and Main Steam System      |                 | 7  |
| 41. Main Generator Systems               | 4               | 0  |
| 42. Electrical Power Supply Systems      |                 | 12                                       |
| Total                                    | 109             | 238                                      |

# FR-25 TRICASTIN-3

**Operator:** EDF (ELECTRICITE DE FRANCE)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 915.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6377.1 GW(e).h  
**Energy Availability Factor:** 82.9%  
**Load Factor:** 79.3%  
**Operating Factor:** 84.9%  
**Energy Unavailability Factor:** 17.1%  
**Total Off-line Time:** 1329 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 675.8 | 261.6 | 0.0   | 556.8 | 644.4 | 584.3 | 599.8 | 616.6 | 595.3 | 496.6 | 660.1 | 685.8 | 6377.1 |
| <b>EAF (%)</b>  | 99.3  | 42.7  | 0.0   | 87.8  | 99.7  | 99.7  | 92.6  | 94.7  | 99.9  | 77.2  | 100.0 | 100.0 | 82.9   |
| <b>UCF (%)</b>  | 100.0 | 44.8  | 0.0   | 87.8  | 100.0 | 100.0 | 99.9  | 100.0 | 99.9  | 78.7  | 100.0 | 100.0 | 84.3   |
| <b>LF (%)</b>   | 99.3  | 41.1  | 0.0   | 84.5  | 94.7  | 88.7  | 88.1  | 90.6  | 90.4  | 72.9  | 100.2 | 100.7 | 79.3   |
| <b>OF (%)</b>   | 100.0 | 45.0  | 0.0   | 92.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 79.9  | 100.0 | 100.0 | 84.9   |
| <b>EUF (%)</b>  | 0.7   | 57.3  | 100.0 | 12.2  | 0.3   | 0.3   | 7.4   | 5.3   | 0.1   | 22.8  | 0.0   | 0.0   | 17.1   |
| <b>PUF (%)</b>  | 0.0   | 55.2  | 90.3  | 4.9   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 12.4   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 9.7   | 7.4   | 0.0   | 0.0   | 0.1   | 0.0   | 0.1   | 21.2  | 0.0   | 0.0   | 3.2    |
| <b>XUF (%)</b>  | 0.7   | 2.1   | 0.0   | 0.0   | 0.3   | 0.3   | 7.3   | 5.3   | 0.1   | 1.5   | 0.0   | 0.0   | 1.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1975  
**Date of First Criticality:** 29 Nov 1980  
**Date of Grid Connection:** 10 Feb 1981  
**Date of Commercial Operation:** 11 May 1981

**Lifetime Generation:** 142846.0 GW(e).h  
**Cumulative Energy Availability Factor:** 78.3%  
**Cumulative Load Factor:** 74.9%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 21.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6342.0         | 915.0          | 84.7   | 75.3   | 84.7                              | 75.3   | 79.1               | 71.2   | 7544               | 86.1   |
| 1984 | 6682.0         | 915.0          | 86.1   | 78.9   | 85.1                              | 78.5   | 83.1               | 75.2   | 7668               | 87.3   |
| 1985 | 7166.0         | 915.0          | 97.1   | 83.4   | 94.3                              | 82.5   | 89.4               | 78.7   | 8518               | 97.2   |
| 1986 | 6230.4         | 915.0          | 86.8   | 84.1   | 83.5                              | 82.7   | 77.7               | 78.5   | 7704               | 87.9   |
| 1987 | 5654.3         | 915.0          | 76.8   | 82.9   | 75.4                              | 81.5   | 70.5               | 77.2   | 6810               | 77.7   |
| 1988 | 5722.0         | 915.0          | 80.3   | 82.5   | 78.0                              | 81.0   | 71.2               | 76.3   | 7106               | 80.9   |
| 1989 | 5834.6         | 915.0          | 80.9   | 82.3   | 75.9                              | 80.3   | 72.8               | 75.9   | 7188               | 82.1   |
| 1990 | 6457.2         | 915.0          | 85.8   | 82.7   | 84.6                              | 80.8   | 80.6               | 76.4   | 7671               | 87.6   |
| 1991 | 4746.8         | 915.0          | 66.5   | 81.1   | 62.1                              | 78.9   | 59.2               | 74.7   | 5941               | 67.8   |
| 1992 | 5199.0         | 915.0          | 67.5   | 79.8   | 66.6                              | 77.8   | 64.7               | 73.8   | 6010               | 68.4   |
| 1993 | 6423.9         | 915.0          | 83.3   | 80.1   | 81.4                              | 78.1   | 80.1               | 74.3   | 7373               | 84.2   |
| 1994 | 6496.5         | 915.0          | 86.3   | 80.6   | 83.6                              | 78.5   | 81.1               | 74.8   | 7641               | 87.2   |
| 1995 | 6494.7         | 915.0          | 87.0   | 81.1   | 85.1                              | 79.0   | 81.0               | 75.3   | 7675               | 87.6   |
| 1996 | 5806.7         | 915.0          | 79.3   | 81.0   | 76.2                              | 78.8   | 72.2               | 75.1   | 7172               | 81.6   |
| 1997 | 6192.8         | 915.0          | 82.6   | 81.0   | 79.1                              | 78.8   | 77.3               | 75.2   | 7331               | 83.7   |
| 1998 | 6359.5         | 915.0          | 82.3   | 81.1   | 80.5                              | 78.9   | 79.3               | 75.4   | 7375               | 84.2   |
| 1999 | 5731.7         | 915.0          | 76.7   | 80.9   | 74.0                              | 78.7   | 71.5               | 75.2   | 6828               | 77.9   |
| 2000 | 5985.2         | 915.0          | 82.3   | 81.0   | 79.0                              | 78.7   | 74.5               | 75.2   | 7325               | 83.4   |
| 2001 | 4929.5         | 915.0          | 65.8   | 80.2   | 65.2                              | 78.0   | 61.5               | 74.5   | 5777               | 65.9   |
| 2002 | 5976.1         | 880.0          | 79.7   | 80.2   | 79.4                              | 78.1   | 77.5               | 74.6   | 7140               | 81.5   |
| 2003 | 6144.9         | 915.0          | 86.9   | 80.5   | 79.7                              | 78.1   | 76.7               | 74.7   | 7607               | 86.8   |
| 2004 | 6377.1         | 915.0          | 84.3   | 80.6   | 82.9                              | 78.3   | 79.3               | 74.9   | 7455               | 84.9   |

## FR-25 TRICASTIN-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 03 Jan | 92.0   | 4.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 19 Jan | 451.0  | 18.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                             |
| 01 Feb | 104.0  | 8.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 13 Feb | 1004.0 | 920.0   | PF   | C    | REFUELLING AND FULL INSPECTION                                 |
| 27 Mar | 47.0   | 43.0    | PF   | C    | REFUELLING AND INSPECTION                                      |
| 29 Mar | 125.0  | 114.0   | UF2  | A31  | THRUST BEARINGS-SHAFTING, BEARING BUSHES                       |
| 03 Apr | 86.0   | 32.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                                |
| 18 Apr | 106.0  | 24.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 May | 348.0  | 35.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Jun | 303.0  | 71.0    | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Jul | 298.0  | 5.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Jul | 137.0  | 26.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 10 Jul | 117.0  | 43.0    | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES      |
| 01 Aug | 227.0  | 61.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 02 Aug | 254.0  | 3.0     | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS          |
| 01 Sep | 209.0  | 63.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Oct | 28.0   | 16.0    | XP   | K    | FREQUENCY CONTROL, OPERATION AT MAXIMUM SET POINT PCMAX        |
| 01 Oct | 66.0   | 1.0     | UP2  | A32  | VARIOUS, VENTILATION, TRANSFER AND COOLING SYSTEMS             |
| 09 Oct | 32.0   | 9.0     | XP   | N    | COMPLIANCE WITH REGULATIONS CONCERNING RIVER TEMPERATURES      |
| 15 Oct | 48.0   | 6.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT BELOW MAXIMUM SET POINT PCOMAX |
| 20 Oct | 10.0   | 6.0     | UP2  | A15  | PRIMARY PUMP   |
| 20 Oct | 149.0  | 137.0   | UF2  | A15  | PRIMARY PUMP   |
| 01 Nov | 92.0   | 4.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |
| 01 Dec | 37.0   | 2.0     | XP   | K    | REMOTE LOAD DISPATCH CONTROL AT MAXIMUM SET POINT PCOMAX       |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure  |                 | 274       |          |  | 325       |          |
| B. Refuelling without a maintenance   |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling   | 1051            |           |          | 1073                                     | 11        |          |
| D. Inspection, maintenance or repair without refuelling   |                 |           |          | 39                                       |           |          |
| E. Testing of plant systems or components   |                 |           |          | 6  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)  |                 |           |          |  | 29        |          |
| L. Human factor related   |                 |           |          |  | 0         |          |
| R. External restrictions on supply and services (lack of funds due to delayed payments from customers, disputes in fuel industries, fuel-rationing, labour strike outside the plant, spare part delivery problems etc.) |                 |           |          |  | 9         |          |
| Z. Others   |                 |           |          |  | 1         |          |
| Subtotal  | 1051            | 274       | 0        | 1118                                     | 390       | 0        |
| Total   |                 | 1325      |          |  | 1508      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 15                                       |
| 12. Reactor I&C Systems             |                 | 45                                       |
| 13. Reactor Auxiliary Systems       |                 | 11                                       |
| 14. Safety Systems                  |                 | 19                                       |
| 15. Reactor Cooling Systems         | 149             | 49                                       |
| 16. Steam generation systems        |                 | 4  |
| 31. Turbine and auxiliaries         | 125             | 57                                       |
| 32. Feedwater and Main Steam System |                 | 7  |
| 41. Main Generator Systems          |                 | 96                                       |
| 42. Electrical Power Supply Systems |                 | 2  |
| Total                               | 274             | 305                                      |

**FR-26 TRICASTIN-4**

Operator: EDF (ELECTRICITE DE FRANCE)

Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 915.0 MW(e)  
 Design Net RUP: 915.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 4724.1 GW(e).h  
 Energy Availability Factor: 58.8%  
 Load Factor: 58.8%  
 Operating Factor: 61.0%  
 Energy Unavailability Factor: 41.2%  
 Total Off-line Time: 3425 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 675.1 | 622.7 | 674.7 | 625.3 | 245.2 | 0.0   | 0.0   | 0.0   | 0.0   | 606.6 | 653.6 | 620.9 | 4724.1 |
| EAF (%)  | 99.2  | 97.8  | 99.3  | 94.9  | 37.1  | 0.0   | 0.0   | 0.0   | 0.0   | 89.0  | 99.2  | 90.8  | 58.8   |
| UCF (%)  | 99.2  | 97.8  | 99.3  | 100.0 | 41.9  | 0.0   | 0.0   | 0.0   | 0.0   | 90.4  | 99.7  | 90.8  | 59.8   |
| LF (%)   | 99.2  | 97.8  | 99.2  | 94.9  | 36.0  | 0.0   | 0.0   | 0.0   | 0.0   | 89.0  | 99.2  | 91.2  | 58.8   |
| OF (%)   | 100.0 | 99.6  | 100.0 | 100.0 | 42.6  | 0.0   | 0.0   | 0.0   | 0.0   | 100.0 | 100.0 | 91.0  | 61.0   |
| EUF (%)  | 0.8   | 2.2   | 0.7   | 5.1   | 62.9  | 100.0 | 100.0 | 100.0 | 100.0 | 11.0  | 0.8   | 9.2   | 41.2   |
| PUF (%)  | 0.0   | 0.2   | 0.0   | 0.0   | 54.5  | 100.0 | 100.0 | 100.0 | 100.0 | 9.6   | 0.3   | 0.0   | 38.8   |
| UCLF (%) | 0.8   | 2.0   | 0.7   | 0.0   | 3.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.2   | 1.4    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 5.1   | 4.8   | 0.0   | 0.0   | 0.0   | 0.0   | 1.4   | 0.4   | 0.0   | 1.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 May 1975      Lifetime Generation: 135757.2 GW(e).h  
 Date of First Criticality: 31 May 1981      Cumulative Energy Availability Factor: 78.4%  
 Date of Grid Connection: 12 Jun 1981      Cumulative Load Factor: 72.4%  
 Date of Commercial Operation: 01 Nov 1981      Cumulative Unit Capability Factor: 77.8%  
    Cumulative Energy Unavailability Factor: 21.6%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 6170.0            | 915.0             | 82.6   | 76.2   | 82.6                                 | 76.2   | 77.0               | 72.6   | 7386                  | 84.3   |
| 1984 | 5446.0            | 915.0             | 91.8   | 81.4   | 87.1                                 | 79.8   | 67.8               | 71.0   | 7587                  | 86.4   |
| 1985 | 6161.7            | 915.0             | 91.3   | 83.9   | 84.8                                 | 81.1   | 76.9               | 72.5   | 7816                  | 89.2   |
| 1986 | 5873.9            | 915.0             | 85.7   | 84.3   | 81.8                                 | 81.2   | 73.3               | 72.6   | 7568                  | 86.4   |
| 1987 | 5725.7            | 915.0             | 84.2   | 84.2   | 80.1                                 | 81.0   | 71.4               | 72.4   | 7257                  | 82.8   |
| 1988 | 3770.0            | 915.0             | 67.7   | 81.9   | 66.2                                 | 78.9   | 46.9               | 68.8   | 4772                  | 54.3   |
| 1989 | 5729.1            | 915.0             | 82.9   | 82.0   | 79.8                                 | 79.0   | 71.5               | 69.1   | 7335                  | 83.7   |
| 1990 | 5201.6            | 915.0             | 82.7   | 82.1   | 77.4                                 | 78.9   | 64.9               | 68.6   | 7329                  | 83.7   |
| 1991 | 5742.8            | 915.0             | 77.1   | 81.6   | 74.5                                 | 78.4   | 71.6               | 68.9   | 6838                  | 78.1   |
| 1992 | 6459.3            | 915.0             | 90.2   | 82.4   | 86.7                                 | 79.2   | 80.4               | 70.0   | 7968                  | 90.7   |
| 1993 | 5302.8            | 915.0             | 80.1   | 82.2   | 70.9                                 | 78.5   | 66.2               | 69.7   | 6842                  | 78.1   |
| 1994 | 5953.0            | 915.0             | 80.9   | 82.1   | 77.8                                 | 78.4   | 74.3               | 70.0   | 7049                  | 80.5   |
| 1995 | 6208.9            | 915.0             | 85.7   | 82.3   | 82.0                                 | 78.7   | 77.5               | 70.6   | 7562                  | 86.3   |
| 1996 | 6700.4            | 915.0             | 87.6   | 82.7   | 86.5                                 | 79.2   | 83.4               | 71.4   | 7774                  | 88.5   |
| 1997 | 6488.8            | 915.0             | 86.0   | 82.9   | 84.8                                 | 79.6   | 81.0               | 72.0   | 7595                  | 86.7   |
| 1998 | 5913.0            | 915.0             | 80.5   | 82.8   | 76.2                                 | 79.4   | 73.8               | 72.1   | 7138                  | 81.5   |
| 1999 | 5887.9            | 915.0             | 80.5   | 82.6   | 78.0                                 | 79.3   | 73.5               | 72.2   | 7158                  | 81.7   |
| 2000 | 5780.3            | 915.0             | 77.4   | 82.3   | 75.8                                 | 79.1   | 71.9               | 72.2   | 6873                  | 78.2   |
| 2001 | 6036.9            | 915.0             | 83.0   | 82.4   | 81.2                                 | 79.2   | 75.3               | 72.3   | 7138                  | 81.5   |
| 2002 | 6260.6            | 880.0             | 83.3   | 82.4   | 81.2                                 | 79.3   | 81.2               | 72.7   | 7168                  | 81.8   |
| 2003 | 6387.9            | 915.0             | 82.9   | 82.4   | 79.9                                 | 79.3   | 79.7               | 73.0   | 7399                  | 84.5   |
| 2004 | 4724.1            | 915.0             | 59.8   | 81.5   | 58.8                                 | 78.4   | 58.8               | 72.4   | 5359                  | 61.0   |

## FR-26 TRICASTIN-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 2111.0 | 13.0    | UP2  | A12  | REACTOR CONTROL   |
| 21 Feb | 3.0    | 3.0     | UF2  | A    | PARALLEL AND TAPER-SEAT VALVES                                |
| 21 Feb | 31.0   | 3.0     | UP2  | A16  | STEAM GENERATOR INCLUDING SG BLOWDOWNS                        |
| 21 Feb | 3.0    | 2.0     | UP2  | A    | PARALLEL AND TAPER-SEAT VALVES                                |
| 21 Feb | 3.0    | 1.0     | PP   | E    | PERIODIC TESTING WITH LOAD REDUCTION OR SHUTDOWN              |
| 01 Apr | 1004.0 | 66.0    | XP   | S    | LOAD LIMITATION DURING STRETCH-OUT                            |
| 04 May | 23.0   | 21.0    | UF2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                           |
| 04 May | 31.0   | 3.0     | UP2  | A12  | REACTOR INSTRUMENTATION AND CONTROL                           |
| 15 May | 3271.0 | 2991.0  | PF   | C    | REFUELLING AND 10-YEARLY INSPECTION                           |
| 28 Sep | 60.0   | 49.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 01 Oct | 171.0  | 65.0    | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 06 Oct | 789.0  | 13.0    | XP   | N    | LOAD LIMITATION OR SHUTDOWN FOR ENVIRONMENTAL REASONS         |
| 18 Nov | 3.0    | 1.0     | PP   | E    | START-UP TESTS AFTER REFUELLING                               |
| 05 Dec | 52.0   | 48.0    | UF2  | A41  | HYDROGEN COOLING SYSTEM                                       |
| 08 Dec | 3.0    | 1.0     | XP   | K    | FREQUENCY CONTROL, OPERATION AT BELOW MAXIMUM SET POINT PCMAX |
| 15 Dec | 15.0   | 14.0    | UF2  | A31  | INSTRUMENTATION AND CONTROL OF TURBINE AND FEEDWATER PLANT    |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 93        |          |   | 249       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 3271            |           |          | 957   | 13        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 24  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 91        | 12       |
| Z. Others  |                 |           |          |   | 3         |          |
| Subtotal   | 3271            | 93        | 0        | 982   | 357       | 12       |
| Total  |                 | 3364      |          |   | 1351      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|-----------------|---|
| 11. Reactor and Accessories         |                 | 27  |
| 12. Reactor I&C Systems             | 23              | 18  |
| 13. Reactor Auxiliary Systems       |                 | 10  |
| 14. Safety Systems                  |                 | 35  |
| 15. Reactor Cooling Systems         |                 | 23  |
| 16. Steam generation systems        |                 | 35  |
| 31. Turbine and auxiliaries         | 15              | 14  |
| 32. Feedwater and Main Steam System |                 | 7   |
| 41. Main Generator Systems          | 52              | 45  |
| 42. Electrical Power Supply Systems |                 | 10  |
| Total                               | 90              | 224   |

# DE-12 BIBLIS-A (KWB A)

**Operator:** RWE (RWE ENERGIE AG)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1167.0 MW(e)  
**Design Net RUP:** 1146.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9645.5 GW(e).h  
**Energy Availability Factor:** 95.2%  
**Load Factor:** 94.1%  
**Operating Factor:** 95.6%  
**Energy Unavailability Factor:** 4.8%  
**Total Off-line Time:** 389 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 714.3 | 502.9 | 872.5 | 835.1 | 858.0 | 822.7 | 827.2 | 821.5 | 818.7 | 860.4 | 843.7 | 868.5 | 9645.5 |
| <b>EAF (%)</b>  | 81.5  | 61.3  | 100.0 | 99.8  | 99.8  | 100.0 | 99.1  | 99.6  | 100.0 | 99.8  | 100.0 | 100.0 | 95.2   |
| <b>UCF (%)</b>  | 81.5  | 61.3  | 100.0 | 99.8  | 99.8  | 100.0 | 99.1  | 99.6  | 100.0 | 99.8  | 100.0 | 100.0 | 95.2   |
| <b>LF (%)</b>   | 82.3  | 61.9  | 100.5 | 99.5  | 98.8  | 97.9  | 95.3  | 94.6  | 97.4  | 99.0  | 100.4 | 100.0 | 94.1   |
| <b>OF (%)</b>   | 83.5  | 61.8  | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.6   |
| <b>EUF (%)</b>  | 18.5  | 38.7  | 0.0   | 0.2   | 0.2   | 0.0   | 0.9   | 0.4   | 0.0   | 0.2   | 0.0   | 0.0   | 4.8    |
| <b>PUF (%)</b>  | 1.9   | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 0.9   | 0.3   | 0.0   | 0.2   | 0.0   | 0.0   | 0.3    |
| <b>UCLF (%)</b> | 16.6  | 38.7  | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 4.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1970  
**Date of First Criticality:** 16 Jul 1974  
**Date of Grid Connection:** 25 Aug 1974  
**Date of Commercial Operation:** 26 Feb 1975

**Lifetime Generation:** 202740.9 GW(e).h  
**Cumulative Energy Availability Factor:** 71.1%  
**Cumulative Load Factor:** 66.5%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 28.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 7766.0         | 1146.0         | 76.7   | 84.5   | 76.7                              | 69.6   | 77.4               | 66.4   | 6783               | 77.4   |
| 1984 | 6901.0         | 1146.0         | 67.9   | 82.6   | 67.9                              | 69.4   | 68.6               | 66.6   | 6175               | 70.3   |
| 1985 | 7564.9         | 1146.0         | 79.2   | 82.2   | 75.1                              | 70.0   | 75.4               | 67.5   | 6797               | 77.6   |
| 1986 | 6968.1         | 1146.0         | 76.9   | 81.7   | 76.9                              | 70.6   | 69.4               | 67.7   | 7227               | 82.5   |
| 1987 | 7467.8         | 1146.0         | 80.9   | 81.7   | 80.9                              | 71.5   | 74.4               | 68.3   | 7154               | 81.7   |
| 1988 | 5985.4         | 1146.0         | 72.5   | 81.0   | 72.5                              | 71.6   | 59.5               | 67.6   | 6594               | 75.1   |
| 1989 | 6431.0         | 1146.0         | 66.9   | 79.9   | 66.9                              | 71.2   | 64.1               | 67.3   | 5904               | 67.4   |
| 1990 | 5052.7         | 1146.0         | 53.1   | 78.1   | 53.1                              | 70.0   | 50.3               | 66.2   | 4676               | 53.4   |
| 1991 | 6931.0         | 1146.0         | 76.3   | 78.0   | 76.3                              | 70.4   | 69.0               | 66.4   | 6778               | 77.4   |
| 1992 | 6884.8         | 1146.0         | 79.6   | 78.1   | 79.6                              | 71.0   | 68.4               | 66.5   | 7024               | 80.0   |
| 1993 | 8240.7         | 1146.0         | 97.5   | 79.2   | 97.5                              | 72.4   | 82.1               | 67.4   | 8558               | 97.7   |
| 1994 | 7483.6         | 1146.0         | 76.8   | 79.1   | 76.8                              | 72.7   | 74.5               | 67.7   | 6697               | 76.4   |
| 1995 | 2509.4         | 1156.0         | 30.0   | 76.6   | 30.0                              | 70.5   | 24.8               | 65.6   | 2655               | 30.3   |
| 1996 | 4012.5         | 1167.0         | 39.7   | 74.8   | 39.7                              | 69.0   | 39.1               | 64.3   | 3503               | 39.9   |
| 1997 | 8002.3         | 1167.0         | 87.0   | 75.3   | 87.0                              | 69.8   | 78.3               | 64.9   | 7648               | 87.3   |
| 1998 | 10042.3        | 1167.0         | 99.7   | 76.4   | 99.7                              | 71.2   | 98.2               | 66.4   | 8752               | 99.9   |
| 1999 | 7251.1         | 1167.0         | 78.0   | 76.5   | 78.0                              | 71.5   | 70.9               | 66.6   | 6865               | 78.4   |
| 2000 | 5910.1         | 1167.0         | 62.5   | 75.9   | 62.5                              | 71.1   | 57.7               | 66.2   | 5497               | 62.6   |
| 2001 | 9532.0         | 1167.0         | 94.9   | 76.7   | 94.9                              | 72.0   | 93.2               | 67.3   | 8334               | 95.1   |
| 2002 | 6167.7         | 1167.0         | 68.0   | 76.3   | 68.1                              | 71.9   | 60.3               | 67.0   | 5988               | 68.4   |
| 2003 | 2695.8         | 1167.0         | 26.6   | 74.5   | 26.6                              | 70.2   | 26.4               | 65.5   | 2406               | 27.5   |
| 2004 | 9645.5         | 1167.0         | 95.2   | 75.3   | 95.2                              | 71.1   | 94.1               | 66.5   | 8395               | 95.6   |

**DE-12 BIBLIS-A (KWB A)****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 123.0 | 144.0   | UF1  | A15  | MAIN COOLING PUMP SEALING REPLACE DUE TO LEAKAGE    |
| 06 Jan | 49.0  | 15.4    | PP   | E    | START-UP ACTIVITIES                                 |
| 09 Feb | 266.0 | 314.3   | UF1  | A16  | STEAM LAEKAGE OF THE STEAM GENERATOR SECONDARY SIDE |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 389       |          |   | 854       |          |
| B. Refuelling without a maintenance  |                 |           |          | 8   | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1396  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 40  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 29  | 7         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 13        | 21       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 2   | 4         | 0        |
| Subtotal   | 0               | 389       | 0        | 1475  | 881       | 21       |
| Total  |                 | 389       |          |   | 2377      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1975 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 12  |
| 12. Reactor I&C Systems                        |                    | 23  |
| 13. Reactor Auxiliary Systems                  |                    | 4   |
| 14. Safety Systems                             |                    | 426   |
| 15. Reactor Cooling Systems                    | 123                | 208   |
| 16. Steam generation systems                   | 266                | 74  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 1   |
| 21. Fuel Handling and Storage Facilities       |                    | 8   |
| 31. Turbine and auxiliaries                    |                    | 33  |
| 32. Feedwater and Main Steam System            |                    | 23  |
| 33. Circulating Water System                   |                    | 3   |
| 41. Main Generator Systems                     |                    | 32  |
| 42. Electrical Power Supply Systems            |                    | 1   |
| Total  | 389                | 848   |

# DE-18 BIBLIS-B (KWB B)

**Operator:** RWE (RWE ENERGIE AG)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1240.0 MW(e)  
**Design Net RUP:** 1178.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8768.4 GW(e).h  
**Energy Availability Factor:** 82.5%  
**Load Factor:** 80.5%  
**Operating Factor:** 83.2%  
**Energy Unavailability Factor:** 17.5%  
**Total Off-line Time:** 1475 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 919.2 | 808.3 | 913.6 | 855.0 | 180.1 | 0.0   | 688.6 | 845.8 | 857.8 | 902.7 | 884.8 | 912.5 | 8768.4 |
| <b>EAF (%)</b>  | 100.0 | 94.3  | 99.8  | 100.0 | 22.4  | 0.0   | 77.8  | 96.7  | 99.4  | 99.5  | 100.0 | 99.5  | 82.5   |
| <b>UCF (%)</b>  | 100.0 | 97.8  | 99.8  | 100.0 | 22.4  | 0.0   | 77.8  | 96.7  | 99.4  | 99.5  | 100.0 | 99.5  | 82.8   |
| <b>LF (%)</b>   | 99.6  | 93.7  | 99.0  | 95.9  | 19.5  | 0.0   | 74.6  | 91.7  | 96.1  | 97.7  | 99.1  | 98.9  | 80.5   |
| <b>OF (%)</b>   | 100.0 | 97.3  | 99.9  | 100.1 | 22.7  | 0.0   | 80.9  | 97.4  | 100.0 | 100.0 | 100.0 | 100.0 | 83.2   |
| <b>EUF (%)</b>  | 0.0   | 5.7   | 0.2   | 0.0   | 77.6  | 100.0 | 22.2  | 3.3   | 0.6   | 0.5   | 0.0   | 0.5   | 17.5   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.2   | 0.0   | 77.6  | 100.0 | 21.7  | 0.0   | 0.0   | 0.3   | 0.0   | 0.5   | 16.7   |
| <b>UCLF (%)</b> | 0.0   | 2.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 3.3   | 0.6   | 0.2   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 3.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1972  
**Date of First Criticality:** 25 Mar 1976  
**Date of Grid Connection:** 06 Apr 1976  
**Date of Commercial Operation:** 31 Jan 1977

**Lifetime Generation:** 208496.2 GW(e).h  
**Cumulative Energy Availability Factor:** 75.9%  
**Cumulative Load Factor:** 68.6%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 24.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6490.0         | 1240.0         | 60.6   | 92.1   | 60.6                              | 70.4   | 59.7               | 65.9   | 5360               | 61.2   |
| 1984 | 8216.0         | 1240.0         | 77.6   | 90.3   | 77.6                              | 71.3   | 75.4               | 67.2   | 7338               | 83.5   |
| 1985 | 7780.2         | 1240.0         | 75.3   | 88.6   | 75.3                              | 71.7   | 71.6               | 67.7   | 6918               | 79.0   |
| 1986 | 6722.6         | 1240.0         | 68.2   | 86.5   | 68.2                              | 71.4   | 61.9               | 67.1   | 6370               | 72.7   |
| 1987 | 5623.0         | 1240.0         | 76.2   | 85.6   | 76.2                              | 71.8   | 51.8               | 65.7   | 7273               | 83.0   |
| 1988 | 5591.8         | 1240.0         | 74.8   | 84.7   | 74.8                              | 72.1   | 51.3               | 64.5   | 6593               | 75.1   |
| 1989 | 5165.8         | 1240.0         | 53.6   | 82.2   | 53.6                              | 70.6   | 47.6               | 63.1   | 4807               | 54.9   |
| 1990 | 9100.1         | 1240.0         | 90.0   | 82.8   | 90.1                              | 72.0   | 83.8               | 64.6   | 8631               | 98.5   |
| 1991 | 3917.8         | 1240.0         | 41.1   | 80.0   | 39.3                              | 69.8   | 36.1               | 62.7   | 3626               | 41.4   |
| 1992 | 7630.5         | 1240.0         | 81.5   | 80.1   | 81.5                              | 70.6   | 70.1               | 63.2   | 7184               | 81.8   |
| 1993 | 7441.8         | 1240.0         | 83.8   | 80.3   | 83.8                              | 71.3   | 68.5               | 63.5   | 7368               | 84.1   |
| 1994 | 7973.8         | 1240.0         | 84.9   | 80.6   | 84.9                              | 72.1   | 73.4               | 64.0   | 7468               | 85.3   |
| 1995 | 7854.2         | 1240.0         | 75.4   | 80.3   | 75.4                              | 72.3   | 72.3               | 64.5   | 6603               | 75.4   |
| 1996 | 7857.4         | 1240.0         | 80.1   | 80.3   | 80.1                              | 72.7   | 72.1               | 64.9   | 6762               | 77.0   |
| 1997 | 8469.4         | 1240.0         | 85.9   | 80.5   | 85.9                              | 73.3   | 78.0               | 65.5   | 7560               | 86.3   |
| 1998 | 8182.1         | 1240.0         | 84.4   | 80.7   | 84.4                              | 73.8   | 75.3               | 65.9   | 7409               | 84.6   |
| 1999 | 8707.4         | 1240.0         | 85.0   | 80.9   | 85.0                              | 74.3   | 80.2               | 66.6   | 7474               | 85.3   |
| 2000 | 8295.7         | 1240.0         | 89.2   | 81.3   | 89.2                              | 74.9   | 76.2               | 67.0   | 7950               | 90.5   |
| 2001 | 7442.2         | 1240.0         | 73.8   | 81.0   | 73.8                              | 74.9   | 68.5               | 67.0   | 6470               | 73.9   |
| 2002 | 10173.6        | 1240.0         | 95.2   | 81.5   | 95.2                              | 75.7   | 93.7               | 68.1   | 8371               | 95.6   |
| 2003 | 7792.0         | 1240.0         | 75.3   | 81.3   | 75.3                              | 75.7   | 71.7               | 68.2   | 6630               | 75.7   |
| 2004 | 8768.4         | 1240.0         | 82.8   | 81.3   | 82.5                              | 75.9   | 80.5               | 68.6   | 7309               | 83.2   |



**DE-18 BIBLIS-B (KWB B)****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                            |
|--------|-------|---------|------|------|--|
| 08 Feb | 19.0  | 30.6    | XF2  | N42  | HIGH VOLTAGE GRID FAILURE DUE TO STORM |
| 10 Feb | 40.0  | 17.0    | UP2  | A12  | CONTROL ROD FAILURE                    |
| 08 May | 575.0 | 713.4   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING      |
| 01 Jun | 720.0 | 892.8   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING      |
| 01 Jul | 141.0 | 175.1   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING      |
| 06 Jul | 60.0  | 21.2    | PP   | E    | START-UP ACTIVITIES                    |
| 11 Aug | 19.0  | 26.8    | UF1  | A15  | REACTOR COOLANT PIPING LEAKAGE         |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 19        |          |   | 492       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1436            |           |          | 1277  |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 4   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3   | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 17  | 40        |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 19       |   |           |          |
| Subtotal   | 1436            | 19        | 19       | 1301  | 532       | 0        |
| Total  |                 | 1474      |          |   | 1833      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1976 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 32  |
| 12. Reactor I&C Systems                        |                    | 2   |
| 13. Reactor Auxiliary Systems                  |                    | 75  |
| 15. Reactor Cooling Systems                    | 19                 | 183   |
| 16. Steam generation systems                   |                    | 134   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 1   |
| 31. Turbine and auxiliaries                    |                    | 12  |
| 32. Feedwater and Main Steam System            |                    | 19  |
| 33. Circulating Water System                   |                    | 1   |
| 41. Main Generator Systems                     |                    | 29  |
| Total  | 19                 | 488   |

# DE-32 BROKDORF (KBR)

**Operator:** EON (EON Kernkraft Ges.m.b.H)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1370.0 MW(e)  
**Design Net RUP:** 1307.0 MW(e)  
**Design Discharge Burnup:** 29000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 11040.8 GW(e).h  
**Energy Availability Factor:** 94.7%  
**Load Factor:** 91.7%  
**Operating Factor:** 94.8%  
**Energy Unavailability Factor:** 5.3%  
**Total Off-line Time:** 457 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb   | Mar    | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct    | Nov   | Dec    | Annual  |
|-----------------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|-------|--------|---------|
| <b>GW(e).h</b>  | 1004.2 | 944.1 | 1004.6 | 974.8 | 995.4 | 930.0 | 857.4 | 339.9 | 973.3 | 1017.9 | 984.1 | 1015.0 | 11040.8 |
| <b>EAF (%)</b>  | 100.0  | 100.0 | 99.8   | 100.0 | 100.0 | 99.8  | 100.0 | 37.4  | 100.0 | 100.0  | 100.0 | 100.0  | 94.7    |
| <b>UCF (%)</b>  | 100.0  | 100.0 | 99.8   | 100.0 | 100.0 | 99.8  | 100.0 | 37.4  | 100.0 | 100.0  | 100.0 | 100.0  | 94.7    |
| <b>LF (%)</b>   | 98.5   | 99.0  | 98.6   | 99.0  | 97.7  | 94.3  | 84.1  | 33.3  | 98.7  | 99.7   | 99.8  | 99.6   | 91.7    |
| <b>OF (%)</b>   | 100.0  | 100.0 | 99.9   | 100.1 | 100.0 | 100.0 | 100.0 | 38.6  | 100.0 | 100.0  | 100.0 | 100.0  | 94.8    |
| <b>EUF (%)</b>  | 0.0    | 0.0   | 0.2    | 0.0   | 0.0   | 0.2   | 0.0   | 62.6  | 0.0   | 0.0    | 0.0   | 0.0    | 5.3     |
| <b>PUF (%)</b>  | 0.0    | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 55.1  | 0.0   | 0.0    | 0.0   | 0.0    | 4.7     |
| <b>UCLF (%)</b> | 0.0    | 0.0   | 0.2    | 0.0   | 0.0   | 0.2   | 0.0   | 7.6   | 0.0   | 0.0    | 0.0   | 0.0    | 0.7     |
| <b>XUF (%)</b>  | 0.0    | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0   | 0.0    | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1976  
**Date of First Criticality:** 08 Oct 1986  
**Date of Grid Connection:** 14 Oct 1986  
**Date of Commercial Operation:** 22 Dec 1986

**Lifetime Generation:** 184700.4 GW(e).h  
**Cumulative Energy Availability Factor:** 89.4%  
**Cumulative Load Factor:** 87.2%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 10.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 296.8          | 1307.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 2.6                | 0.0    | 228                | 2.6    |
| 1987 | 9481.3         | 1307.0         | 85.2   | 85.2   | 85.2                              | 85.2   | 82.8               | 82.8   | 7477               | 85.4   |
| 1988 | 8581.8         | 1326.0         | 85.2   | 85.2   | 85.2                              | 85.2   | 73.7               | 78.2   | 7014               | 79.8   |
| 1989 | 8991.3         | 1326.0         | 80.0   | 83.5   | 80.0                              | 83.5   | 77.4               | 77.9   | 7134               | 81.4   |
| 1990 | 8337.2         | 1326.0         | 72.5   | 80.7   | 72.5                              | 80.7   | 71.8               | 76.4   | 6447               | 73.6   |
| 1991 | 9492.7         | 1326.0         | 85.7   | 81.7   | 85.7                              | 81.7   | 81.7               | 77.5   | 7542               | 86.1   |
| 1992 | 10788.0        | 1326.0         | 96.0   | 84.1   | 96.0                              | 84.1   | 92.6               | 80.0   | 8461               | 96.3   |
| 1993 | 9447.1         | 1326.0         | 85.6   | 84.3   | 84.8                              | 84.2   | 81.3               | 80.2   | 7441               | 84.9   |
| 1994 | 10228.6        | 1326.0         | 88.7   | 84.9   | 88.7                              | 84.8   | 88.1               | 81.2   | 7793               | 89.0   |
| 1995 | 9912.4         | 1326.0         | 86.6   | 85.1   | 86.6                              | 85.0   | 85.3               | 81.6   | 7833               | 89.4   |
| 1996 | 10555.4        | 1326.0         | 93.2   | 85.9   | 93.2                              | 85.8   | 90.6               | 82.5   | 8212               | 93.5   |
| 1997 | 11249.3        | 1326.0         | 95.1   | 86.7   | 95.1                              | 86.6   | 96.8               | 83.8   | 8328               | 95.1   |
| 1998 | 10752.3        | 1326.0         | 92.6   | 87.2   | 90.4                              | 87.0   | 92.6               | 84.6   | 7966               | 90.9   |
| 1999 | 11093.3        | 1370.0         | 93.3   | 87.7   | 93.3                              | 87.5   | 92.4               | 85.2   | 8177               | 93.3   |
| 2000 | 11335.1        | 1370.0         | 95.5   | 88.3   | 95.6                              | 88.1   | 94.2               | 85.9   | 8397               | 95.6   |
| 2001 | 11215.4        | 1370.0         | 95.0   | 88.7   | 95.0                              | 88.5   | 93.5               | 86.4   | 8331               | 95.1   |
| 2002 | 11336.9        | 1370.0         | 95.8   | 89.2   | 95.8                              | 89.0   | 94.5               | 86.9   | 8405               | 95.9   |
| 2003 | 10564.6        | 1370.0         | 90.1   | 89.2   | 90.1                              | 89.1   | 88.0               | 87.0   | 7903               | 90.2   |
| 2004 | 11040.8        | 1370.0         | 94.7   | 89.5   | 94.7                              | 89.4   | 91.7               | 87.2   | 8327               | 94.8   |

## DE-32 BROKDORF (KBR)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 Aug | 401.0 | 553.4   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 22 Aug | 56.0  | 76.0    | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 99        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 18        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 401             |           |          | 642   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 10  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 57        | 9        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 11        | 4        |
| Z. Others  |                 | 56        |          |   | 14        |          |
| Subtotal   | 401             | 56        | 0        | 652   | 199       | 13       |
| Total  |                 | 457       |          |   | 864       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1987 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|-----------------|---|
| 13. Reactor Auxiliary Systems       |                 | 9   |
| 31. Turbine and auxiliaries         |                 | 1   |
| 32. Feedwater and Main Steam System |                 | 1   |
| 41. Main Generator Systems          |                 | 88  |
| Total                               | 0               | 99  |

# DE-13 BRUNSBUETTEL (KKB)

**Operator:** HEW (Hamburgische Elektrizitaetswerke)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 771.0 MW(e)  
**Design Net RUP:** 770.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4873.2 GW(e).h  
**Energy Availability Factor:** 73.3%  
**Load Factor:** 72.0%  
**Operating Factor:** 74.0%  
**Energy Unavailability Factor:** 26.7%  
**Total Off-line Time:** 2280 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 564.9 | 506.8 | 84.3 | 475.8 | 567.8 | 543.5 | 564.2 | 376.0 | 0.0   | 64.3 | 554.0 | 571.7 | 4873.2 |
| <b>EAF (%)</b>  | 98.5  | 100.0 | 17.2 | 90.4  | 99.6  | 99.1  | 99.8  | 67.8  | 0.0   | 10.5 | 99.6  | 99.3  | 73.3   |
| <b>UCF (%)</b>  | 98.5  | 100.0 | 17.2 | 90.4  | 99.6  | 99.1  | 99.8  | 67.8  | 0.0   | 10.5 | 99.6  | 99.3  | 73.3   |
| <b>LF (%)</b>   | 98.5  | 94.4  | 14.7 | 85.8  | 99.0  | 97.9  | 98.4  | 65.5  | 0.0   | 11.2 | 99.8  | 99.7  | 72.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 17.1 | 89.0  | 100.0 | 100.0 | 100.0 | 70.4  | 0.0   | 13.6 | 100.0 | 100.0 | 74.0   |
| <b>EUF (%)</b>  | 1.5   | 0.0   | 82.8 | 9.6   | 0.4   | 0.9   | 0.2   | 32.2  | 100.0 | 89.5 | 0.4   | 0.7   | 26.7   |
| <b>PUF (%)</b>  | 0.5   | 0.0   | 62.1 | 3.4   | 0.4   | 0.6   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.7   | 5.7    |
| <b>UCLF (%)</b> | 1.0   | 0.0   | 20.7 | 6.2   | 0.0   | 0.3   | 0.2   | 32.2  | 100.0 | 89.5 | 0.4   | 0.0   | 20.9   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 15 Apr 1970  
**Date of First Criticality:** 23 Jun 1976  
**Date of Grid Connection:** 13 Jul 1976  
**Date of Commercial Operation:** 09 Feb 1977

**Lifetime Generation:** 106007.6 GW(e).h  
**Cumulative Energy Availability Factor:** 60.2%  
**Cumulative Load Factor:** 55.7%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 39.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2416.0         | 770.0          | 34.2   | 60.5   | 34.2                              | 32.9   | 35.8               | 33.0   | 3241               | 37.0   |
| 1984 | 5334.0         | 770.0          | 78.9   | 63.1   | 78.9                              | 39.5   | 78.9               | 39.6   | 7549               | 85.9   |
| 1985 | 5625.3         | 770.0          | 83.1   | 65.6   | 83.1                              | 44.9   | 83.4               | 45.0   | 7661               | 87.5   |
| 1986 | 5630.9         | 771.0          | 86.1   | 67.9   | 86.1                              | 49.5   | 83.4               | 49.3   | 7802               | 89.1   |
| 1987 | 5233.8         | 771.0          | 85.9   | 69.7   | 85.9                              | 53.2   | 77.5               | 52.1   | 7837               | 89.5   |
| 1988 | 5085.3         | 771.0          | 85.4   | 71.1   | 85.4                              | 56.1   | 75.1               | 54.2   | 7800               | 88.8   |
| 1989 | 4097.2         | 771.0          | 71.6   | 71.2   | 71.6                              | 57.4   | 60.7               | 54.8   | 6730               | 76.8   |
| 1990 | 4780.3         | 771.0          | 93.8   | 72.9   | 93.8                              | 60.2   | 70.8               | 56.0   | 8527               | 97.3   |
| 1991 | 3819.3         | 771.0          | 80.8   | 73.5   | 61.2                              | 60.3   | 56.5               | 56.0   | 6317               | 72.1   |
| 1992 | 3487.4         | 771.0          | 57.4   | 72.4   | 57.4                              | 60.1   | 51.5               | 55.7   | 5425               | 61.8   |
| 1993 | 0.0            | 771.0          | 0.0  | 67.9   | 0.0                               | 56.3   | 0.0                | 52.2   | 0                  | 0.0    |
| 1994 | 0.0            | 771.0          | 0.0  | 63.9   | 0.0                               | 53.0   | 0.0                | 49.2   | 0                  | 0.0    |
| 1995 | 3001.0         | 771.0          | 51.4   | 63.2   | 51.4                              | 52.9   | 44.4               | 48.9   | 4750               | 54.2   |
| 1996 | 4696.4         | 771.0          | 77.9   | 64.0   | 74.7                              | 54.1   | 69.3               | 50.0   | 7255               | 82.6   |
| 1997 | 5102.9         | 771.0          | 97.4   | 65.6   | 97.4                              | 56.2   | 75.6               | 51.3   | 8760               | 100.0  |
| 1998 | 3993.9         | 771.0          | 64.7   | 65.6   | 64.7                              | 56.6   | 59.1               | 51.6   | 5712               | 65.2   |
| 1999 | 6219.8         | 771.0          | 93.6   | 66.9   | 93.6                              | 58.3   | 92.1               | 53.5   | 8290               | 94.6   |
| 2000 | 5784.8         | 771.0          | 93.8   | 68.0   | 93.8                              | 59.9   | 85.4               | 54.9   | 8295               | 94.4   |
| 2001 | 5764.3         | 771.0          | 93.1   | 69.1   | 86.8                              | 61.0   | 85.3               | 56.1   | 8202               | 93.6   |
| 2002 | 860.0          | 771.0          | 13.1   | 66.8   | 13.1                              | 59.1   | 12.7               | 54.4   | 1167               | 13.3   |
| 2003 | 4905.8         | 771.0          | 76.3   | 67.2   | 76.3                              | 59.7   | 72.6               | 55.1   | 6688               | 76.3   |
| 2004 | 4873.2         | 771.0          | 73.3   | 67.4   | 73.3                              | 60.2   | 72.0               | 55.7   | 6504               | 74.0   |

## DE-13 BRUNSBUETTEL (KKB)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 06 Mar | 462.0 | 356.2   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                               |
| 25 Mar | 155.0 | 118.7   | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING              |
| 01 Apr | 41.0  | 32.0    | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING              |
| 04 Apr | 64.0  | 18.9    | PP   | E    | START-UP ACTIVITIES   |
| 15 Aug | 20.0  | 28.0    | UF1  | A31  | REPAIR OF VALVE RL38S103 AND TURBINE CONTROL SYSTEM CALIBRATION |
| 23 Aug | 200.0 | 154.5   | UF2  | A42  | SHORT CIRCUIT IN THE INTERNAL GRID                              |
| 01 Sep | 720.0 | 555.1   | UF2  | A42  | SHORT CIRCUIT IN THE INTERNAL GRID                              |
| 01 Oct | 644.0 | 495.4   | UF2  | A42  | SHORT CIRCUIT IN THE INTERNAL GRID                              |
| 27 Oct | 46.0  | 18.6    | UP2  | A42  | START-UP FROM FULL OUTAGE                                       |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1584      |          |  | 1420      |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 462             |           |          | 631                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 475                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 0  | 25        | 29       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         |          |
| M. Governmental requirements or court decisions                                      |                 |           |          |  |           | 6        |
| Z. Others  |                 | 196       |          |  | 62        |          |
| Subtotal   | 462             | 1780      | 0        | 1106                                     | 1512      | 35       |
| Total  |                 | 2242      |          |  | 2653      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1976 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 3  |
| 13. Reactor Auxiliary Systems                  |                 | 780                                      |
| 15. Reactor Cooling Systems                    |                 | 113                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    | 20              | 504                                      |
| 32. Feedwater and Main Steam System            |                 | 0  |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     |                 | 6  |
| 42. Electrical Power Supply Systems            | 1564            |  |
| Total  | 1584            | 1406                                     |

**DE-33 EMSLAND (KKE)**

Operator: RWE (RWE ENERGIE AG)

Contractor: SIEM, KWU (SIEMENS AG, KRAFTWERK UNION AG)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1329.0 MW(e)  
 Design Net RUP: 1242.0 MW(e)  
 Design Discharge Burnup: 36000 MW.d/t

**2. Production Summary 2004**

Energy Production: 11147.2 GW(e).h  
 Energy Availability Factor: 96.1%  
 Load Factor: 95.5%  
 Operating Factor: 96.3%  
 Energy Unavailability Factor: 3.9%  
 Total Off-line Time: 328 hours

**3. 2004 Monthly Performance Data**

|          | Jan    | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|----------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| GW(e).h  | 1000.2 | 933.0 | 996.7 | 957.2 | 936.7 | 488.1 | 972.6 | 973.6 | 938.8 | 989.0 | 962.3 | 999.1 | 11147.2 |
| EAF (%)  | 100.0  | 100.0 | 100.0 | 100.0 | 100.0 | 53.5  | 100.0 | 100.0 | 98.8  | 100.0 | 100.0 | 100.0 | 96.1    |
| UCF (%)  | 100.0  | 100.0 | 100.0 | 100.0 | 100.0 | 53.5  | 100.0 | 100.0 | 98.8  | 100.0 | 100.0 | 100.0 | 96.1    |
| LF (%)   | 101.2  | 100.9 | 100.8 | 100.2 | 94.7  | 51.0  | 98.4  | 98.5  | 98.1  | 99.9  | 100.6 | 101.0 | 95.5    |
| OF (%)   | 100.0  | 100.0 | 99.9  | 100.1 | 100.0 | 54.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.3    |
| EUF (%)  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 46.5  | 0.0   | 0.0   | 1.2   | 0.0   | 0.0   | 0.0   | 3.9     |
| PUF (%)  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 39.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.2     |
| UCLF (%) | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 7.3   | 0.0   | 0.0   | 1.2   | 0.0   | 0.0   | 0.0   | 0.7     |
| XUF (%)  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 10 Aug 1982  
 Date of First Criticality: 14 Apr 1988  
 Date of Grid Connection: 19 Apr 1988  
 Date of Commercial Operation: 20 Jun 1988

Lifetime Generation: 174489.2 GW(e).h  
 Cumulative Energy Availability Factor: 93.0%  
 Cumulative Load Factor: 93.2%  
 Cumulative Unit Capability Factor: 78.8%  
 Cumulative Energy Unavailability Factor: 7.0%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1988 | 5694.9            | 1262.0            | 0.0  | 0.0    | 98.2                                 | 100.0  | 51.4               | 0.0    | 4516                  | 51.4   |
| 1989 | 9857.2            | 1242.0            | 88.7   | 88.7   | 88.7                                 | 88.7   | 90.6               | 90.6   | 7794                  | 89.0   |
| 1990 | 10039.2           | 1242.0            | 90.4   | 89.5   | 90.4                                 | 89.5   | 91.2               | 91.4   | 7956                  | 90.8   |
| 1991 | 9287.3            | 1242.0            | 82.0   | 87.0   | 82.0                                 | 87.0   | 85.4               | 89.4   | 7304                  | 83.4   |
| 1992 | 10158.0           | 1290.0            | 90.2   | 87.8   | 90.2                                 | 87.8   | 89.6               | 89.5   | 7933                  | 90.3   |
| 1993 | 10477.1           | 1290.0            | 92.9   | 88.9   | 92.9                                 | 88.8   | 92.7               | 90.1   | 8147                  | 93.0   |
| 1994 | 10526.7           | 1290.0            | 93.4   | 89.6   | 93.4                                 | 89.6   | 93.2               | 90.6   | 8193                  | 93.5   |
| 1995 | 10495.7           | 1290.0            | 93.1   | 90.1   | 93.1                                 | 90.1   | 92.9               | 91.0   | 8168                  | 93.2   |
| 1996 | 10557.3           | 1290.0            | 93.2   | 90.5   | 93.2                                 | 90.5   | 93.2               | 91.3   | 8195                  | 93.3   |
| 1997 | 10650.2           | 1290.0            | 94.6   | 91.0   | 94.6                                 | 91.0   | 94.2               | 91.6   | 8298                  | 94.7   |
| 1998 | 10794.7           | 1290.0            | 95.7   | 91.5   | 95.7                                 | 91.4   | 95.5               | 92.0   | 8388                  | 95.8   |
| 1999 | 10729.2           | 1290.0            | 96.0   | 91.9   | 96.0                                 | 91.9   | 94.9               | 92.3   | 8413                  | 96.0   |
| 2000 | 10802.0           | 1306.0            | 94.9   | 92.1   | 94.9                                 | 92.1   | 94.2               | 92.4   | 8339                  | 94.9   |
| 2001 | 10933.2           | 1329.0            | 94.2   | 92.3   | 93.8                                 | 92.3   | 93.9               | 92.5   | 8257                  | 94.3   |
| 2002 | 11242.3           | 1329.0            | 96.9   | 92.6   | 96.9                                 | 92.6   | 96.6               | 92.8   | 8497                  | 97.0   |
| 2003 | 11097.0           | 1329.0            | 95.8   | 92.8   | 95.8                                 | 92.8   | 95.3               | 93.0   | 8401                  | 95.9   |
| 2004 | 11147.2           | 1329.0            | 96.1   | 93.0   | 96.1                                 | 93.0   | 95.5               | 93.2   | 8456                  | 96.3   |

**DE-33 EMSLAND (KKE)****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 Jun | 280.0 | 375.0   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 17 Jun | 48.0  | 69.8    | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 33        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 280             |           |          | 470   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 0         |          |
| Z. Others  |                 | 48        |          |   |           |          |
| Subtotal   | 280             | 48        | 0        | 470   | 33        | 0        |
| Total  |                 | 328       |          |   | 503       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 15. Reactor Cooling Systems         |                    | 19  |
| 31. Turbine and auxiliaries         |                    | 4   |
| 41. Main Generator Systems          |                    | 8   |
| 42. Electrical Power Supply Systems |                    | 1   |
| Total                               | 0                  | 32  |

**DE-23 GRAFENRHEINFELD (KKG)**

Operator: EON (EON Kernkraft Ges.m.b.H)

Contractor: KWU (SIEMENS KRAFTWERK UNION AG)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1275.0 MW(e)  
 Design Net RUP: 1225.0 MW(e)  
 Design Discharge Burnup: 34100 MW.d/t

**2. Production Summary 2004**

Energy Production: 10129.4 GW(e).h  
 Energy Availability Factor: 91.6%  
 Load Factor: 90.4%  
 Operating Factor: 91.7%  
 Energy Unavailability Factor: 8.4%  
 Total Off-line Time: 725 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|----------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|---------|
| GW(e).h  | 951.9 | 887.4 | 947.0 | 885.9 | 15.9 | 885.6 | 913.1 | 914.9 | 905.9 | 948.3 | 918.9 | 954.7 | 10129.4 |
| EAF (%)  | 100.0 | 99.9  | 100.0 | 98.1  | 3.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.6    |
| UCF (%)  | 100.0 | 99.9  | 100.0 | 98.1  | 3.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.6    |
| LF (%)   | 100.3 | 100.0 | 99.8  | 96.6  | 1.7  | 96.5  | 96.3  | 96.4  | 98.7  | 99.8  | 100.1 | 100.6 | 90.4    |
| OF (%)   | 100.0 | 100.0 | 99.9  | 99.2  | 3.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.7    |
| EUF (%)  | 0.0   | 0.1   | 0.0   | 1.9   | 96.9 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.4     |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 1.9   | 76.6 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.6     |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 20.3 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.7     |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Jan 1975      Lifetime Generation: 215558.1 GW(e).h  
 Date of First Criticality: 09 Dec 1981      Cumulative Energy Availability Factor: 87.6%  
 Date of Grid Connection: 21 Dec 1981      Cumulative Load Factor: 85.7%  
 Date of Commercial Operation: 17 Jun 1982      Cumulative Unit Capability Factor: 77.9%  
    Cumulative Energy Unavailability Factor: 12.4%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 9412.0            | 1229.0            | 87.5   | 87.5   | 87.5                                 | 87.5   | 87.4               | 87.4   | 7898                  | 90.2   |
| 1984 | 9590.0            | 1229.0            | 88.7   | 88.1   | 88.7                                 | 88.1   | 88.8               | 88.1   | 7890                  | 89.8   |
| 1985 | 9741.6            | 1235.0            | 90.6   | 88.9   | 90.6                                 | 88.9   | 90.0               | 88.8   | 8155                  | 93.1   |
| 1986 | 8718.2            | 1235.0            | 80.9   | 86.9   | 80.9                                 | 86.9   | 80.6               | 86.7   | 7179                  | 82.0   |
| 1987 | 8360.6            | 1235.0            | 77.8   | 85.1   | 77.8                                 | 85.1   | 77.3               | 84.8   | 7509                  | 85.7   |
| 1988 | 8799.9            | 1235.0            | 84.3   | 85.0   | 84.3                                 | 85.0   | 81.1               | 84.2   | 7604                  | 86.6   |
| 1989 | 9401.7            | 1235.0            | 88.0   | 85.4   | 88.0                                 | 85.4   | 86.9               | 84.6   | 7840                  | 89.5   |
| 1990 | 7910.3            | 1235.0            | 73.5   | 83.9   | 73.5                                 | 83.9   | 73.1               | 83.2   | 6743                  | 77.0   |
| 1991 | 9753.5            | 1235.0            | 92.5   | 84.9   | 92.5                                 | 84.9   | 90.2               | 83.9   | 8114                  | 92.6   |
| 1992 | 9657.2            | 1235.0            | 91.8   | 85.6   | 91.8                                 | 85.6   | 89.0               | 84.4   | 8074                  | 91.9   |
| 1993 | 8845.9            | 1235.0            | 84.5   | 85.5   | 84.5                                 | 85.5   | 81.8               | 84.2   | 7524                  | 85.9   |
| 1994 | 9674.5            | 1275.0            | 88.8   | 85.8   | 88.8                                 | 85.8   | 86.6               | 84.4   | 8116                  | 92.6   |
| 1995 | 9946.0            | 1275.0            | 93.5   | 86.4   | 93.5                                 | 86.4   | 89.1               | 84.8   | 8193                  | 93.5   |
| 1996 | 9528.6            | 1275.0            | 89.1   | 86.6   | 89.1                                 | 86.6   | 85.1               | 84.8   | 7886                  | 89.8   |
| 1997 | 10131.0           | 1275.0            | 93.5   | 87.0   | 93.5                                 | 87.0   | 90.7               | 85.2   | 8202                  | 93.6   |
| 1998 | 9147.0            | 1275.0            | 84.6   | 86.9   | 84.6                                 | 86.9   | 81.9               | 85.0   | 7429                  | 84.8   |
| 1999 | 8336.7            | 1275.0            | 76.1   | 86.2   | 76.1                                 | 86.2   | 74.6               | 84.4   | 6737                  | 76.9   |
| 2000 | 9600.9            | 1275.0            | 89.1   | 86.4   | 89.1                                 | 86.4   | 85.7               | 84.4   | 7829                  | 89.1   |
| 2001 | 10573.9           | 1275.0            | 95.7   | 86.9   | 95.7                                 | 86.9   | 94.7               | 85.0   | 8392                  | 95.8   |
| 2002 | 9889.9            | 1275.0            | 91.0   | 87.1   | 91.0                                 | 87.1   | 88.5               | 85.2   | 7977                  | 91.1   |
| 2003 | 10270.2           | 1275.0            | 93.4   | 87.4   | 93.4                                 | 87.4   | 92.0               | 85.5   | 8196                  | 93.6   |
| 2004 | 10129.4           | 1275.0            | 91.6   | 87.6   | 91.6                                 | 87.6   | 90.4               | 85.7   | 8059                  | 91.7   |



## DE-23 GRAFENRHEINFELD (KKG)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 30 Apr | 7.0   | 9.0     | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 01 May | 567.0 | 724.2   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 24 May | 151.0 | 192.6   | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                       |                 |           |          |   | 156       |          |
| C. Inspection, maintenance or repair<br>combined with refuelling | 574             |           |          | 777   |           |          |
| Z. Others  |                 | 151       |          |   |           |          |
| Subtotal   | 574             | 151       | 0        | 777   | 156       | 0        |
| Total  | 725             |           |          | 933   |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1983 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 14. Safety Systems                  |                    | 0   |
| 15. Reactor Cooling Systems         |                    | 42  |
| 16. Steam generation systems        |                    | 27  |
| 31. Turbine and auxiliaries         |                    | 32  |
| 32. Feedwater and Main Steam System |                    | 11  |
| 41. Main Generator Systems          |                    | 41  |
| Total                               | 0                  | 153   |

# DE-27 GROHNDE (KWG)

**Operator:** EON (EON Kernkraft Ges.m.b.H)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1360.0 MW(e)  
**Design Net RUP:** 1289.0 MW(e)  
**Design Discharge Burnup:** 34000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10695.4 GW(e).h  
**Energy Availability Factor:** 93.6%  
**Load Factor:** 89.5%  
**Operating Factor:** 93.9%  
**Energy Unavailability Factor:** 6.4%  
**Total Off-line Time:** 539 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 1011.3 | 945.0 | 985.0 | 946.6 | 950.6 | 680.8 | 369.8 | 948.5 | 928.2 | 983.1 | 965.7 | 981.0 | 10695.4 |
| <b>EAF (%)</b>  | 100.0  | 99.9  | 99.8  | 100.0 | 99.8  | 86.3  | 38.3  | 100.0 | 100.0 | 100.0 | 99.8  | 99.9  | 93.6    |
| <b>UCF (%)</b>  | 100.0  | 99.9  | 99.8  | 100.0 | 99.8  | 86.3  | 38.3  | 100.0 | 100.0 | 100.0 | 99.8  | 99.9  | 93.6    |
| <b>LF (%)</b>   | 99.9   | 99.8  | 97.3  | 96.8  | 93.9  | 69.5  | 36.5  | 93.7  | 94.8  | 97.0  | 98.6  | 97.0  | 89.5    |
| <b>OF (%)</b>   | 100.0  | 100.0 | 99.9  | 100.1 | 100.0 | 87.4  | 39.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.9    |
| <b>EUF (%)</b>  | 0.0    | 0.1   | 0.2   | 0.0   | 0.2   | 13.7  | 61.7  | 0.0   | 0.0   | 0.0   | 0.2   | 0.1   | 6.4     |
| <b>PUF (%)</b>  | 0.0    | 0.1   | 0.0   | 0.0   | 0.1   | 13.3  | 51.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 5.5     |
| <b>UCLF (%)</b> | 0.0    | 0.0   | 0.2   | 0.0   | 0.1   | 0.4   | 10.0  | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 0.9     |
| <b>XUF (%)</b>  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1976  
**Date of First Criticality:** 01 Sep 1984  
**Date of Grid Connection:** 04 Sep 1984  
**Date of Commercial Operation:** 01 Feb 1985

**Lifetime Generation:** 213865.9 GW(e).h  
**Cumulative Energy Availability Factor:** 92.0%  
**Cumulative Load Factor:** 90.7%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 8.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 1214.0         | 1336.0         | 0.0  | 0.0    | 76.4                              | 100.0  | 10.5               | 0.0    | 1424               | 16.4   |
| 1985 | 10871.1        | 1300.0         | 0.0  | 0.0    | 95.6                              | 100.0  | 95.5               | 0.0    | 8406               | 96.0   |
| 1986 | 10205.4        | 1300.0         | 89.7   | 89.7   | 89.7                              | 89.7   | 89.6               | 89.6   | 8120               | 92.7   |
| 1987 | 9648.5         | 1300.0         | 86.4   | 88.1   | 86.4                              | 88.1   | 84.7               | 87.2   | 7979               | 91.1   |
| 1988 | 10208.3        | 1300.0         | 90.8   | 89.0   | 90.8                              | 89.0   | 89.4               | 87.9   | 8104               | 92.3   |
| 1989 | 10279.4        | 1300.0         | 90.3   | 89.3   | 90.3                              | 89.3   | 90.3               | 88.5   | 8058               | 92.0   |
| 1990 | 10123.6        | 1300.0         | 88.1   | 89.1   | 88.1                              | 89.1   | 87.9               | 88.6   | 7872               | 89.9   |
| 1991 | 9957.8         | 1325.0         | 86.4   | 88.6   | 86.4                              | 88.6   | 85.8               | 88.1   | 7603               | 86.8   |
| 1992 | 10424.3        | 1325.0         | 90.0   | 88.8   | 90.0                              | 88.8   | 89.6               | 88.3   | 7981               | 90.9   |
| 1993 | 10680.1        | 1325.0         | 92.8   | 89.3   | 92.8                              | 89.3   | 92.0               | 88.8   | 8147               | 93.0   |
| 1994 | 10266.5        | 1325.0         | 91.9   | 89.6   | 91.9                              | 89.6   | 88.5               | 88.7   | 8063               | 92.0   |
| 1995 | 10771.2        | 1349.0         | 91.1   | 89.8   | 91.1                              | 89.8   | 91.1               | 89.0   | 7986               | 91.2   |
| 1996 | 10589.8        | 1360.0         | 88.9   | 89.7   | 88.9                              | 89.7   | 88.6               | 89.0   | 7861               | 89.5   |
| 1997 | 11864.7        | 1360.0         | 100.0  | 90.6   | 100.0                             | 90.6   | 99.6               | 89.9   | 8760               | 100.0  |
| 1998 | 11146.3        | 1360.0         | 94.5   | 90.9   | 94.5                              | 90.9   | 93.6               | 90.2   | 8301               | 94.8   |
| 1999 | 11212.1        | 1360.0         | 95.3   | 91.2   | 95.3                              | 91.2   | 94.1               | 90.5   | 8351               | 95.3   |
| 2000 | 11055.9        | 1360.0         | 93.7   | 91.4   | 93.7                              | 91.4   | 92.5               | 90.6   | 8250               | 93.9   |
| 2001 | 10926.6        | 1360.0         | 94.7   | 91.6   | 94.2                              | 91.5   | 91.7               | 90.7   | 8310               | 94.9   |
| 2002 | 10791.9        | 1360.0         | 93.8   | 91.7   | 93.8                              | 91.7   | 90.6               | 90.7   | 8233               | 94.0   |
| 2003 | 10933.0        | 1360.0         | 95.0   | 91.9   | 95.0                              | 91.9   | 91.8               | 90.7   | 8343               | 95.2   |
| 2004 | 10695.4        | 1360.0         | 93.6   | 92.0   | 93.6                              | 92.0   | 89.5               | 90.7   | 8245               | 93.9   |

## DE-27 GROHNDE (KWG)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 26 Jun | 91.0  | 129.5   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 01 Jul | 384.0 | 522.2   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 17 Jul | 46.0  | 84.3    | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |
| 22 Jul | 18.0  | 16.5    | UF2  | A32  | MAIN FEEDWATER PUMP FAILURE                        |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 18        |          |  | 51        |          |
| C. Inspection, maintenance or repair combined with refuelling | 475             |           |          | 487                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 2  |           |          |
| Z. Others   |                 | 46        |          |  | 11        |          |
| Subtotal  | 475             | 64        | 0        | 489                                      | 62        | 0        |
| Total   |                 | 539       |          |  | 551       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 5  |
| 15. Reactor Cooling Systems         |                 | 4  |
| 32. Feedwater and Main Steam System | 18              | 0  |
| 41. Main Generator Systems          |                 | 35                                       |
| 42. Electrical Power Supply Systems |                 | 5  |
| Total                               | 18              | 49                                       |

**DE-26 GUNDREMMINGEN-B (GUN-B)**

Operator: RWE (RWE ENERGIE AG)

Contractor: KWU (SIEMENS KRAFTWERK UNION AG)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1284.0 MW(e)  
 Design Net RUP: 1244.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 10283.1 GW(e).h  
 Energy Availability Factor: 91.3%  
 Load Factor: 91.2%  
 Operating Factor: 93.4%  
 Energy Unavailability Factor: 8.7%  
 Total Off-line Time: 576 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| GW(e).h  | 960.8 | 889.5 | 895.8 | 650.9 | 352.7 | 912.7 | 944.9 | 937.4 | 890.2 | 958.3 | 924.8 | 965.0 | 10283.1 |
| EAF (%)  | 100.0 | 99.6  | 94.4  | 71.0  | 36.8  | 99.3  | 99.9  | 99.4  | 96.8  | 100.0 | 99.1  | 100.0 | 91.3    |
| UCF (%)  | 100.0 | 99.6  | 94.4  | 71.0  | 36.8  | 99.3  | 99.9  | 99.4  | 96.8  | 100.0 | 99.1  | 100.0 | 91.3    |
| LF (%)   | 100.6 | 99.5  | 93.8  | 70.5  | 36.9  | 98.7  | 98.9  | 98.1  | 96.3  | 100.2 | 100.0 | 101.0 | 91.2    |
| OF (%)   | 100.0 | 100.0 | 99.9  | 82.5  | 39.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.4    |
| EUF (%)  | 0.0   | 0.4   | 5.6   | 29.0  | 63.2  | 0.7   | 0.1   | 0.6   | 3.2   | 0.0   | 0.9   | 0.0   | 8.7     |
| PUF (%)  | 0.0   | 0.0   | 3.6   | 29.0  | 63.2  | 0.0   | 0.0   | 0.0   | 2.5   | 0.0   | 0.9   | 0.0   | 8.3     |
| UCLF (%) | 0.0   | 0.4   | 2.0   | 0.0   | 0.0   | 0.7   | 0.1   | 0.6   | 0.7   | 0.0   | 0.0   | 0.0   | 0.4     |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 20 Jul 1976  
 Date of First Criticality: 09 Mar 1984  
 Date of Grid Connection: 16 Mar 1984  
 Date of Commercial Operation: 19 Jul 1984

Lifetime Generation: 185597.0 GW(e).h  
 Cumulative Energy Availability Factor: 87.9%  
 Cumulative Load Factor: 81.1%  
 Cumulative Unit Capability Factor: 78.1%  
 Cumulative Energy Unavailability Factor: 12.1%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1984 | 6132.0            | 1250.0            | 0.0  | 0.0    | 76.7                                 | 100.0  | 58.4               | 0.0    | 5744                  | 68.4   |
| 1985 | 9147.5            | 1244.0            | 85.5   | 85.5   | 85.5                                 | 85.5   | 83.9               | 83.9   | 7852                  | 89.6   |
| 1986 | 8298.3            | 1244.0            | 83.1   | 84.3   | 83.1                                 | 84.3   | 76.1               | 80.0   | 7434                  | 84.9   |
| 1987 | 8413.2            | 1240.0            | 84.4   | 84.3   | 84.4                                 | 84.3   | 77.5               | 79.2   | 7876                  | 89.9   |
| 1988 | 7079.3            | 1240.0            | 83.7   | 84.2   | 83.6                                 | 84.2   | 65.0               | 75.6   | 7706                  | 87.7   |
| 1989 | 9653.7            | 1240.0            | 97.8   | 86.9   | 97.9                                 | 86.9   | 88.9               | 78.3   | 8743                  | 99.8   |
| 1990 | 8442.3            | 1240.0            | 83.6   | 86.3   | 83.6                                 | 86.4   | 77.7               | 78.2   | 7717                  | 88.1   |
| 1991 | 8002.7            | 1240.0            | 77.8   | 85.1   | 74.8                                 | 84.7   | 73.7               | 77.5   | 7520                  | 85.8   |
| 1992 | 7366.8            | 1240.0            | 78.4   | 84.3   | 78.4                                 | 83.9   | 67.6               | 76.3   | 7073                  | 80.5   |
| 1993 | 8015.8            | 1240.0            | 84.9   | 84.3   | 84.9                                 | 84.0   | 73.8               | 76.0   | 7632                  | 87.1   |
| 1994 | 8825.6            | 1240.0            | 92.1   | 85.1   | 91.7                                 | 84.8   | 81.2               | 76.5   | 8213                  | 93.8   |
| 1995 | 8681.7            | 1284.0            | 84.8   | 85.1   | 84.7                                 | 84.8   | 77.2               | 76.6   | 7535                  | 86.0   |
| 1996 | 9370.9            | 1284.0            | 88.6   | 85.4   | 88.6                                 | 85.1   | 83.1               | 77.2   | 7903                  | 90.0   |
| 1997 | 9206.1            | 1284.0            | 92.8   | 86.0   | 92.8                                 | 85.7   | 81.8               | 77.5   | 8264                  | 94.3   |
| 1998 | 9072.1            | 1284.0            | 89.2   | 86.2   | 89.2                                 | 86.0   | 80.7               | 77.8   | 7996                  | 91.3   |
| 1999 | 9595.4            | 1284.0            | 93.3   | 86.7   | 93.3                                 | 86.5   | 85.3               | 78.3   | 8257                  | 94.3   |
| 2000 | 9336.4            | 1284.0            | 88.8   | 86.8   | 88.8                                 | 86.6   | 82.8               | 78.6   | 7887                  | 89.8   |
| 2001 | 10216.7           | 1284.0            | 94.8   | 87.3   | 94.8                                 | 87.1   | 90.8               | 79.3   | 8405                  | 95.9   |
| 2002 | 9976.9            | 1284.0            | 92.1   | 87.6   | 92.1                                 | 87.4   | 88.7               | 79.8   | 8139                  | 92.9   |
| 2003 | 10480.4           | 1284.0            | 94.4   | 87.9   | 94.4                                 | 87.8   | 93.2               | 80.5   | 8325                  | 95.0   |
| 2004 | 10283.1           | 1284.0            | 91.3   | 88.1   | 91.3                                 | 87.9   | 91.2               | 81.1   | 8208                  | 93.4   |

## DE-26 GUNDREMMINGEN-B (GUN-B)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                      |
|--------|-------|---------|------|------|--|
| 08 Mar | 263.0 | 18.6    | UP1  | Z    | LOWERING ROTATION DUE TO DECREASE STEAM HUMIDITY |
| 20 Mar | 264.0 | 30.6    | PP   | Z    | LOWERING ROTATION DUE TO DECREASE STEAM HUMIDITY |
| 01 Apr | 576.0 | 101.1   | PP   | Z    | LOWERING ROTATION DUE TO DECREASE STEAM HUMIDITY |
| 25 Apr | 127.0 | 167.0   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                |
| 01 May | 449.0 | 597.0   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                |
| 17 Sep | 69.0  | 22.9    | PP   | E    | START-UP ACTIVITIES                              |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 15        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 576             |           |          | 723   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 14  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 6         |          |
| Subtotal   | 576             | 0         | 0        | 737   | 21        | 0        |
| Total  |                 | 576       |          |   | 758       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 14. Safety Systems                  |                    | 0   |
| 15. Reactor Cooling Systems         |                    | 0   |
| 31. Turbine and auxiliaries         |                    | 4   |
| 32. Feedwater and Main Steam System |                    | 10  |
| Total                               | 0                  | 14  |

# DE-28 GUNDREMMINGEN-C (GUN-C)

**Operator:** EON (EON Kernkraft Ges.m.b.H)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1288.0 MW(e)  
**Design Net RUP:** 1249.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8470.5 GW(e).h  
**Energy Availability Factor:** 74.9%  
**Load Factor:** 74.9%  
**Operating Factor:** 76.8%  
**Energy Unavailability Factor:** 25.1%  
**Total Off-line Time:** 2037 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 967.1 | 899.7 | 960.3 | 925.5 | 911.7 | 805.0 | 90.2 | 0.0   | 64.0 | 951.9 | 932.2 | 963.0 | 8470.5 |
| <b>EAF (%)</b>  | 100.0 | 99.7  | 100.0 | 100.0 | 96.4  | 88.0  | 9.5  | 0.0   | 7.0  | 99.4  | 100.0 | 100.0 | 74.9   |
| <b>UCF (%)</b>  | 100.0 | 99.7  | 100.0 | 100.0 | 96.4  | 88.0  | 9.6  | 0.0   | 7.0  | 99.4  | 100.0 | 100.0 | 74.9   |
| <b>LF (%)</b>   | 100.9 | 100.4 | 100.2 | 99.9  | 95.1  | 86.8  | 9.4  | 0.0   | 6.9  | 99.2  | 100.5 | 100.5 | 74.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 12.0 | 0.0   | 11.4 | 100.0 | 100.0 | 100.0 | 76.8   |
| <b>EUF (%)</b>  | 0.0   | 0.3   | 0.0   | 0.0   | 3.6   | 12.0  | 90.5 | 100.0 | 93.0 | 0.6   | 0.0   | 0.0   | 25.1   |
| <b>PUF (%)</b>  | 0.0   | 0.3   | 0.0   | 0.0   | 0.4   | 11.2  | 53.6 | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 5.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 3.2   | 0.8   | 36.8 | 100.0 | 93.0 | 0.6   | 0.0   | 0.0   | 19.6   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 20 Jul 1976  
**Date of First Criticality:** 26 Oct 1984  
**Date of Grid Connection:** 02 Nov 1984  
**Date of Commercial Operation:** 18 Jan 1985

**Lifetime Generation:** 175833.7 GW(e).h  
**Cumulative Energy Availability Factor:** 86.0%  
**Cumulative Load Factor:** 78.5%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 14.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 1310.0         | 1280.0         | 0.0  | 0.0    | 90.9                              | 100.0  | 11.7               | 0.0    | 1258               | 14.4   |
| 1985 | 9149.6         | 1244.0         | 85.5   | 85.5   | 85.5                              | 85.5   | 84.0               | 84.0   | 7663               | 87.5   |
| 1986 | 8018.5         | 1244.0         | 84.7   | 85.1   | 84.7                              | 85.1   | 73.6               | 78.8   | 7945               | 90.7   |
| 1987 | 7333.2         | 1248.0         | 74.7   | 81.6   | 74.7                              | 81.6   | 67.1               | 74.9   | 7345               | 83.8   |
| 1988 | 7456.1         | 1248.0         | 88.3   | 83.3   | 88.3                              | 83.3   | 68.0               | 73.1   | 7887               | 89.8   |
| 1989 | 7884.5         | 1248.0         | 84.2   | 83.5   | 84.2                              | 83.5   | 72.1               | 72.9   | 7722               | 88.2   |
| 1990 | 8264.8         | 1248.0         | 80.2   | 82.9   | 80.2                              | 82.9   | 75.6               | 73.4   | 7519               | 85.8   |
| 1991 | 8341.3         | 1248.0         | 85.9   | 83.3   | 85.9                              | 83.3   | 76.3               | 73.8   | 7709               | 88.0   |
| 1992 | 9381.0         | 1248.0         | 98.9   | 85.3   | 98.9                              | 85.3   | 85.6               | 75.3   | 8784               | 100.0  |
| 1993 | 6689.2         | 1248.0         | 79.1   | 84.6   | 79.1                              | 84.6   | 61.2               | 73.7   | 7051               | 80.5   |
| 1994 | 7502.0         | 1248.0         | 81.1   | 84.3   | 80.7                              | 84.2   | 68.6               | 73.2   | 7147               | 81.6   |
| 1995 | 9376.7         | 1288.0         | 89.3   | 84.7   | 89.3                              | 84.7   | 83.1               | 74.1   | 7929               | 90.5   |
| 1996 | 9509.0         | 1288.0         | 91.7   | 85.3   | 91.7                              | 85.3   | 84.0               | 75.0   | 8176               | 93.1   |
| 1997 | 9013.6         | 1288.0         | 89.1   | 85.6   | 88.7                              | 85.6   | 79.9               | 75.4   | 7861               | 89.7   |
| 1998 | 9629.5         | 1288.0         | 91.5   | 86.1   | 91.5                              | 86.0   | 85.3               | 76.1   | 8153               | 93.1   |
| 1999 | 8187.6         | 1288.0         | 77.0   | 85.4   | 77.0                              | 85.4   | 72.6               | 75.9   | 6942               | 79.2   |
| 2000 | 10176.8        | 1288.0         | 94.6   | 86.0   | 94.6                              | 86.0   | 90.0               | 76.8   | 8375               | 95.3   |
| 2001 | 9838.4         | 1288.0         | 90.7   | 86.3   | 87.2                              | 86.0   | 87.2               | 77.4   | 8016               | 91.5   |
| 2002 | 10335.8        | 1288.0         | 93.4   | 86.7   | 93.4                              | 86.5   | 91.6               | 78.2   | 8301               | 94.8   |
| 2003 | 9965.6         | 1288.0         | 89.2   | 86.8   | 89.2                              | 86.6   | 88.3               | 78.7   | 7931               | 90.5   |
| 2004 | 8470.5         | 1288.0         | 74.9   | 86.2   | 74.9                              | 86.0   | 74.9               | 78.5   | 6747               | 76.8   |

## DE-28 GUNDREMMINGEN-C (GUN-C)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                      |
|--------|-------|---------|------|------|--|
| 06 May | 402.0 | 14.2    | UP1  | Z    | LOWERING ROTATION DUE TO DECREASE STEAM HUMIDITY |
| 24 May | 191.0 | 16.2    | UP1  | Z    | LOWERING ROTATION DUE TO DECREASE STEAM HUMIDITY |
| 08 Jun | 552.0 | 93.1    | PP   | Z    | LOWERING ROTATION DUE TO DECREASE STEAM HUMIDITY |
| 01 Jul | 85.0  | 19.1    | PP   | Z    | LOWERING ROTATION DUE TO DECREASE STEAM HUMIDITY |
| 04 Jul | 381.0 | 494.8   | PF   | B    | REFUELLING                                       |
| 20 Jul | 274.0 | 352.9   | UF2  | A41  | DAMAGE IN THE BASEMENT OF THE GENERATOR          |
| 01 Aug | 19.0  | 24.9    | UF2  | A41  | DAMAGE IN THE BASEMENT OF THE GENERATOR          |
| 01 Aug | 94.0  | 120.6   | UF2  | A15  | MAIN STEM ISOLATION VALVE REPLACE                |
| 05 Aug | 631.0 | 812.7   | UF2  | A41  | SHORT CIRCUIT IN THE BASEMENT OF THE GENERATOR   |
| 01 Sep | 638.0 | 821.4   | UF2  | A41  | GENERATOR REPLACEMENT                            |
| 27 Sep | 82.0  | 40.5    | UP2  | A41  | START-UP   |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 1656      |          |   | 122       |          |
| B. Refuelling without a maintenance                           | 381             |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 749   |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 21  |           |          |
| E. Testing of plant systems or components                     |                 |           |          |   | 2         |          |
| Subtotal  | 381             | 1656      | 0        | 770   | 124       | 0        |
| Total   |                 | 2037      |          |   | 894       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 14. Safety Systems                  |                    | 17  |
| 15. Reactor Cooling Systems         | 94                 | 6   |
| 31. Turbine and auxiliaries         |                    | 40  |
| 32. Feedwater and Main Steam System |                    | 0   |
| 41. Main Generator Systems          | 1562               | 57  |
| Total                               | 1656               | 120   |

# DE-16 ISAR-1 (KKI 1)

**Operator:** EON (EON Kernkraft Ges.m.b.H)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 878.0 MW(e)  
**Design Net RUP:** 870.0 MW(e)  
**Design Discharge Burnup:** 27600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6771.1 GW(e).h  
**Energy Availability Factor:** 89.1%  
**Load Factor:** 87.8%  
**Operating Factor:** 90.9%  
**Energy Unavailability Factor:** 10.9%  
**Total Off-line Time:** 800 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 659.5 | 603.1 | 658.1 | 621.9 | 655.7 | 630.8 | 639.1 | 575.9 | 472.3 | 37.3 | 590.4 | 627.0 | 6771.1 |
| <b>EAF (%)</b>  | 100.0 | 97.9  | 100.0 | 97.7  | 100.0 | 100.0 | 99.2  | 91.9  | 84.4  | 8.9  | 94.3  | 95.7  | 89.1   |
| <b>UCF (%)</b>  | 100.0 | 97.9  | 100.0 | 97.7  | 100.0 | 100.0 | 99.3  | 91.9  | 84.4  | 8.9  | 94.3  | 95.7  | 89.1   |
| <b>LF (%)</b>   | 101.0 | 98.7  | 100.7 | 98.5  | 100.4 | 99.8  | 97.8  | 88.2  | 74.7  | 5.7  | 93.4  | 96.0  | 87.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 86.5  | 10.1 | 96.5  | 98.9  | 90.9   |
| <b>EUF (%)</b>  | 0.0   | 2.1   | 0.0   | 2.3   | 0.0   | 0.0   | 0.8   | 8.1   | 15.6  | 91.1 | 5.7   | 4.3   | 10.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 2.3   | 0.0   | 0.0   | 0.0   | 5.4   | 15.6  | 67.2 | 0.0   | 0.0   | 7.6    |
| <b>UCLF (%)</b> | 0.0   | 2.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 2.7   | 0.0   | 23.8 | 5.7   | 4.3   | 3.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1972  
**Date of First Criticality:** 20 Nov 1977  
**Date of Grid Connection:** 03 Dec 1977  
**Date of Commercial Operation:** 21 Mar 1979

**Lifetime Generation:** 154936.1 GW(e).h  
**Cumulative Energy Availability Factor:** 81.5%  
**Cumulative Load Factor:** 77.1%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 18.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 7143.0         | 870.0          | 93.9   | 67.5   | 93.9                              | 56.0   | 93.7               | 56.1   | 8627               | 98.5   |
| 1984 | 5587.0         | 870.0          | 73.2   | 68.7   | 73.2                              | 59.4   | 73.1               | 59.5   | 7262               | 82.7   |
| 1985 | 6515.6         | 870.0          | 86.0   | 71.5   | 86.0                              | 63.8   | 85.5               | 63.8   | 8006               | 91.4   |
| 1986 | 6370.4         | 870.0          | 83.4   | 73.2   | 83.4                              | 66.6   | 83.6               | 66.6   | 7871               | 89.9   |
| 1987 | 7164.7         | 870.0          | 93.6   | 75.8   | 93.6                              | 70.0   | 94.0               | 70.1   | 8335               | 95.1   |
| 1988 | 5639.1         | 870.0          | 82.3   | 76.5   | 82.3                              | 71.4   | 73.8               | 70.5   | 7674               | 87.4   |
| 1989 | 5205.3         | 870.0          | 74.4   | 76.3   | 74.4                              | 71.7   | 68.3               | 70.3   | 7233               | 82.6   |
| 1990 | 5054.8         | 870.0          | 74.2   | 76.1   | 74.2                              | 71.9   | 66.3               | 69.9   | 7577               | 86.5   |
| 1991 | 6760.6         | 870.0          | 94.9   | 77.7   | 94.9                              | 73.8   | 88.7               | 71.5   | 8381               | 95.7   |
| 1992 | 5872.0         | 870.0          | 89.3   | 78.6   | 89.4                              | 75.0   | 76.8               | 71.9   | 7903               | 90.0   |
| 1993 | 5575.2         | 870.0          | 85.5   | 79.1   | 85.5                              | 75.8   | 73.2               | 72.0   | 7553               | 86.2   |
| 1994 | 5150.3         | 870.0          | 73.5   | 78.7   | 73.5                              | 75.6   | 67.6               | 71.7   | 6462               | 73.8   |
| 1995 | 6446.0         | 870.0          | 94.7   | 79.7   | 94.7                              | 76.8   | 84.6               | 72.5   | 8306               | 94.8   |
| 1996 | 5816.3         | 870.0          | 86.2   | 80.1   | 86.2                              | 77.4   | 76.1               | 72.7   | 7674               | 87.4   |
| 1997 | 5998.4         | 870.0          | 91.5   | 80.7   | 91.5                              | 78.1   | 78.7               | 73.0   | 8059               | 92.0   |
| 1998 | 6335.8         | 870.0          | 89.3   | 81.2   | 89.2                              | 78.7   | 83.1               | 73.6   | 7857               | 89.7   |
| 1999 | 7532.1         | 870.0          | 98.7   | 82.0   | 98.7                              | 79.7   | 98.8               | 74.8   | 8736               | 99.7   |
| 2000 | 6646.0         | 874.0          | 90.8   | 82.5   | 90.8                              | 80.2   | 86.6               | 75.4   | 8231               | 93.7   |
| 2001 | 5889.0         | 878.0          | 82.4   | 82.5   | 76.2                              | 80.1   | 76.6               | 75.4   | 7353               | 83.9   |
| 2002 | 7566.2         | 878.0          | 98.6   | 83.2   | 98.6                              | 80.9   | 98.4               | 76.4   | 8731               | 99.7   |
| 2003 | 6301.4         | 878.0          | 87.4   | 83.3   | 87.4                              | 81.1   | 81.9               | 76.7   | 7773               | 88.7   |
| 2004 | 6771.1         | 878.0          | 89.1   | 83.6   | 89.1                              | 81.5   | 87.8               | 77.1   | 7984               | 90.9   |



## DE-16 ISAR-1 (KKI 1)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Feb | 49.0  | 12.5    | UP1  | A31  | CONDENSER LEAKAGE                                  |
| 17 Apr | 108.0 | 14.2    | PP   | D31  | CONDENSER LEAKAGE                                  |
| 07 Aug | 48.0  | 12.3    | PP   | D15  | MAIN CIRCULATING PUMP REPAIR                       |
| 21 Aug | 72.0  | 22.9    | PP   | D32  | FEEDWATER PUMP REPAIR                              |
| 27 Aug | 58.0  | 17.6    | UP1  | A32  | FEEDWATER PUMP FAILURE                             |
| 26 Sep | 97.0  | 90.8    | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 01 Oct | 501.0 | 439.9   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 21 Oct | 168.0 | 147.5   | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |
| 19 Nov | 25.0  | 32.0    | UF2  | A31  | TURBINE BEARING VIBRATION                          |
| 01 Dec | 57.0  | 15.4    | UP1  | E    | NON-RETURN VALVE CHECK                             |
| 15 Dec | 8.0   | 12.5    | UF2  | A15  | DISTURBANCE IN THE PRIMARY COOLING SYSTEM          |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 33        |          |   | 156       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 598             |           |          | 900   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 96  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 107   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 26        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 9   | 0         | 0        |
| Z. Others  |                 | 168       |          |   | 5         |          |
| Subtotal   | 598             | 201       | 0        | 1112  | 187       | 0        |
| Total  |                 | 799       |          |   | 1299      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004<br>Hours Lost | 1977 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 14  |
| 15. Reactor Cooling Systems              | 8                  | 30  |
| 21. Fuel Handling and Storage Facilities |                    | 7   |
| 31. Turbine and auxiliaries              | 25                 | 27  |
| 32. Feedwater and Main Steam System      |                    | 4   |
| 41. Main Generator Systems               |                    | 20  |
| 42. Electrical Power Supply Systems      |                    | 32  |
| Total                                    | 33                 | 134   |

# DE-31 ISAR-2 (KKI 2)

**Operator:** EON (EON Kernkraft Ges.m.b.H)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1400.0 MW(e)  
**Design Net RUP:** 1285.0 MW(e)  
**Design Discharge Burnup:** >35000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 11595.3 GW(e).h  
**Energy Availability Factor:** 95.4%  
**Load Factor:** 94.3%  
**Operating Factor:** 95.6%  
**Energy Unavailability Factor:** 4.6%  
**Total Off-line Time:** 389 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb   | Mar    | Apr   | May    | Jun   | Jul   | Aug   | Sep   | Oct    | Nov    | Dec    | Annual  |
|-----------------|--------|-------|--------|-------|--------|-------|-------|-------|-------|--------|--------|--------|---------|
| <b>GW(e).h</b>  | 1049.8 | 976.5 | 1043.5 | 999.5 | 1023.6 | 961.5 | 509.0 | 925.7 | 991.4 | 1039.4 | 1017.3 | 1058.2 | 11595.3 |
| <b>EAF (%)</b>  | 100.0  | 100.0 | 100.0  | 100.0 | 100.0  | 100.0 | 100.0 | 55.3  | 90.7  | 99.6   | 99.9   | 100.0  | 95.4    |
| <b>UCF (%)</b>  | 100.0  | 100.0 | 100.0  | 100.0 | 100.0  | 100.0 | 100.0 | 55.3  | 90.8  | 99.6   | 99.9   | 100.0  | 95.4    |
| <b>LF (%)</b>   | 100.8  | 100.2 | 100.2  | 99.3  | 98.3   | 95.4  | 48.9  | 88.9  | 98.4  | 99.7   | 100.9  | 101.6  | 94.3    |
| <b>OF (%)</b>   | 100.0  | 100.0 | 99.9   | 100.1 | 100.0  | 100.0 | 55.8  | 91.9  | 100.0 | 100.0  | 100.0  | 100.0  | 95.6    |
| <b>EUF (%)</b>  | 0.0    | 0.0   | 0.0    | 0.0   | 0.0    | 0.0   | 44.7  | 9.3   | 0.4   | 0.1    | 0.0    | 0.0    | 4.6     |
| <b>PUF (%)</b>  | 0.0    | 0.0   | 0.0    | 0.0   | 0.0    | 0.0   | 44.5  | 3.2   | 0.0   | 0.0    | 0.0    | 0.0    | 4.0     |
| <b>UCLF (%)</b> | 0.0    | 0.0   | 0.0    | 0.0   | 0.0    | 0.0   | 0.2   | 6.1   | 0.4   | 0.1    | 0.0    | 0.0    | 0.6     |
| <b>XUF (%)</b>  | 0.0    | 0.0   | 0.0    | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 15 Sep 1982  
**Date of First Criticality:** 15 Jan 1988  
**Date of Grid Connection:** 22 Jan 1988  
**Date of Commercial Operation:** 09 Apr 1988

**Lifetime Generation:** 174641.2 GW(e).h  
**Cumulative Energy Availability Factor:** 91.2%  
**Cumulative Load Factor:** 88.6%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 8.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6023.0         | 1323.0         | 0.0  | 0.0    | 96.3                              | 100.0  | 51.8               | 0.0    | 6177               | 70.3   |
| 1989 | 7728.9         | 1310.0         | 73.4   | 73.4   | 73.4                              | 73.4   | 67.4               | 67.4   | 6876               | 78.5   |
| 1990 | 9271.4         | 1310.0         | 84.9   | 79.2   | 84.9                              | 79.2   | 80.8               | 74.1   | 7915               | 90.4   |
| 1991 | 9699.2         | 1320.0         | 87.8   | 82.1   | 87.8                              | 82.1   | 84.0               | 77.4   | 7732               | 88.3   |
| 1992 | 9843.5         | 1320.0         | 89.9   | 84.0   | 89.9                              | 84.0   | 84.9               | 79.3   | 7917               | 90.1   |
| 1993 | 10193.0        | 1330.0         | 91.3   | 85.5   | 88.1                              | 84.9   | 87.5               | 80.9   | 8052               | 91.9   |
| 1994 | 10499.9        | 1330.0         | 93.1   | 86.8   | 93.1                              | 86.2   | 90.1               | 82.5   | 8209               | 93.7   |
| 1995 | 10040.3        | 1332.0         | 89.8   | 87.2   | 89.8                              | 86.8   | 86.0               | 83.0   | 7891               | 90.1   |
| 1996 | 10265.1        | 1338.0         | 90.7   | 87.7   | 88.5                              | 87.0   | 87.3               | 83.5   | 7989               | 90.9   |
| 1997 | 10906.4        | 1365.0         | 94.1   | 88.4   | 94.1                              | 87.8   | 91.2               | 84.4   | 8258               | 94.3   |
| 1998 | 10758.1        | 1365.0         | 93.6   | 88.9   | 93.6                              | 88.4   | 90.0               | 85.0   | 8356               | 95.4   |
| 1999 | 11610.9        | 1380.0         | 96.5   | 89.6   | 96.5                              | 89.2   | 96.0               | 86.0   | 8465               | 96.6   |
| 2000 | 11291.1        | 1400.0         | 94.5   | 90.1   | 94.5                              | 89.6   | 91.8               | 86.5   | 8311               | 94.6   |
| 2001 | 11731.3        | 1400.0         | 97.1   | 90.6   | 97.1                              | 90.2   | 95.7               | 87.2   | 8506               | 97.1   |
| 2002 | 11512.2        | 1400.0         | 95.1   | 91.0   | 95.1                              | 90.6   | 93.9               | 87.7   | 8350               | 95.3   |
| 2003 | 11671.6        | 1400.0         | 96.7   | 91.3   | 95.9                              | 91.0   | 95.2               | 88.3   | 8491               | 96.9   |
| 2004 | 11595.3        | 1400.0         | 95.4   | 91.6   | 95.4                              | 91.2   | 94.3               | 88.6   | 8395               | 95.6   |

**DE-31 ISAR-2 (KKI 2)****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                 |
|--------|-------|---------|------|------|-----------------------------|
| 18 Jul | 329.0 | 461.0   | PF   | B    | REFUELLING                  |
| 01 Aug | 24.0  | 33.3    | PF   | B    | REFUELLING                  |
| 01 Aug | 36.0  | 63.1    | UF3  | Z    | EXTENSION OF THE REFUELLING |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 78        |          |
| B. Refuelling without a maintenance                           | 353             |           |          |   |           |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 528   |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 0   | 2         |          |
| Z. Others   |                 | 36        |          |   |           |          |
| Subtotal  | 353             | 36        | 0        | 528   | 80        | 0        |
| Total   |                 | 389       |          |   | 608       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 15. Reactor Cooling Systems         |                    | 18  |
| 31. Turbine and auxiliaries         |                    | 6   |
| 32. Feedwater and Main Steam System |                    | 0   |
| 41. Main Generator Systems          |                    | 53  |
| Total                               | 0                  | 77  |

**DE-20 KRUEMEL (KKK)**

**Operator:** HEW (Hamburgische Elektrizitaetswerke)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1260.0 MW(e)  
**Design Net RUP:** 1260.0 MW(e)  
**Design Discharge Burnup:** 18000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 9626.7 GW(e).h  
**Energy Availability Factor:** 87.7%  
**Load Factor:** 87.0%  
**Operating Factor:** 89.1%  
**Energy Unavailability Factor:** 12.3%  
**Total Off-line Time:** 959 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 953.2 | 877.9 | 917.7 | 892.2 | 912.0 | 894.3 | 900.9 | 709.8 | 0.0   | 702.2 | 917.5 | 949.1 | 9626.7 |
| <b>EAF (%)</b>  | 99.9  | 98.6  | 96.7  | 97.7  | 97.7  | 99.6  | 99.3  | 88.3  | 0.0   | 74.3  | 99.9  | 99.9  | 87.7   |
| <b>UCF (%)</b>  | 99.9  | 98.6  | 96.7  | 97.7  | 97.7  | 99.6  | 99.3  | 88.3  | 0.0   | 74.3  | 99.9  | 99.9  | 87.7   |
| <b>LF (%)</b>   | 101.7 | 100.1 | 97.9  | 98.5  | 97.3  | 98.6  | 96.1  | 75.7  | 0.0   | 74.8  | 101.1 | 101.2 | 87.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 89.0  | 0.0   | 78.9  | 100.0 | 100.0 | 89.1   |
| <b>EUF (%)</b>  | 0.1   | 1.4   | 3.3   | 2.3   | 2.3   | 0.4   | 0.7   | 11.7  | 100.0 | 25.7  | 0.1   | 0.1   | 12.3   |
| <b>PUF (%)</b>  | 0.1   | 1.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3  | 61.7  | 0.0   | 0.1   | 0.1   | 6.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 3.3   | 2.3   | 2.3   | 0.4   | 0.8   | 1.4   | 38.3  | 25.7  | 0.0   | 0.0   | 6.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 05 Apr 1974  
**Date of First Criticality:** 14 Sep 1983  
**Date of Grid Connection:** 28 Sep 1983  
**Date of Commercial Operation:** 28 Mar 1984

**Lifetime Generation:** 176581.2 GW(e).h  
**Cumulative Energy Availability Factor:** 79.1%  
**Cumulative Load Factor:** 75.1%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 20.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 944.0          | 1260.0         | 0.0  | 0.0    | 81.5                              | 100.0  | 9.3                | 0.0    | 1652               | 20.4   |
| 1984 | 9672.0         | 1260.0         | 0.0  | 0.0    | 86.9                              | 100.0  | 87.4               | 0.0    | 8112               | 92.3   |
| 1985 | 9301.9         | 1260.0         | 86.2   | 86.2   | 84.5                              | 84.5   | 84.3               | 84.3   | 7551               | 86.2   |
| 1986 | 9488.3         | 1260.0         | 87.0   | 86.6   | 87.0                              | 85.7   | 86.0               | 85.1   | 7780               | 88.8   |
| 1987 | 9180.2         | 1260.0         | 87.9   | 87.0   | 87.9                              | 86.5   | 83.2               | 84.5   | 7822               | 89.3   |
| 1988 | 9219.2         | 1260.0         | 90.0   | 87.8   | 90.1                              | 87.4   | 83.3               | 84.2   | 8018               | 91.3   |
| 1989 | 8241.6         | 1260.0         | 78.5   | 85.9   | 78.5                              | 85.6   | 74.7               | 82.3   | 7247               | 82.7   |
| 1990 | 8830.2         | 1260.0         | 84.5   | 85.7   | 84.5                              | 85.4   | 80.0               | 81.9   | 7507               | 85.7   |
| 1991 | 7737.6         | 1260.0         | 80.0   | 84.9   | 80.0                              | 84.6   | 70.1               | 80.2   | 6946               | 79.3   |
| 1992 | 8325.0         | 1260.0         | 83.2   | 84.7   | 83.2                              | 84.5   | 75.2               | 79.6   | 7188               | 81.8   |
| 1993 | 6558.5         | 1260.0         | 61.3   | 82.1   | 61.3                              | 81.9   | 59.4               | 77.3   | 5399               | 61.6   |
| 1994 | 2479.8         | 1260.0         | 25.1   | 76.4   | 25.1                              | 76.2   | 22.5               | 71.9   | 2091               | 23.9   |
| 1995 | 9217.9         | 1260.0         | 88.2   | 77.5   | 88.2                              | 77.3   | 83.5               | 72.9   | 7824               | 89.3   |
| 1996 | 8242.3         | 1260.0         | 83.9   | 78.0   | 83.9                              | 77.9   | 74.5               | 73.1   | 6868               | 78.2   |
| 1997 | 9250.6         | 1260.0         | 87.3   | 78.7   | 85.1                              | 78.4   | 83.8               | 73.9   | 7492               | 85.5   |
| 1998 | 4611.1         | 1260.0         | 46.1   | 76.4   | 44.0                              | 76.0   | 41.8               | 71.6   | 3878               | 44.3   |
| 1999 | 10517.1        | 1260.0         | 99.4   | 77.9   | 99.4                              | 77.5   | 95.3               | 73.2   | 8760               | 100.0  |
| 2000 | 9022.9         | 1260.0         | 90.2   | 78.7   | 90.2                              | 78.3   | 81.5               | 73.7   | 7975               | 90.8   |
| 2001 | 8141.9         | 1260.0         | 76.7   | 78.6   | 76.2                              | 78.2   | 73.8               | 73.7   | 6591               | 75.2   |
| 2002 | 8483.9         | 1260.0         | 78.0   | 78.5   | 78.0                              | 78.2   | 76.9               | 73.9   | 7069               | 80.7   |
| 2003 | 9488.5         | 1260.0         | 88.2   | 79.0   | 88.2                              | 78.7   | 86.0               | 74.5   | 7809               | 89.1   |
| 2004 | 9626.7         | 1260.0         | 87.7   | 79.5   | 87.7                              | 79.1   | 87.0               | 75.1   | 7825               | 89.1   |

## DE-20 KRUEMMEL (KKK)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 28 Aug | 82.0  | 102.9   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 01 Sep | 444.0 | 559.4   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 19 Sep | 276.0 | 347.8   | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |
| 01 Oct | 157.0 | 241.4   | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 535       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 526             |           |          | 1012  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 25  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 9   | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 8         | 18       |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 8        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 0         |          |
| Z. Others  |                 | 433       |          |   |           |          |
| Subtotal   | 526             | 433       | 0        | 1046  | 544       | 26       |
| Total  |                 | 959       |          |   | 1616      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                  |                    | 0   |
| 14. Safety Systems                       |                    | 1   |
| 15. Reactor Cooling Systems              |                    | 2   |
| 21. Fuel Handling and Storage Facilities |                    | 25  |
| 31. Turbine and auxiliaries              |                    | 0   |
| 32. Feedwater and Main Steam System      |                    | 479   |
| 41. Main Generator Systems               |                    | 20  |
| XX. Miscellaneous Systems                |                    | 5   |
| Total                                    | 0                  | 532   |

# DE-15 NECKARWESTHEIM-1 (GKN 1)

**Operator:** EnBW (EnBW Kraftwerk AG)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 785.0 MW(e)  
**Design Net RUP:** 805.0 MW(e)  
**Design Discharge Burnup:** 37000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5928.5 GW(e).h  
**Energy Availability Factor:** 89.7%  
**Load Factor:** 86.0%  
**Operating Factor:** 94.1%  
**Energy Unavailability Factor:** 10.3%  
**Total Off-line Time:** 514 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 574.9 | 522.9 | 574.3 | 545.8 | 464.0 | 50.6 | 453.2 | 545.7 | 516.4 | 549.9 | 552.2 | 578.7 | 5928.5 |
| <b>EAF (%)</b>  | 100.0 | 95.1  | 100.0 | 100.0 | 91.0  | 8.4  | 82.8  | 100.0 | 100.0 | 98.6  | 99.5  | 99.9  | 89.7   |
| <b>UCF (%)</b>  | 100.0 | 95.1  | 100.0 | 100.0 | 91.0  | 8.4  | 82.8  | 100.0 | 100.0 | 98.7  | 99.5  | 99.9  | 89.7   |
| <b>LF (%)</b>   | 98.4  | 95.7  | 98.3  | 96.7  | 79.4  | 9.0  | 77.6  | 93.4  | 91.4  | 94.0  | 97.7  | 99.1  | 86.0   |
| <b>OF (%)</b>   | 100.0 | 95.4  | 99.9  | 100.1 | 91.5  | 41.8 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.1   |
| <b>EUF (%)</b>  | 0.0   | 4.9   | 0.0   | 0.0   | 9.0   | 91.6 | 17.2  | 0.0   | 0.0   | 1.4   | 0.5   | 0.1   | 10.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 9.0   | 62.0 | 0.0   | 0.0   | 0.0   | 1.3   | 0.5   | 0.0   | 6.0    |
| <b>UCLF (%)</b> | 0.0   | 4.9   | 0.0   | 0.0   | 0.0   | 29.6 | 17.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 4.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1972  
**Date of First Criticality:** 26 May 1976  
**Date of Grid Connection:** 03 Jun 1976  
**Date of Commercial Operation:** 01 Dec 1976

**Lifetime Generation:** 158104.9 GW(e).h  
**Cumulative Energy Availability Factor:** 82.3%  
**Cumulative Load Factor:** 80.2%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 17.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6047.0         | 810.0          | 85.3   | 95.4   | 85.3                              | 75.0   | 85.2               | 73.9   | 7910               | 90.3   |
| 1984 | 5842.0         | 795.0          | 83.1   | 93.9   | 83.1                              | 76.0   | 83.7               | 75.1   | 7618               | 86.7   |
| 1985 | 6161.4         | 795.0          | 88.8   | 93.3   | 88.8                              | 77.4   | 88.5               | 76.5   | 8050               | 91.9   |
| 1986 | 4153.1         | 795.0          | 59.6   | 90.0   | 59.6                              | 75.6   | 59.6               | 74.9   | 5368               | 61.3   |
| 1987 | 5395.1         | 795.0          | 76.8   | 88.8   | 76.8                              | 75.7   | 77.5               | 75.1   | 6828               | 77.9   |
| 1988 | 5269.4         | 795.0          | 75.5   | 87.7   | 75.5                              | 75.7   | 75.5               | 75.1   | 6772               | 77.1   |
| 1989 | 4019.5         | 795.0          | 64.2   | 85.9   | 64.2                              | 74.8   | 57.7               | 73.8   | 6395               | 73.0   |
| 1990 | 5754.1         | 785.0          | 82.8   | 85.7   | 82.8                              | 75.4   | 83.7               | 74.5   | 7524               | 85.9   |
| 1991 | 5404.5         | 785.0          | 85.0   | 85.7   | 85.0                              | 76.0   | 78.6               | 74.8   | 7614               | 86.9   |
| 1992 | 5270.1         | 785.0          | 83.6   | 85.5   | 83.6                              | 76.5   | 76.4               | 74.9   | 7470               | 85.0   |
| 1993 | 5559.5         | 785.0          | 81.6   | 85.3   | 81.6                              | 76.8   | 80.8               | 75.2   | 7371               | 84.1   |
| 1994 | 6307.8         | 785.0          | 92.0   | 85.7   | 92.0                              | 77.6   | 91.7               | 76.1   | 8184               | 93.4   |
| 1995 | 5966.0         | 785.0          | 87.5   | 85.8   | 87.4                              | 78.1   | 86.8               | 76.7   | 8020               | 91.6   |
| 1996 | 6054.5         | 785.0          | 92.0   | 86.1   | 92.0                              | 78.8   | 87.8               | 77.2   | 8301               | 94.5   |
| 1997 | 6230.2         | 785.0          | 92.6   | 86.4   | 92.6                              | 79.5   | 90.6               | 77.8   | 8305               | 94.8   |
| 1998 | 5907.8         | 785.0          | 91.3   | 86.6   | 91.1                              | 80.0   | 85.9               | 78.2   | 8185               | 93.4   |
| 1999 | 5849.1         | 785.0          | 90.0   | 86.7   | 90.0                              | 80.4   | 85.1               | 78.5   | 8022               | 91.6   |
| 2000 | 6141.4         | 785.0          | 94.2   | 87.0   | 94.2                              | 81.0   | 89.1               | 78.9   | 8284               | 94.3   |
| 2001 | 5991.5         | 785.0          | 90.0   | 87.2   | 88.1                              | 81.3   | 87.1               | 79.3   | 8038               | 91.8   |
| 2002 | 6238.3         | 785.0          | 92.7   | 87.4   | 92.7                              | 81.7   | 90.7               | 79.7   | 8239               | 94.1   |
| 2003 | 6024.0         | 785.0          | 90.5   | 87.5   | 90.5                              | 82.0   | 87.6               | 80.0   | 8304               | 94.8   |
| 2004 | 5928.5         | 785.0          | 89.7   | 87.6   | 89.7                              | 82.3   | 86.0               | 80.2   | 8270               | 94.1   |

**DE-15 NECKARWESTHEIM-1 (GKN 1)****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                                   |
|--------|-------|---------|------|------|---|
| 28 Feb | 32.0  | 26.8    | UF2  | A14  | LEAKAGE IN BOG FITTING                        |
| 29 May | 63.0  | 52.8    | PF   | C    | ANNAUL MAINTENANCE AND REFUELLING             |
| 01 Jun | 419.0 | 350.7   | PF   | C    | ANNAUL MAINTENANCE AND REFUELLING             |
| 19 Jun | 263.0 | 167.1   | UP2  | A31  | FIXING DAMAGED SHAFTSEALING OF THE HP TURBINE |
| 01 Jul | 153.0 | 100.4   | UP2  | A31  | FIXING DAMAGED SHAFTSEALING OF THE HP TURBINE |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 32        |          |   | 35        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 482             |           |          | 1142  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 20  |           |          |
| E. Testing of plant systems or components  |                 |           |          |   | 53        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 1        |
| Subtotal   | 482             | 32        | 0        | 1162  | 88        | 1        |
| Total  |                 | 514       |          |   | 1251      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1976 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 14. Safety Systems                  | 32                 |   |
| 15. Reactor Cooling Systems         |                    | 20  |
| 31. Turbine and auxiliaries         |                    | 2   |
| 32. Feedwater and Main Steam System |                    | 8   |
| 41. Main Generator Systems          |                    | 4   |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 32                 | 34  |

## DE-44 NECKARWESTHEIM-2 (GKN 2)

Operator: EnBW (EnBW Kraftwerk AG)

Contractor: SIEM,KWU (SIEMENS AG, KRAFTWERK UNION AG)

### 1. Station Details

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1269.0 MW(e)  
 Design Net RUP: 1225.0 MW(e)  
 Design Discharge Burnup: 35000 MW.d/t

### 2. Production Summary 2004

Energy Production: 10470.7 GW(e).h  
 Energy Availability Factor: 92.9%  
 Load Factor: 93.9%  
 Operating Factor: 93.0%  
 Energy Unavailability Factor: 7.1%  
 Total Off-line Time: 619 hours

### 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| GW(e).h  | 961.6 | 896.6 | 955.5 | 921.8 | 949.1 | 909.1 | 657.7 | 393.6 | 922.5 | 973.7 | 950.3 | 979.2 | 10470.7 |
| EAF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 74.8  | 41.1  | 100.0 | 100.0 | 100.0 | 100.0 | 92.9    |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 74.8  | 41.1  | 100.0 | 100.0 | 100.0 | 100.0 | 92.9    |
| LF (%)   | 101.8 | 101.5 | 101.2 | 101.0 | 100.5 | 99.5  | 69.7  | 41.7  | 101.0 | 103.0 | 104.0 | 103.7 | 93.9    |
| OF (%)   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 75.0  | 41.8  | 100.0 | 100.0 | 100.0 | 100.0 | 93.0    |
| EUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 25.2  | 58.9  | 0.0   | 0.0   | 0.0   | 0.0   | 7.1     |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 25.2  | 46.8  | 0.0   | 0.0   | 0.0   | 0.0   | 6.1     |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.1  | 0.0   | 0.0   | 0.0   | 0.0   | 1.0     |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

Date of Construction Start: 09 Nov 1982  
 Date of First Criticality: 29 Dec 1988  
 Date of Grid Connection: 03 Jan 1989  
 Date of Commercial Operation: 15 Apr 1989

Lifetime Generation: 162270.2 GW(e).h  
 Cumulative Energy Availability Factor: 93.1%  
 Cumulative Load Factor: 92.5%  
 Cumulative Unit Capability Factor: 79.2%  
 Cumulative Energy Unavailability Factor: 6.9%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1989 | 8673.2            | 1225.0            | 0.0  | 0.0    | 99.8                                 | 100.0  | 80.8               | 0.0    | 8205                  | 93.7   |
| 1990 | 9693.9            | 1225.0            | 90.2   | 90.2   | 90.2                                 | 90.2   | 90.3               | 90.3   | 7958                  | 90.8   |
| 1991 | 9434.9            | 1225.0            | 90.5   | 90.4   | 90.5                                 | 90.4   | 87.9               | 89.1   | 7932                  | 90.5   |
| 1992 | 10204.6           | 1269.0            | 91.6   | 90.8   | 91.6                                 | 90.8   | 91.5               | 90.0   | 8094                  | 92.1   |
| 1993 | 9912.2            | 1269.0            | 89.0   | 90.3   | 89.0                                 | 90.3   | 89.2               | 89.8   | 8163                  | 93.2   |
| 1994 | 10320.7           | 1269.0            | 93.6   | 91.0   | 93.6                                 | 91.0   | 92.8               | 90.4   | 8215                  | 93.8   |
| 1995 | 10532.0           | 1269.0            | 94.7   | 91.6   | 94.7                                 | 91.6   | 94.7               | 91.1   | 8351                  | 95.3   |
| 1996 | 10614.3           | 1269.0            | 95.1   | 92.1   | 95.1                                 | 92.1   | 95.2               | 91.7   | 8419                  | 95.8   |
| 1997 | 10111.6           | 1269.0            | 91.5   | 92.0   | 91.5                                 | 92.0   | 91.0               | 91.6   | 8028                  | 91.6   |
| 1998 | 10610.8           | 1269.0            | 96.0   | 92.5   | 96.0                                 | 92.5   | 95.5               | 92.0   | 8411                  | 96.0   |
| 1999 | 10460.9           | 1269.0            | 96.1   | 92.8   | 96.1                                 | 92.9   | 94.1               | 92.3   | 8435                  | 96.3   |
| 2000 | 10473.9           | 1269.0            | 96.2   | 93.2   | 96.2                                 | 93.2   | 94.0               | 92.4   | 8450                  | 96.2   |
| 2001 | 10423.9           | 1269.0            | 95.4   | 93.3   | 94.2                                 | 93.2   | 93.8               | 92.5   | 8363                  | 95.5   |
| 2002 | 9787.5            | 1269.0            | 88.7   | 93.0   | 88.7                                 | 92.9   | 88.0               | 92.2   | 7777                  | 88.8   |
| 2003 | 10545.0           | 1269.0            | 95.8   | 93.2   | 95.8                                 | 93.1   | 94.9               | 92.4   | 8408                  | 96.0   |
| 2004 | 10470.7           | 1269.0            | 92.9   | 93.2   | 92.9                                 | 93.1   | 93.9               | 92.5   | 8165                  | 93.0   |



**DE-44 NECKARWESTHEIM-2 (GKN 2)****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                       |
|--------|-------|---------|------|------|-----------------------------------|
| 24 Jul | 186.0 | 238.0   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING |
| 01 Aug | 433.0 | 555.8   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair<br>combined with refuelling | 619             |           |          | 473   | 7         |          |
| Subtotal   | 619             | 0         | 0        | 473   | 7         | 0        |
| Total  | 619             |           |          | 480   |           |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 6   |
| 32. Feedwater and Main Steam System |                    | 0   |
| 41. Main Generator Systems          |                    | 0   |
| Total                               | 0                  | 6   |

# DE-5 OBRIGHEIM (KWO)

**Operator:** EnBW (EnBW Kraftwerk AG)  
**Contractor:** SIEM,KWU (SIEMENS AG, KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 340.0 MW(e)  
**Design Net RUP:** 283.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2592.8 GW(e).h  
**Energy Availability Factor:** 93.8%  
**Load Factor:** 86.8%  
**Operating Factor:** 94.0%  
**Energy Unavailability Factor:** 6.2%  
**Total Off-line Time:** 528 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 226.4 | 236.5 | 252.3 | 227.9 | 235.0 | 243.1 | 241.4 | 204.6 | 217.9 | 61.6 | 230.6 | 215.5 | 2592.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.6 | 95.2  | 100.0 | 93.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.6 | 95.2  | 100.0 | 93.8   |
| <b>LF (%)</b>   | 89.5  | 99.9  | 99.7  | 93.2  | 92.9  | 99.3  | 95.4  | 80.9  | 89.0  | 24.3 | 94.2  | 85.2  | 86.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.7 | 97.4  | 100.0 | 94.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 68.4 | 4.8   | 0.0   | 6.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 68.4 | 0.0   | 0.0   | 5.8    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 4.8   | 0.0   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 15 Mar 1965  
**Date of First Criticality:** 22 Sep 1968  
**Date of Grid Connection:** 29 Oct 1968  
**Date of Commercial Operation:** 31 Mar 1969

**Lifetime Generation:** 85963.2 GW(e).h  
**Cumulative Energy Availability Factor:** 82.2%  
**Cumulative Load Factor:** 81.2%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 17.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1951.0         | 328.0          | 67.6   | 93.1   | 67.4                              | 80.4   | 67.9               | 80.0   | 6051               | 69.1   |
| 1984 | 2483.0         | 340.0          | 83.1   | 92.4   | 83.1                              | 80.5   | 83.1               | 80.2   | 7798               | 88.8   |
| 1985 | 2592.9         | 340.0          | 86.7   | 92.0   | 86.7                              | 80.9   | 87.1               | 80.6   | 7783               | 88.8   |
| 1986 | 2663.3         | 340.0          | 88.7   | 91.8   | 88.7                              | 81.4   | 89.4               | 81.2   | 7869               | 89.8   |
| 1987 | 2483.0         | 340.0          | 83.0   | 91.3   | 83.0                              | 81.5   | 83.4               | 81.3   | 7351               | 83.9   |
| 1988 | 2621.6         | 340.0          | 88.0   | 91.1   | 88.0                              | 81.8   | 87.8               | 81.6   | 7800               | 88.8   |
| 1989 | 2558.0         | 340.0          | 86.1   | 90.9   | 86.1                              | 82.1   | 85.9               | 81.9   | 7756               | 88.5   |
| 1990 | 1178.2         | 340.0          | 39.4   | 88.4   | 39.4                              | 80.0   | 39.6               | 79.8   | 3475               | 39.7   |
| 1991 | 1051.7         | 340.0          | 79.5   | 88.0   | 35.3                              | 77.9   | 35.3               | 77.8   | 3186               | 36.4   |
| 1992 | 1882.0         | 340.0          | 67.6   | 87.1   | 67.6                              | 77.5   | 63.0               | 77.1   | 6015               | 68.5   |
| 1993 | 2616.8         | 340.0          | 88.3   | 87.1   | 88.3                              | 77.9   | 87.9               | 77.6   | 7773               | 88.7   |
| 1994 | 2623.8         | 340.0          | 89.4   | 87.2   | 89.4                              | 78.4   | 88.1               | 78.0   | 7858               | 89.7   |
| 1995 | 2165.4         | 340.0          | 76.4   | 86.8   | 76.4                              | 78.3   | 72.7               | 77.8   | 6717               | 76.7   |
| 1996 | 2775.0         | 340.0          | 93.1   | 87.0   | 93.1                              | 78.9   | 92.9               | 78.3   | 8189               | 93.2   |
| 1997 | 2769.4         | 340.0          | 93.8   | 87.3   | 93.8                              | 79.4   | 93.0               | 78.9   | 8242               | 94.1   |
| 1998 | 2758.8         | 340.0          | 94.7   | 87.5   | 94.7                              | 79.9   | 92.6               | 79.4   | 8317               | 94.9   |
| 1999 | 2802.8         | 340.0          | 94.8   | 87.8   | 94.8                              | 80.4   | 94.1               | 79.9   | 8319               | 95.0   |
| 2000 | 2660.3         | 340.0          | 89.7   | 87.8   | 89.7                              | 80.7   | 89.1               | 80.2   | 7888               | 89.8   |
| 2001 | 2797.1         | 340.0          | 96.0   | 88.1   | 94.4                              | 81.2   | 93.9               | 80.6   | 8424               | 96.2   |
| 2002 | 2841.1         | 340.0          | 95.9   | 88.3   | 95.9                              | 81.6   | 95.4               | 81.0   | 8410               | 96.0   |
| 2003 | 2450.2         | 340.0          | 88.3   | 88.3   | 88.3                              | 81.8   | 82.3               | 81.1   | 7747               | 88.4   |
| 2004 | 2592.8         | 340.0          | 93.8   | 88.5   | 93.8                              | 82.2   | 86.8               | 81.2   | 8256               | 94.0   |

**DE-5 OBRIGHEIM (KWO)****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 10 Oct | 509.0 | 173.2   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 01 Nov | 11.0  | 7.7     | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |
| 07 Nov | 8.0   | 4.0     | UF1  | A41  | SHORT CIRCUIT OF THE GENERATOR CONTROL SYSTEM      |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 8         |          |   | 159       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 26        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 509             |           |          | 976   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 12  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 131       | 111      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 5        |
| Z. Others  |                 | 11        |          |   |           |          |
| Subtotal   | 509             | 19        | 0        | 988   | 316       | 116      |
| Total  |                 | 528       |          |   | 1420      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 16  |
| 12. Reactor I&C Systems             |                    | 36  |
| 13. Reactor Auxiliary Systems       |                    | 2   |
| 15. Reactor Cooling Systems         |                    | 26  |
| 16. Steam generation systems        |                    | 41  |
| 31. Turbine and auxiliaries         |                    | 4   |
| 32. Feedwater and Main Steam System |                    | 0   |
| 33. Circulating Water System        |                    | 3   |
| 41. Main Generator Systems          | 8                  | 27  |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 8                  | 155   |

# DE-14 PHILIPPSBURG-1 (KKP 1)

**Operator:** EnBW (EnBW Kraftwerk AG)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 890.0 MW(e)  
**Design Net RUP:** 864.0 MW(e)  
**Design Discharge Burnup:** 27000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6332.0 GW(e).h  
**Energy Availability Factor:** 83.5%  
**Load Factor:** 81.0%  
**Operating Factor:** 84.5%  
**Energy Unavailability Factor:** 16.5%  
**Total Off-line Time:** 1359 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 657.6 | 606.4 | 403.6 | 435.1 | 0.0   | 463.0 | 593.2 | 630.3 | 621.7 | 644.1 | 632.4 | 644.6 | 6332.0 |
| <b>EAF (%)</b>  | 99.5  | 99.5  | 64.8  | 73.6  | 0.0   | 76.6  | 92.7  | 99.6  | 100.0 | 99.0  | 99.9  | 98.7  | 83.5   |
| <b>UCF (%)</b>  | 99.5  | 99.5  | 64.8  | 73.6  | 0.0   | 76.6  | 92.7  | 99.6  | 100.0 | 99.0  | 99.9  | 98.7  | 83.5   |
| <b>LF (%)</b>   | 99.3  | 97.9  | 61.0  | 68.0  | 0.0   | 72.3  | 89.6  | 95.2  | 97.0  | 97.1  | 98.7  | 97.4  | 81.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 66.3  | 74.8  | 0.0   | 79.2  | 95.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 84.5   |
| <b>EUF (%)</b>  | 0.5   | 0.5   | 35.2  | 26.4  | 100.0 | 23.4  | 7.3   | 0.4   | 0.0   | 1.0   | 0.1   | 1.3   | 16.5   |
| <b>PUF (%)</b>  | 0.5   | 0.5   | 35.2  | 26.4  | 92.5  | 0.0   | 0.0   | 0.4   | 0.0   | 0.4   | 0.0   | 0.0   | 13.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.1   | 0.0   | 7.5   | 23.4  | 7.3   | 0.0   | 0.0   | 0.6   | 0.1   | 1.3   | 3.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1970  
**Date of First Criticality:** 09 Mar 1979  
**Date of Grid Connection:** 07 May 1979  
**Date of Commercial Operation:** 26 Mar 1980

**Lifetime Generation:** 147267.4 GW(e).h  
**Cumulative Energy Availability Factor:** 80.7%  
**Cumulative Load Factor:** 78.4%  
**Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 19.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5503.0         | 864.0          | 72.7   | 79.8   | 72.7                              | 51.8   | 72.7               | 51.7   | 6567               | 75.0   |
| 1984 | 6325.0         | 864.0          | 83.2   | 80.7   | 83.2                              | 59.7   | 83.3               | 59.7   | 7482               | 85.2   |
| 1985 | 6120.2         | 864.0          | 81.2   | 80.8   | 81.1                              | 64.0   | 80.9               | 63.9   | 7561               | 86.3   |
| 1986 | 5222.0         | 864.0          | 69.1   | 78.8   | 69.1                              | 64.9   | 69.0               | 64.8   | 6148               | 70.2   |
| 1987 | 6488.4         | 864.0          | 84.9   | 79.7   | 84.9                              | 67.7   | 85.7               | 67.8   | 7582               | 86.6   |
| 1988 | 6199.6         | 864.0          | 83.7   | 80.2   | 83.7                              | 69.7   | 81.7               | 69.5   | 7302               | 83.1   |
| 1989 | 6158.9         | 864.0          | 81.3   | 80.3   | 81.4                              | 71.0   | 81.4               | 70.9   | 7432               | 84.8   |
| 1990 | 5203.1         | 864.0          | 68.3   | 79.1   | 68.3                              | 70.8   | 68.7               | 70.6   | 6138               | 70.1   |
| 1991 | 6171.9         | 864.0          | 82.9   | 79.5   | 82.9                              | 71.9   | 81.5               | 71.6   | 7304               | 83.4   |
| 1992 | 6513.0         | 864.0          | 86.6   | 80.1   | 86.6                              | 73.1   | 85.8               | 72.8   | 7647               | 87.1   |
| 1993 | 4614.5         | 864.0          | 74.7   | 79.7   | 74.7                              | 73.2   | 61.0               | 71.9   | 6599               | 75.3   |
| 1994 | 6565.9         | 864.0          | 86.5   | 80.1   | 86.5                              | 74.2   | 86.8               | 73.0   | 7645               | 87.3   |
| 1995 | 6317.1         | 876.0          | 86.9   | 80.6   | 86.9                              | 75.0   | 82.3               | 73.6   | 7671               | 87.6   |
| 1996 | 6929.8         | 864.0          | 91.1   | 81.3   | 91.1                              | 76.0   | 91.3               | 74.7   | 8087               | 92.1   |
| 1997 | 6409.5         | 876.0          | 85.3   | 81.5   | 85.3                              | 76.6   | 83.5               | 75.2   | 7510               | 85.7   |
| 1998 | 6905.9         | 890.0          | 93.9   | 82.2   | 93.9                              | 77.6   | 88.6               | 76.0   | 8253               | 94.2   |
| 1999 | 6892.9         | 890.0          | 94.3   | 82.9   | 94.3                              | 78.5   | 88.4               | 76.7   | 8292               | 94.7   |
| 2000 | 6904.9         | 890.0          | 92.9   | 83.4   | 92.9                              | 79.2   | 88.3               | 77.3   | 8187               | 93.2   |
| 2001 | 6956.9         | 890.0          | 92.7   | 83.8   | 92.7                              | 79.9   | 89.2               | 77.9   | 8206               | 93.7   |
| 2002 | 6559.4         | 890.0          | 89.4   | 84.1   | 89.4                              | 80.3   | 84.1               | 78.1   | 7885               | 90.0   |
| 2003 | 6395.2         | 890.0          | 86.0   | 84.2   | 86.0                              | 80.6   | 82.0               | 78.3   | 7629               | 87.1   |
| 2004 | 6332.0         | 890.0          | 83.5   | 84.2   | 83.5                              | 80.7   | 81.0               | 78.4   | 7425               | 84.5   |

## DE-14 PHILIPPSBURG-1 (KKP 1)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 Mar | 250.0 | 232.9   | PF   | D11  | CHANGE OF DAMAGED FUEL ROD                         |
| 23 Apr | 182.0 | 169.1   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 01 May | 688.0 | 612.3   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                  |
| 29 May | 56.0  | 49.8    | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |
| 01 Jun | 113.0 | 108.2   | UF3  | Z    | EXTENSION OF THE ANNUAL MAINTENANCE AND REFUELLING |
| 06 Jun | 37.0  | 40.8    | UF   | A32  | BYPASS VALVE STEAM LEAKAGE                         |
| 02 Jul | 32.0  | 32.4    | UF1  | A32  | LEAKAGE REPAIR OF THE ISOLATION VALVE FLANGE       |
| 07 Jul | 1.0   | 10.4    | UF2  | A15  | RCP FAILURE  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 70        |          |  | 128       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 870             |           |          | 972                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 250             |           |          | 10                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 7         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 6         |          |
| Z. Others  |                 | 169       |          |  |           |          |
| Subtotal   | 1120            | 239       | 0        | 982                                      | 141       | 0        |
| Total  |                 | 1359      |          |  | 1123      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 3  |
| 12. Reactor I&C Systems             |                 | 5  |
| 13. Reactor Auxiliary Systems       |                 | 2  |
| 14. Safety Systems                  |                 | 11                                       |
| 15. Reactor Cooling Systems         | 1               | 24                                       |
| 31. Turbine and auxiliaries         |                 | 24                                       |
| 32. Feedwater and Main Steam System | 69              | 24                                       |
| 33. Circulating Water System        |                 | 1  |
| 41. Main Generator Systems          |                 | 6  |
| 42. Electrical Power Supply Systems |                 | 0  |
| XX. Miscellaneous Systems           |                 | 16                                       |
| Total                               | 70              | 116                                      |

## DE-24 PHILIPPSBURG-2 (KKP 2)

**Operator:** EnBW (EnBW Kraftwerk AG)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1392.0 MW(e)  
**Design Net RUP:** 1268.0 MW(e)  
**Design Discharge Burnup:** 34000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 10295.0 GW(e).h  
**Energy Availability Factor:** 86.9%  
**Load Factor:** 84.2%  
**Operating Factor:** 87.0%  
**Energy Unavailability Factor:** 13.1%  
**Total Off-line Time:** 1143 hours

### 3. 2004 Monthly Performance Data

|                 | Jan    | Feb   | Mar   | Apr   | May    | Jun   | Jul   | Aug   | Sep   | Oct    | Nov   | Dec    | Annual  |
|-----------------|--------|-------|-------|-------|--------|-------|-------|-------|-------|--------|-------|--------|---------|
| <b>GW(e).h</b>  | 1036.5 | 966.6 | 524.9 | 879.7 | 1013.6 | 974.7 | 978.4 | 607.2 | 309.5 | 1011.3 | 981.8 | 1011.0 | 10295.0 |
| <b>EAF (%)</b>  | 100.0  | 100.0 | 51.7  | 89.7  | 100.0  | 99.8  | 100.0 | 67.8  | 33.7  | 100.0  | 100.0 | 99.8   | 86.9    |
| <b>UCF (%)</b>  | 100.0  | 100.0 | 51.7  | 89.7  | 100.0  | 99.8  | 100.0 | 67.8  | 33.7  | 100.0  | 100.0 | 99.8   | 86.9    |
| <b>LF (%)</b>   | 100.1  | 99.8  | 50.7  | 87.9  | 97.9   | 97.2  | 94.5  | 58.6  | 30.9  | 97.5   | 98.0  | 97.6   | 84.2    |
| <b>OF (%)</b>   | 100.0  | 100.0 | 51.7  | 90.0  | 100.0  | 100.0 | 100.0 | 68.3  | 33.9  | 100.0  | 100.0 | 100.0  | 87.0    |
| <b>EUF (%)</b>  | 0.0    | 0.0   | 48.3  | 10.3  | 0.0    | 0.2   | 0.0   | 32.2  | 66.3  | 0.0    | 0.0   | 0.2    | 13.1    |
| <b>PUF (%)</b>  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 0.1   | 0.0   | 32.2  | 66.3  | 0.0    | 0.0   | 0.1    | 8.2     |
| <b>UCLF (%)</b> | 0.0    | 0.0   | 48.3  | 10.3  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0   | 0.1    | 5.0     |
| <b>XUF (%)</b>  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0   | 0.0    | 0.0     |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 07 Jul 1977  
**Date of First Criticality:** 13 Dec 1984  
**Date of Grid Connection:** 17 Dec 1984  
**Date of Commercial Operation:** 17 Apr 1985

**Lifetime Generation:** 203990.4 GW(e).h  
**Cumulative Energy Availability Factor:** 88.8%  
**Cumulative Load Factor:** 87.7%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 11.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 26.0           | 1350.0         | 0.0  | 0.0    | 96.5                              | 100.0  | 0.2                | 0.0    | 110                | 1.3    |
| 1985 | 9359.8         | 1268.0         | 0.0  | 0.0    | 88.4                              | 100.0  | 84.3               | 0.0    | 7896               | 90.1   |
| 1986 | 10235.3        | 1268.0         | 90.6   | 90.6   | 90.6                              | 90.6   | 92.1               | 92.1   | 7958               | 90.8   |
| 1987 | 9616.2         | 1268.0         | 85.0   | 87.8   | 85.0                              | 87.8   | 86.6               | 89.4   | 7446               | 85.0   |
| 1988 | 9710.8         | 1268.0         | 86.5   | 87.4   | 86.5                              | 87.4   | 87.2               | 88.6   | 7656               | 87.2   |
| 1989 | 9677.3         | 1268.0         | 86.2   | 87.1   | 86.2                              | 87.1   | 87.1               | 88.3   | 7575               | 86.5   |
| 1990 | 8516.3         | 1268.0         | 75.5   | 84.8   | 75.5                              | 84.8   | 76.7               | 85.9   | 6628               | 75.7   |
| 1991 | 9903.3         | 1276.0         | 88.4   | 85.4   | 88.0                              | 85.3   | 89.1               | 86.4   | 7757               | 88.6   |
| 1992 | 9400.0         | 1324.0         | 82.2   | 84.9   | 82.2                              | 84.9   | 83.3               | 85.6   | 7273               | 82.8   |
| 1993 | 10481.3        | 1324.0         | 90.5   | 85.6   | 90.5                              | 85.6   | 90.4               | 86.2   | 7946               | 90.7   |
| 1994 | 10284.8        | 1336.0         | 88.7   | 86.0   | 88.7                              | 86.0   | 87.9               | 86.4   | 7778               | 88.8   |
| 1995 | 10550.5        | 1336.0         | 91.0   | 86.5   | 91.0                              | 86.5   | 90.1               | 86.8   | 7990               | 91.2   |
| 1996 | 11217.6        | 1358.0         | 94.7   | 87.3   | 94.7                              | 87.3   | 94.0               | 87.5   | 8323               | 94.8   |
| 1997 | 11113.5        | 1358.0         | 95.3   | 88.0   | 95.3                              | 88.0   | 93.4               | 88.0   | 8358               | 95.4   |
| 1998 | 10731.5        | 1358.0         | 93.0   | 88.4   | 93.0                              | 88.4   | 90.2               | 88.2   | 8304               | 94.8   |
| 1999 | 11122.9        | 1358.0         | 96.1   | 89.0   | 96.1                              | 89.0   | 93.5               | 88.5   | 8431               | 96.2   |
| 2000 | 10689.1        | 1363.0         | 92.2   | 89.2   | 92.2                              | 89.2   | 89.3               | 88.6   | 8115               | 92.4   |
| 2001 | 8995.8         | 1392.0         | 96.0   | 89.6   | 76.6                              | 88.3   | 73.8               | 87.6   | 6749               | 77.0   |
| 2002 | 11053.2        | 1392.0         | 92.4   | 89.8   | 92.4                              | 88.6   | 90.6               | 87.8   | 8138               | 92.9   |
| 2003 | 11010.2        | 1392.0         | 93.5   | 90.0   | 93.5                              | 88.9   | 90.3               | 88.0   | 8234               | 94.0   |
| 2004 | 10295.0        | 1392.0         | 86.9   | 89.8   | 86.9                              | 88.8   | 84.2               | 87.7   | 7641               | 87.0   |

## DE-24 PHILIPPSBURG-2 (KKP 2)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 16 Mar | 358.0 | 499.9   | UF2  | Z    | ABERRATION FROM SPECIFICATION IN FIXING OF PUMPS IN IMPORTANT SECURITY SYSTEMS |
| 01 Apr | 73.0  | 103.5   | UF2  | Z    | ABERRATION FROM SPECIFICATION IN FIXING OF PUMPS IN IMPORTANT SECURITY SYSTEMS |
| 22 Aug | 236.0 | 333.3   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING  |
| 01 Sep | 476.0 | 664.3   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 94        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 712             |           |          | 651                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 56                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 83       |
| Z. Others  |                 | 431       |          |  |           |          |
| Subtotal   | 712             | 431       | 0        | 707                                      | 94        | 83       |
| Total  |                 | 1143      |          |  | 884       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 6  |
| 15. Reactor Cooling Systems         |                 | 63                                       |
| 31. Turbine and auxiliaries         |                 | 1  |
| 32. Feedwater and Main Steam System |                 | 0  |
| 41. Main Generator Systems          |                 | 15                                       |
| 42. Electrical Power Supply Systems |                 | 7  |
| Total                               | 0               | 92                                       |

# DE-17 UNTERWESER (KKU)

**Operator:** EON (EON Kernkraft Ges.m.b.H)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1345.0 MW(e)  
**Design Net RUP:** 1230.0 MW(e)  
**Design Discharge Burnup:** 31500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9724.0 GW(e).h  
**Energy Availability Factor:** 87.4%  
**Load Factor:** 82.3%  
**Operating Factor:** 87.8%  
**Energy Unavailability Factor:** 12.6%  
**Total Off-line Time:** 1073 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct    | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|--------|
| <b>GW(e).h</b>  | 983.1 | 937.8 | 984.3 | 896.7 | 812.3 | 0.1   | 709.4 | 711.5 | 946.6 | 1009.1 | 742.0 | 991.1 | 9724.0 |
| <b>EAF (%)</b>  | 98.9  | 100.0 | 98.5  | 100.0 | 99.8  | 0.0   | 74.9  | 99.2  | 100.0 | 100.0  | 75.7  | 100.0 | 87.4   |
| <b>UCF (%)</b>  | 98.9  | 100.0 | 98.5  | 100.0 | 99.8  | 0.0   | 74.9  | 99.2  | 100.0 | 100.0  | 75.7  | 100.0 | 87.4   |
| <b>LF (%)</b>   | 98.2  | 100.2 | 98.4  | 92.7  | 81.2  | 0.0   | 70.9  | 71.1  | 97.7  | 100.7  | 76.6  | 99.0  | 82.3   |
| <b>OF (%)</b>   | 99.3  | 100.0 | 98.9  | 100.1 | 100.0 | 0.3   | 77.0  | 99.5  | 100.0 | 100.0  | 76.7  | 100.0 | 87.8   |
| <b>EUF (%)</b>  | 1.1   | 0.0   | 1.5   | 0.0   | 0.2   | 100.0 | 25.1  | 0.8   | 0.0   | 0.0    | 24.3  | 0.0   | 12.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.0   | 0.2   | 100.0 | 25.1  | 0.8   | 0.0   | 0.0    | 0.0   | 0.0   | 10.4   |
| <b>UCLF (%)</b> | 1.1   | 0.0   | 1.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 24.3  | 0.0   | 2.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1972  
**Date of First Criticality:** 16 Sep 1978  
**Date of Grid Connection:** 29 Sep 1978  
**Date of Commercial Operation:** 06 Sep 1979

**Lifetime Generation:** 228992.1 GW(e).h  
**Cumulative Energy Availability Factor:** 82.2%  
**Cumulative Load Factor:** 79.5%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 17.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 8215.0         | 1230.0         | 100.0  | 96.2   | 76.4                              | 82.8   | 76.2               | 82.6   | 7191               | 82.1   |
| 1984 | 9483.0         | 1230.0         | 87.2   | 94.4   | 87.2                              | 83.7   | 87.8               | 83.6   | 7908               | 90.0   |
| 1985 | 9931.8         | 1230.0         | 93.5   | 94.3   | 93.4                              | 85.3   | 92.2               | 85.1   | 8279               | 94.5   |
| 1986 | 7280.8         | 1230.0         | 67.4   | 90.4   | 67.4                              | 82.7   | 67.6               | 82.6   | 6254               | 71.4   |
| 1987 | 8673.9         | 1230.0         | 80.7   | 89.2   | 80.7                              | 82.5   | 80.5               | 82.3   | 7277               | 83.1   |
| 1988 | 9108.4         | 1230.0         | 85.0   | 88.7   | 84.9                              | 82.8   | 84.3               | 82.5   | 7627               | 86.8   |
| 1989 | 9245.6         | 1230.0         | 89.3   | 88.8   | 89.3                              | 83.4   | 85.8               | 82.9   | 7873               | 89.9   |
| 1990 | 8485.0         | 1230.0         | 78.9   | 87.9   | 78.9                              | 83.0   | 78.7               | 82.5   | 6921               | 79.0   |
| 1991 | 6485.9         | 1243.0         | 61.1   | 85.7   | 61.1                              | 81.2   | 60.1               | 80.6   | 5369               | 61.3   |
| 1992 | 8731.5         | 1230.0         | 86.5   | 85.7   | 86.5                              | 81.6   | 80.8               | 80.6   | 7646               | 87.0   |
| 1993 | 10824.8        | 1255.0         | 99.9   | 86.8   | 99.9                              | 82.9   | 98.5               | 81.9   | 8760               | 100.0  |
| 1994 | 7685.9         | 1255.0         | 80.1   | 86.3   | 80.1                              | 82.7   | 69.9               | 81.1   | 7039               | 80.4   |
| 1995 | 7980.6         | 1255.0         | 77.5   | 85.7   | 77.5                              | 82.4   | 72.6               | 80.5   | 6832               | 78.0   |
| 1996 | 9907.7         | 1285.0         | 91.3   | 86.1   | 91.3                              | 83.0   | 87.8               | 81.0   | 8055               | 91.7   |
| 1997 | 9932.4         | 1285.0         | 94.4   | 86.6   | 94.4                              | 83.6   | 88.2               | 81.4   | 8291               | 94.6   |
| 1998 | 6618.0         | 1285.0         | 58.7   | 85.0   | 58.7                              | 82.3   | 58.8               | 80.2   | 5217               | 59.6   |
| 1999 | 8096.6         | 1285.0         | 78.3   | 84.7   | 78.3                              | 82.0   | 71.9               | 79.7   | 6899               | 78.8   |
| 2000 | 9615.8         | 1295.0         | 86.2   | 84.8   | 86.2                              | 82.3   | 84.5               | 80.0   | 7604               | 86.6   |
| 2001 | 10656.7        | 1345.0         | 95.3   | 85.3   | 90.8                              | 82.7   | 90.4               | 80.5   | 8378               | 95.6   |
| 2002 | 6774.8         | 1345.0         | 60.5   | 84.1   | 60.5                              | 81.6   | 57.5               | 79.4   | 5313               | 60.7   |
| 2003 | 9254.9         | 1345.0         | 88.3   | 84.3   | 88.3                              | 81.9   | 78.5               | 79.4   | 7882               | 90.0   |
| 2004 | 9724.0         | 1345.0         | 87.4   | 84.5   | 87.4                              | 82.2   | 82.3               | 79.5   | 7711               | 87.8   |



## DE-17 UNTERWESER (KKU)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                       |
|--------|-------|---------|------|------|---|
| 20 Mar | 7.0   | 14.0    | UF2  | A31  | DISCONNECTION FROM GRID DUE TO TURBINE CONTROL    |
| 01 Jun | 718.0 | 968.2   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                 |
| 01 Jul | 99.0  | 151.6   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING                 |
| 28 Jul | 72.0  | 99.3    | PF   | D16  | STEAM GENERATOR SEALING CHANGE DUE TO THE LEAKAGE |
| 06 Nov | 168.0 | 235.2   | UF1  | A15  | CHANGE OF AXIAL BEARING IN MAIN COOLING PUMP      |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 175       |          |   | 285       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 817             |           |          | 855   | 42        |          |
| D. Inspection, maintenance or repair without refuelling                              | 72              |           |          | 29  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 32  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 0   | 29        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 20        |          |
| Subtotal   | 889             | 175       | 0        | 916   | 389       | 0        |
| Total  |                 | 1064      |          |   | 1305      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1978 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 36  |
| 12. Reactor I&C Systems             |                    | 6   |
| 13. Reactor Auxiliary Systems       |                    | 24  |
| 15. Reactor Cooling Systems         | 168                | 10  |
| 31. Turbine and auxiliaries         | 7                  | 60  |
| 32. Feedwater and Main Steam System |                    | 2   |
| 33. Circulating Water System        |                    | 0   |
| 41. Main Generator Systems          |                    | 142   |
| 42. Electrical Power Supply Systems |                    | 1   |
| XX. Miscellaneous Systems           |                    | 0   |
| Total                               | 175                | 281   |

# HU-1 PAKS-1

**Operator:** PAKS RT. (PAKS NUCLEAR POWER PLANT LTD)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 437.0 MW(e)  
**Design Net RUP:** 408.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3342.3 GW(e).h  
**Energy Availability Factor:** 87.1%  
**Load Factor:** 87.1%  
**Operating Factor:** 87.6%  
**Energy Unavailability Factor:** 12.9%  
**Total Off-line Time:** 1092 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 324.7 | 302.6 | 324.3 | 0.0   | 183.7 | 307.2 | 317.9 | 303.7 | 314.1 | 325.1 | 314.1 | 325.0 | 3342.3 |
| <b>EAF (%)</b>  | 99.9  | 99.5  | 99.9  | 0.0   | 56.5  | 97.6  | 97.8  | 93.4  | 99.8  | 99.9  | 99.8  | 100.0 | 87.1   |
| <b>UCF (%)</b>  | 99.9  | 99.5  | 99.9  | 0.0   | 56.5  | 97.6  | 97.8  | 93.4  | 99.8  | 99.9  | 99.8  | 100.0 | 87.1   |
| <b>LF (%)</b>   | 99.9  | 99.5  | 99.9  | 0.0   | 56.5  | 97.6  | 97.8  | 93.4  | 99.8  | 99.9  | 99.8  | 100.0 | 87.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 0.0   | 58.2  | 97.2  | 100.0 | 94.5  | 100.0 | 100.0 | 100.0 | 100.0 | 87.6   |
| <b>EUF (%)</b>  | 0.1   | 0.5   | 0.1   | 100.0 | 43.5  | 2.4   | 2.2   | 6.6   | 0.2   | 0.1   | 0.2   | 0.0   | 12.9   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.1   | 100.0 | 15.6  | 0.0   | 1.9   | 6.3   | 0.0   | 0.0   | 0.0   | 0.0   | 10.2   |
| <b>UCLF (%)</b> | 0.1   | 0.5   | 0.0   | 0.0   | 27.9  | 2.4   | 0.3   | 0.3   | 0.2   | 0.1   | 0.2   | 0.1   | 2.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

OPERATION AT FULL POWER IN BASE LOAD MODE.

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1974      **Lifetime Generation:** 69647.1 GW(e).h  
**Date of First Criticality:** 14 Dec 1982      **Cumulative Energy Availability Factor:** 85.1%  
**Date of Grid Connection:** 28 Dec 1982      **Cumulative Load Factor:** 86.1%  
**Date of Commercial Operation:** 10 Aug 1983      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 14.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2299.7         | 410.0          | 0.0  | 0.0    | 65.7                              | 100.0  | 64.0               | 0.0    | 7106               | 81.1   |
| 1984 | 2595.3         | 410.0          | 75.7   | 75.7   | 75.6                              | 76.0   | 73.3               | 72.1   | 6901               | 78.6   |
| 1985 | 2997.3         | 410.0          | 84.2   | 80.0   | 84.2                              | 80.1   | 83.5               | 77.8   | 7491               | 85.5   |
| 1986 | 3114.6         | 410.0          | 87.1   | 82.4   | 87.1                              | 82.4   | 86.7               | 80.7   | 7718               | 88.1   |
| 1987 | 2883.1         | 415.0          | 79.2   | 81.6   | 79.2                              | 81.6   | 79.3               | 80.4   | 7107               | 81.1   |
| 1988 | 3076.9         | 415.0          | 85.8   | 82.4   | 85.8                              | 82.5   | 84.4               | 81.2   | 7737               | 88.1   |
| 1989 | 3182.2         | 415.0          | 87.7   | 83.3   | 87.7                              | 83.3   | 87.5               | 82.3   | 7929               | 90.5   |
| 1990 | 3216.8         | 415.0          | 87.2   | 83.9   | 87.2                              | 83.9   | 88.5               | 83.1   | 7837               | 89.5   |
| 1991 | 2883.9         | 410.0          | 75.1   | 82.8   | 75.1                              | 82.8   | 80.3               | 82.8   | 6823               | 77.9   |
| 1992 | 3498.9         | 430.0          | 84.9   | 83.0   | 84.9                              | 83.0   | 92.6               | 83.9   | 7629               | 86.9   |
| 1993 | 3512.4         | 430.0          | 85.8   | 83.3   | 85.8                              | 83.3   | 93.2               | 84.9   | 7637               | 87.2   |
| 1994 | 3441.5         | 430.0          | 89.9   | 83.9   | 89.8                              | 83.9   | 91.4               | 85.5   | 8031               | 91.7   |
| 1995 | 3056.3         | 430.0          | 79.6   | 83.6   | 79.5                              | 83.6   | 81.1               | 85.1   | 7088               | 80.9   |
| 1996 | 3472.7         | 430.0          | 90.7   | 84.1   | 90.6                              | 84.1   | 91.9               | 85.7   | 8033               | 91.5   |
| 1997 | 3328.5         | 430.0          | 87.0   | 84.3   | 86.9                              | 84.3   | 88.4               | 85.9   | 7646               | 87.3   |
| 1998 | 3487.7         | 430.0          | 92.4   | 84.9   | 92.4                              | 84.9   | 92.6               | 86.3   | 8095               | 92.4   |
| 1999 | 3117.5         | 430.0          | 81.6   | 84.7   | 81.2                              | 84.6   | 82.8               | 86.1   | 7240               | 82.6   |
| 2000 | 3192.1         | 430.0          | 82.5   | 84.5   | 82.3                              | 84.5   | 84.5               | 86.0   | 7268               | 82.7   |
| 2001 | 3514.9         | 437.0          | 91.8   | 85.0   | 91.6                              | 84.9   | 91.8               | 86.3   | 8069               | 92.1   |
| 2002 | 3330.7         | 437.0          | 90.2   | 85.3   | 90.1                              | 85.2   | 87.0               | 86.4   | 7909               | 90.3   |
| 2003 | 3097.8         | 437.0          | 81.0   | 85.0   | 81.0                              | 85.0   | 80.9               | 86.1   | 7197               | 82.1   |
| 2004 | 3342.3         | 437.0          | 87.1   | 85.1   | 87.1                              | 85.1   | 87.1               | 86.1   | 7692               | 87.6   |

# HU-1 PAKS-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                              |
|--------|-------|---------|------|------|--|
| 15 Jan | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 17 Jan | 11.0  | 0.3     | XP   | K    | LOAD FOLLOWING IN JANUARY.               |
| 29 Jan | 1.0   | 0.0     | UP2  | A31  | HIGH BEARING OIL TEMPERATURE.            |
| 01 Feb | 36.0  | 1.3     | XP   | K    | LOAD FOLLOWING IN FEBRUARY.              |
| 07 Feb | 2.0   | 0.2     | PP   | E    | TEST                                     |
| 01 Mar | 5.0   | 0.1     | XP   | K    | LOAD FOLLOWING IN MARCH.                 |
| 31 Mar | 836.0 | 365.6   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.       |
| 05 May | 207.0 | 90.7    | UF3  | Z    | UNPLANNED EXTENSIONS OF PLANNED OUTAGE.  |
| 21 May | 7.0   | 0.7     | UP2  | A32  | FEED WATER SYSTEM SUPPLY FAILURE.        |
| 01 Jun | 44.0  | 1.9     | XP   | K    | LOAD FOLLOWING IN JUNE.                  |
| 06 Jun | 27.0  | 5.5     | UP1  | A31  | UNPLANNED MAINTENANCE (TURBINE CHECKING) |
| 01 Jul | 30.0  | 0.8     | XP   | K    | LOAD FOLLOWING IN JULY.                  |
| 08 Jul | 1.0   | 0.2     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 11 Jul | 33.0  | 6.2     | PP   | D31  | SHORT TERM MAINTENANCE OF 2ND TURBINE.   |
| 07 Aug | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 08 Aug | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 08 Aug | 3.0   | 0.4     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 09 Aug | 2.0   | 0.1     | PP   | E    | TEST                                     |
| 21 Aug | 2.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 28 Aug | 47.0  | 20.6    | PF   | D    | SHORT TERM MAINTENANCE.                  |
| 02 Sep | 8.0   | 0.4     | XP   | K    | LOAD FOLLOWING IN SEPTEMBER.             |
| 24 Sep | 2.0   | 0.2     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 02 Oct | 2.0   | 0.0     | XP   | K    | LOAD FOLLOWING IN OCTOBER.               |
| 23 Oct | 1.0   | 0.0     | PP   | E    | TEST                                     |
| 27 Oct | 0.3   | 0.0     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 31 Oct | 2.0   | 0.2     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 31 Oct | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                 |
| 01 Nov | 14.0  | 0.6     | XP   | K    | LOAD FOLLOWING IN NOVEMBER.              |
| 12 Dec | 5.0   | 0.2     | XP   | K    | LOAD FOLLOWING IN DECEMBER.              |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 78        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 836             |           |          | 968                                      | 30        |          |
| D. Inspection, maintenance or repair without refuelling                              | 47              |           |          | 17                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         |          |
| Z. Others  |                 | 207       |          |  |           |          |
| Subtotal   | 883             | 207       | 0        | 985                                      | 116       | 0        |
| Total  |                 | 1090      |          |  | 1101      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 0  |
| 12. Reactor I&C Systems             |                 | 19                                       |
| 14. Safety Systems                  |                 | 5  |
| 15. Reactor Cooling Systems         |                 | 2  |
| 16. Steam generation systems        |                 | 15                                       |
| 31. Turbine and auxiliaries         |                 | 3  |
| 32. Feedwater and Main Steam System |                 | 13                                       |
| 33. Circulating Water System        |                 | 1  |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 0  |
| Total                               | 0               | 58                                       |

# HU-2 PAKS-2

**Operator:** PAKS RT. (PAKS NUCLEAR POWER PLANT LTD)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 441.0 MW(e)  
**Design Net RUP:** 410.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1137.2 GW(e).h  
**Energy Availability Factor:** 29.4%  
**Load Factor:** 29.4%  
**Operating Factor:** 29.8%  
**Energy Unavailability Factor:** 70.6%  
**Total Off-line Time:** 6164 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 44.9 | 267.4 | 323.2 | 317.4 | 184.5 | 1137.2 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.7 | 84.2  | 98.4  | 100.0 | 56.2  | 29.4   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.7 | 84.2  | 98.4  | 100.0 | 56.2  | 29.4   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.7 | 84.2  | 98.4  | 100.0 | 56.2  | 29.4   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.0  | 100.0 | 99.6  | 100.0 | 54.8  | 29.8   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.3 | 15.8  | 1.6   | 0.0   | 43.8  | 70.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 43.8  | 3.7    |
| <b>UCLF (%)</b> | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.3 | 15.8  | 1.6   | 0.1   | 0.0   | 66.9   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

LONG TERM SHUTDOWN - OUTAGE EXTENSION DUE TO FUEL CLEANING PROBLEM IN APRIL 2003.

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1974      **Lifetime Generation:** 61426.7 GW(e).h  
**Date of First Criticality:** 26 Aug 1984      **Cumulative Energy Availability Factor:** 79.4%  
**Date of Grid Connection:** 06 Sep 1984      **Cumulative Load Factor:** 80.5%  
**Date of Commercial Operation:** 14 Nov 1984      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 20.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 921.8          | 425.0          | 0.0  | 0.0    | 98.7                              | 100.0  | 25.0               | 0.0    | 2659               | 30.7   |
| 1985 | 3101.6         | 415.0          | 85.1   | 85.1   | 85.1                              | 85.1   | 85.3               | 85.3   | 7695               | 87.8   |
| 1986 | 3148.3         | 415.0          | 86.0   | 85.6   | 86.0                              | 85.6   | 86.6               | 86.0   | 7643               | 87.2   |
| 1987 | 3193.9         | 415.0          | 85.3   | 85.5   | 85.3                              | 85.5   | 87.9               | 86.6   | 7770               | 88.7   |
| 1988 | 3046.3         | 415.0          | 81.9   | 84.6   | 81.9                              | 84.6   | 83.6               | 85.8   | 7352               | 83.7   |
| 1989 | 3300.7         | 415.0          | 88.6   | 85.4   | 88.6                              | 85.4   | 90.8               | 86.8   | 7962               | 90.9   |
| 1990 | 3338.2         | 425.0          | 88.0   | 85.8   | 88.0                              | 85.8   | 89.7               | 87.3   | 7845               | 89.6   |
| 1991 | 3421.6         | 415.0          | 88.6   | 86.2   | 88.6                              | 86.2   | 94.1               | 88.3   | 7912               | 90.3   |
| 1992 | 3174.9         | 433.0          | 76.0   | 84.9   | 76.0                              | 84.9   | 83.5               | 87.7   | 6829               | 77.7   |
| 1993 | 3569.0         | 433.0          | 87.0   | 85.2   | 87.0                              | 85.2   | 94.1               | 88.4   | 7731               | 88.3   |
| 1994 | 3440.4         | 433.0          | 89.5   | 85.6   | 89.4                              | 85.6   | 90.7               | 88.6   | 8000               | 91.3   |
| 1995 | 3309.1         | 433.0          | 86.6   | 85.7   | 86.4                              | 85.7   | 87.2               | 88.5   | 7657               | 87.4   |
| 1996 | 3019.9         | 433.0          | 79.5   | 85.2   | 79.4                              | 85.1   | 79.4               | 87.7   | 7011               | 79.8   |
| 1997 | 3267.6         | 433.0          | 88.3   | 85.4   | 88.2                              | 85.4   | 86.1               | 87.6   | 7807               | 89.1   |
| 1998 | 3206.7         | 433.0          | 88.3   | 85.6   | 88.2                              | 85.6   | 84.5               | 87.4   | 7717               | 88.1   |
| 1999 | 3246.6         | 433.0          | 90.2   | 85.9   | 89.2                              | 85.8   | 85.6               | 87.3   | 7780               | 88.8   |
| 2000 | 3059.3         | 433.0          | 80.1   | 85.5   | 80.0                              | 85.5   | 80.4               | 86.8   | 7073               | 80.5   |
| 2001 | 3266.9         | 441.0          | 84.9   | 85.5   | 84.8                              | 85.4   | 84.6               | 86.7   | 7484               | 85.4   |
| 2002 | 3338.5         | 441.0          | 86.7   | 85.6   | 86.5                              | 85.5   | 86.4               | 86.7   | 7644               | 87.3   |
| 2003 | 918.8          | 441.0          | 23.8   | 82.2   | 23.8                              | 82.1   | 23.8               | 83.3   | 2089               | 23.8   |
| 2004 | 1137.2         | 441.0          | 29.4   | 79.5   | 29.4                              | 79.4   | 29.4               | 80.5   | 2620               | 29.8   |

## HU-2 PAKS-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 5828.0 | 2693.0  | UF3  | A11  | ANNUAL MAINTENANCE. (COUNTINUE THE LAST YEAR PROBLEM IN THE 1ST PIT) |
| 03 Sep | 0.6    | 0.0     | PP   | E    | TESTING.   |
| 13 Sep | 2275.0 | 50.0    | UP2  | S    | OPERATIONAL REGLAMENT BECAUSE OF BURNING OUT LIMIT.                  |
| 15 Sep | 1.0    | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.   |
| 20 Oct | 11.0   | 5.2     | UF2  | A42  | FORCED OUTAGE HOUSE TRANSFORMER OIL LEAKAGE.                         |
| 21 Oct | 1.0    | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.   |
| 26 Oct | 2.0    | 0.1     | PP   | E    | TESTING.   |
| 16 Nov | 1.0    | 0.0     | XP   | K    | LOAD FOLLOWING.  |
| 27 Nov | 2.0    | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.   |
| 17 Dec | 325.0  | 143.6   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.                                   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 5839      |          |  | 346       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 18        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 325             |           |          | 878                                      | 21        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 15                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 24        |          |
| Z. Others  |                 |           |          |  | 6         |          |
| Subtotal   | 325             | 5839      | 0        | 894                                      | 415       | 0        |
| Total  |                 | 6164      |          |  | 1309      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    | 5828            | 271                                      |
| 12. Reactor I&C Systems                        |                 | 23                                       |
| 15. Reactor Cooling Systems                    |                 | 4  |
| 16. Steam generation systems                   |                 | 11                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 23                                       |
| 31. Turbine and auxiliaries                    |                 | 1  |
| 32. Feedwater and Main Steam System            |                 | 0  |
| 41. Main Generator Systems                     |                 | 0  |
| 42. Electrical Power Supply Systems            | 11              | 2  |
| Total  | 5839            | 335                                      |

# HU-3 PAKS-3

**Operator:** PAKS RT. (PAKS NUCLEAR POWER PLANT LTD)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 433.0 MW(e)  
**Design Net RUP:** 410.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3333.3 GW(e).h  
**Energy Availability Factor:** 87.6%  
**Load Factor:** 87.6%  
**Operating Factor:** 88.0%  
**Energy Unavailability Factor:** 12.4%  
**Total Off-line Time:** 1052 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 321.9 | 300.5 | 308.3 | 311.7 | 320.5 | 306.7 | 321.0 | 322.0 | 307.7 | 18.0 | 231.3 | 263.6 | 3333.3 |
| <b>EAF (%)</b>  | 99.9  | 99.7  | 95.8  | 100.0 | 99.5  | 98.4  | 99.6  | 100.0 | 98.7  | 5.6  | 74.2  | 81.8  | 87.6   |
| <b>UCF (%)</b>  | 99.9  | 99.7  | 95.8  | 100.0 | 99.5  | 98.4  | 99.6  | 100.0 | 98.7  | 5.6  | 74.2  | 81.8  | 87.6   |
| <b>LF (%)</b>   | 99.9  | 99.7  | 95.7  | 100.1 | 99.5  | 98.4  | 99.6  | 100.0 | 98.7  | 5.6  | 74.2  | 81.8  | 87.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 94.2  | 100.1 | 99.5  | 98.3  | 100.0 | 100.0 | 99.2  | 6.4  | 77.4  | 82.8  | 88.0   |
| <b>EUF (%)</b>  | 0.1   | 0.3   | 4.2   | 0.0   | 0.5   | 1.6   | 0.4   | 0.0   | 1.3   | 94.4 | 25.8  | 18.2  | 12.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 3.7   | 0.0   | 0.4   | 0.0   | 0.0   | 0.0   | 1.3   | 87.9 | 0.0   | 0.0   | 7.9    |
| <b>UCLF (%)</b> | 0.1   | 0.3   | 0.5   | 0.0   | 0.1   | 1.6   | 0.4   | 0.0   | 0.0   | 6.5  | 25.8  | 18.2  | 4.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

OPERATION AT FULL POWER IN BASE LOAD MODE.

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1979      **Lifetime Generation:** 59824.2 GW(e).h  
**Date of First Criticality:** 15 Sep 1986      **Cumulative Energy Availability Factor:** 86.3%  
**Date of Grid Connection:** 28 Sep 1986      **Cumulative Load Factor:** 87.3%  
**Date of Commercial Operation:** 01 Dec 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 13.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 718.5          | 427.0          | 0.0  | 0.0    | 100.0                             | 100.0  | 20.7               | 0.0    | 2109               | 26.0   |
| 1987 | 3209.6         | 415.0          | 87.0   | 87.0   | 87.0                              | 87.0   | 88.3               | 88.3   | 7648               | 87.3   |
| 1988 | 3300.9         | 415.0          | 88.1   | 87.5   | 88.1                              | 87.5   | 90.6               | 89.4   | 7874               | 89.6   |
| 1989 | 3140.5         | 415.0          | 82.4   | 85.8   | 82.4                              | 85.8   | 86.4               | 88.4   | 7343               | 83.8   |
| 1990 | 3273.4         | 435.0          | 85.6   | 85.8   | 85.6                              | 85.8   | 85.9               | 87.8   | 7755               | 88.5   |
| 1991 | 3256.0         | 410.0          | 84.2   | 85.5   | 84.2                              | 85.5   | 90.7               | 88.3   | 7580               | 86.5   |
| 1992 | 3587.3         | 433.0          | 87.7   | 85.8   | 87.5                              | 85.8   | 94.3               | 89.4   | 7852               | 89.4   |
| 1993 | 3177.9         | 433.0          | 77.6   | 84.6   | 77.4                              | 84.6   | 83.8               | 88.5   | 6950               | 79.3   |
| 1994 | 3376.0         | 433.0          | 88.6   | 85.2   | 88.5                              | 85.1   | 89.0               | 88.6   | 7884               | 90.0   |
| 1995 | 3392.8         | 433.0          | 89.2   | 85.6   | 89.0                              | 85.5   | 89.4               | 88.7   | 7911               | 90.3   |
| 1996 | 3429.4         | 433.0          | 90.9   | 86.2   | 90.8                              | 86.1   | 90.2               | 88.8   | 8136               | 92.6   |
| 1997 | 3066.1         | 433.0          | 81.1   | 85.7   | 80.9                              | 85.6   | 80.8               | 88.1   | 7136               | 81.5   |
| 1998 | 3294.1         | 433.0          | 88.0   | 85.9   | 88.0                              | 85.8   | 86.8               | 88.0   | 7566               | 86.4   |
| 1999 | 3445.7         | 433.0          | 92.3   | 86.4   | 92.2                              | 86.3   | 90.8               | 88.2   | 8058               | 92.0   |
| 2000 | 3517.3         | 433.0          | 93.0   | 86.9   | 92.8                              | 86.8   | 92.5               | 88.5   | 8163               | 92.9   |
| 2001 | 3040.4         | 433.0          | 80.7   | 86.5   | 80.3                              | 86.3   | 80.2               | 88.0   | 7159               | 81.7   |
| 2002 | 3256.8         | 433.0          | 90.5   | 86.7   | 90.4                              | 86.6   | 85.9               | 87.8   | 7900               | 90.2   |
| 2003 | 3008.3         | 433.0          | 87.8   | 86.8   | 80.5                              | 86.2   | 79.3               | 87.3   | 7746               | 88.4   |
| 2004 | 3333.3         | 433.0          | 87.6   | 86.8   | 87.6                              | 86.3   | 87.6               | 87.3   | 7732               | 88.0   |

# HU-3 PAKS-3

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 17 Jan | 10.0  | 0.2     | XP   | K    | LOAD FOLLOWING IN JANUARY.   |
| 03 Feb | 30.0  | 0.9     | XP   | K    | LOAD FOLLOWING IN FEBRUARY.  |
| 01 Mar | 41.0  | 1.6     | XP   | K    | LOAD FOLLOWING IN MARCH.   |
| 27 Mar | 27.0  | 11.8    | PF   | D31  | SHORT TERM MAINTENANCE.  |
| 24 Apr | 2.0   | 0.0     | PP   | E    | TEST   |
| 01 May | 5.0   | 0.2     | XP   | K    | LOAD FOLLOWING IN MAY.   |
| 26 May | 3.0   | 1.4     | PF   | D31  | SHORT TERM MAINTENANCE.  |
| 01 Jun | 40.0  | 1.8     | XP   | K    | LOAD FOLLOWING IN JUNE.  |
| 20 Jun | 7.0   | 3.3     | UF2  | A31  | TURBINE TRIP.  |
| 01 Jul | 36.0  | 1.2     | XP   | K    | LOAD FOLLOWING IN JULY.  |
| 01 Aug | 6.0   | 0.1     | XP   | K    | LOAD FOLLOWING IN AUGUST.  |
| 02 Sep | 1.0   | 0.0     | XP   | K    | LOAD FOLLOWING.  |
| 05 Sep | 9.0   | 4.1     | PF   | D    | SHORT TERM MAINTENANCE (HOUSE TRANSFORMER DISCONNECTION).                                |
| 02 Oct | 626.0 | 283.6   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.   |
| 30 Oct | 244.0 | 106.1   | UF3  | Z    | UNPLANNED EXTENSIONS OF PLANNED OUTAGE. (THE ANNUAL MAINTENANCE IS NOT FINISHED IN TIME) |
| 10 Nov | 3.0   | 1.4     | UF2  | A42  | BREAKER FAILURE PROTECTION OF 400 KV CIRCUIT.  |
| 12 Nov | 0.3   | 0.0     | PP   | E    | TESTING.   |
| 14 Nov | 4.0   | 0.1     | XP   | K    | LOAD FOLLOWING IN NOVEMBER.  |
| 12 Dec | 4.0   | 0.2     | XP   | K    | LOAD FOLLOWING IN DECEMBER.  |
| 21 Dec | 133.0 | 57.8    | UF2  | A12  | FORCED OUTAGE DUE TO LEAKAGE AT CONTROL ROD SUPPLY.                                      |
| 27 Dec | 5.0   | 0.5     | UP2  | A31  | SEPARATOR-REHEATER LEAKAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 143       |          |  | 120       |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 626             |           |          | 847                                      | 148       |          |
| D. Inspection, maintenance or repair without refuelling       | 39              |           |          | 26                                       |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 2  | 7         |          |
| Z. Others   |                 | 244       |          |  |           |          |
| Subtotal  | 665             | 387       | 0        | 875                                      | 275       | 0        |
| Total   |                 | 1052      |          |  | 1150      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        | 133             | 38                                       |
| 14. Safety Systems                             |                 | 0  |
| 15. Reactor Cooling Systems                    |                 | 0  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    | 7               | 0  |
| 32. Feedwater and Main Steam System            |                 | 25                                       |
| 42. Electrical Power Supply Systems            | 3               | 41                                       |
| Total  | 143             | 104                                      |

# HU-4 PAKS-4

**Operator:** PAKS RT. (PAKS NUCLEAR POWER PLANT LTD)  
**Contractor:** AEE (ATOMENERGOEXPORT)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 444.0 MW(e)  
**Design Net RUP:** 410.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3396.6 GW(e).h  
**Energy Availability Factor:** 87.1%  
**Load Factor:** 87.1%  
**Operating Factor:** 89.7%  
**Energy Unavailability Factor:** 12.9%  
**Total Off-line Time:** 906 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 330.0 | 307.5 | 242.0 | 317.9 | 85.8 | 173.8 | 328.8 | 329.6 | 311.7 | 330.2 | 318.6 | 320.7 | 3396.6 |
| <b>EAF (%)</b>  | 99.9  | 99.5  | 87.0  | 85.4  | 26.0 | 54.4  | 99.5  | 99.8  | 97.5  | 99.8  | 99.7  | 97.1  | 87.1   |
| <b>UCF (%)</b>  | 99.9  | 99.5  | 87.0  | 85.4  | 26.0 | 54.4  | 99.5  | 99.8  | 97.5  | 99.8  | 99.7  | 97.1  | 87.1   |
| <b>LF (%)</b>   | 99.9  | 99.5  | 73.3  | 99.6  | 26.0 | 54.4  | 99.5  | 99.8  | 97.5  | 99.8  | 99.7  | 97.1  | 87.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 23.1 | 55.4  | 100.0 | 100.0 | 98.9  | 99.3  | 100.0 | 100.0 | 89.7   |
| <b>EUF (%)</b>  | 0.1   | 0.5   | 13.0  | 14.6  | 74.0 | 45.6  | 0.5   | 0.2   | 2.5   | 0.2   | 0.3   | 2.9   | 12.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 12.2  | 14.1  | 72.7 | 45.3  | 0.1   | 0.1   | 1.5   | 0.0   | 0.0   | 2.8   | 12.4   |
| <b>UCLF (%)</b> | 0.1   | 0.5   | 0.8   | 0.6   | 1.3  | 0.3   | 0.4   | 0.2   | 1.0   | 0.2   | 0.3   | 0.1   | 0.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

OPERATION AT FULL POWER IN BASE LOAD MODE.

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1979      **Lifetime Generation:** 58539.7 GW(e).h  
**Date of First Criticality:** 09 Aug 1987      **Cumulative Energy Availability Factor:** 87.4%  
**Date of Grid Connection:** 16 Aug 1987      **Cumulative Load Factor:** 89.3%  
**Date of Commercial Operation:** 01 Nov 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 12.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 1039.1         | 425.0          | 0.0  | 0.0    | 29.1                              | 100.0  | 29.1               | 0.0    | 2936               | 35.0   |
| 1988 | 3200.9         | 415.0          | 85.7   | 85.7   | 85.6                              | 85.6   | 87.8               | 87.8   | 7564               | 86.1   |
| 1989 | 3425.3         | 415.0          | 89.7   | 87.7   | 89.7                              | 87.7   | 94.2               | 91.0   | 7974               | 91.0   |
| 1990 | 3064.5         | 435.0          | 76.7   | 83.9   | 76.7                              | 83.9   | 80.4               | 87.4   | 7253               | 82.8   |
| 1991 | 3343.0         | 410.0          | 86.5   | 84.5   | 86.5                              | 84.5   | 93.1               | 88.8   | 7787               | 88.9   |
| 1992 | 3702.8         | 433.0          | 90.9   | 85.8   | 90.7                              | 85.8   | 97.4               | 90.5   | 8082               | 92.0   |
| 1993 | 3537.2         | 430.0          | 87.5   | 86.1   | 87.0                              | 86.0   | 93.9               | 91.1   | 7767               | 88.7   |
| 1994 | 2971.2         | 433.0          | 78.1   | 85.0   | 78.1                              | 84.9   | 78.3               | 89.2   | 7019               | 80.1   |
| 1995 | 3443.8         | 433.0          | 90.8   | 85.7   | 90.4                              | 85.6   | 90.8               | 89.4   | 8049               | 91.9   |
| 1996 | 3487.5         | 433.0          | 91.3   | 86.3   | 90.7                              | 86.1   | 91.7               | 89.7   | 8087               | 92.1   |
| 1997 | 3487.1         | 433.0          | 92.0   | 86.9   | 91.6                              | 86.7   | 91.9               | 89.9   | 8098               | 92.4   |
| 1998 | 3136.1         | 433.0          | 84.3   | 86.7   | 83.7                              | 86.4   | 82.7               | 89.3   | 7389               | 84.3   |
| 1999 | 3464.0         | 433.0          | 89.3   | 86.9   | 89.3                              | 86.7   | 91.3               | 89.4   | 8046               | 91.8   |
| 2000 | 3578.4         | 433.0          | 92.3   | 87.3   | 92.2                              | 87.1   | 94.1               | 89.8   | 8116               | 92.4   |
| 2001 | 3471.7         | 444.0          | 90.1   | 87.5   | 90.0                              | 87.3   | 89.3               | 89.8   | 7916               | 90.4   |
| 2002 | 3182.9         | 444.0          | 83.3   | 87.2   | 83.1                              | 87.0   | 81.8               | 89.2   | 7287               | 83.2   |
| 2003 | 3607.6         | 444.0          | 93.0   | 87.6   | 92.8                              | 87.4   | 92.8               | 89.4   | 8119               | 92.7   |
| 2004 | 3396.6         | 444.0          | 87.1   | 87.6   | 87.1                              | 87.4   | 87.1               | 89.3   | 7878               | 89.7   |



# HU-4 PAKS-4

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 17 Jan | 10.0  | 0.3     | XP   | K    | LOAD FOLLOWING IN JANUARY.                          |
| 01 Feb | 38.0  | 1.5     | XP   | K    | LOAD FOLLOWING IN FEBRUARY.                         |
| 01 Mar | 46.0  | 2.4     | XP   | K    | LOAD FOLLOWING IN MARCH.                            |
| 17 Mar | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 18 Mar | 713.0 | 85.2    | PP   | S    | OPERATIONAL REGLEMENT BECAUSE OF BURNING OUT LIMIT. |
| 24 Mar | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 25 Apr | 4.0   | 1.8     | UF2  | A41  | UNPLANNED MAINTENANCE (EXCITING FAILURE)            |
| 01 May | 19.0  | 4.1     | UP2  | A41  | TURBINE TRIP DUE TO GENERATOR PROTECTION.           |
| 05 May | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 05 May | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 08 May | 867.0 | 385.1   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.                  |
| 16 Jun | 1.0   | 0.0     | PP   | E    | TESTING.  |
| 18 Jun | 2.0   | 1.0     | XP   | K    | LOAD FOLLOWING IN JUNE.                             |
| 01 Jul | 32.0  | 1.3     | XP   | K    | LOAD FOLLOWING IN JULY.                             |
| 10 Jul | 3.0   | 0.3     | PP   | D12  | CONTROL ROD SUPPLY MAINTENANCE.                     |
| 01 Aug | 5.0   | 0.1     | XP   | K    | LOAD FOLLOWING IN AUGUST.                           |
| 08 Aug | 2.0   | 0.2     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 17 Aug | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 20 Aug | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 20 Aug | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 26 Aug | 2.0   | 0.2     | PP   | D12  | SHORT TERM MAINTENANCE.                             |
| 06 Sep | 3.0   | 0.3     | XP   | K    | LOAD FOLLOWING IN SEPTEMBER.                        |
| 19 Sep | 5.0   | 0.9     | UP2  | A31  | TURBINE TRIP.                                       |
| 19 Sep | 9.0   | 2.0     | UP2  | A31  | TURBINE TRIP DUE TO GENERATOR PROTECTION.           |
| 26 Sep | 10.0  | 4.8     | PF   | D42  | HOUSE TRANSFORMER DISCONNECTION.                    |
| 02 Oct | 3.0   | 0.1     | XP   | K    | LOAD FOLLOWING IN OCTOBER.                          |
| 26 Oct | 5.0   | 0.4     | UP1  | Z31  | CONDENSER CHECKING.                                 |
| 27 Oct | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 01 Nov | 14.0  | 0.9     | XP   | K    | LOAD FOLLOWING IN NOVEMBER.                         |
| 29 Nov | 1.0   | 0.1     | UP2  | A12  | CONTROL ROD SUPPLY TRIP.                            |
| 12 Dec | 6.0   | 0.3     | XP   | K    | LOAD FOLLOWING IN DECEMBER.                         |
| 16 Dec | 43.0  | 9.3     | PP   | D31  | SHORT TERM MAINTENANCE.                             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 4         |          |  | 62        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 867             |           |          | 821                                      | 32        |          |
| D. Inspection, maintenance or repair without refuelling                              | 10              |           |          | 6  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 1  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 4  |           |          |
| Z. Others  |                 |           |          |  | 4         |          |
| Subtotal   | 877             | 4         | 0        | 832                                      | 98        | 0        |
| Total  |                 | 881       |          |  | 930       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 11                                       |
| 15. Reactor Cooling Systems                    |                 | 19                                       |
| 16. Steam generation systems                   |                 | 6  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 6  |
| 32. Feedwater and Main Steam System            |                 | 6  |
| 41. Main Generator Systems                     | 4               |  |
| 42. Electrical Power Supply Systems            |                 | 1  |
| Total  | 4               | 50                                       |

**IN-13 KAIGA-1**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 202.0 MW(e)  
 Design Net RUP: 220.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 1344.9 GW(e).h  
 Energy Availability Factor: 77.8%  
 Load Factor: 75.8%  
 Operating Factor: 93.1%  
 Energy Unavailability Factor: 22.2%  
 Total Off-line Time: 603 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb  | Mar  | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|------|------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| GW(e).h  | 120.3 | 99.3 | 72.0 | 103.5 | 116.6 | 112.7 | 110.0 | 93.0 | 120.2 | 133.6 | 129.6 | 134.1 | 1344.9 |
| EAF (%)  | 82.1  | 72.6 | 49.9 | 73.2  | 79.6  | 79.5  | 75.2  | 63.9 | 84.6  | 90.8  | 91.1  | 91.2  | 77.8   |
| UCF (%)  | 100.0 | 89.8 | 68.6 | 92.7  | 100.0 | 100.0 | 100.0 | 84.1 | 99.9  | 100.0 | 100.0 | 100.0 | 94.6   |
| LF (%)   | 80.1  | 70.7 | 47.9 | 71.2  | 77.6  | 77.5  | 73.2  | 61.9 | 82.6  | 88.9  | 89.1  | 89.2  | 75.8   |
| OF (%)   | 100.0 | 87.4 | 60.3 | 90.7  | 100.0 | 100.0 | 100.0 | 79.6 | 99.9  | 100.0 | 100.0 | 100.0 | 93.1   |
| EUF (%)  | 17.9  | 27.4 | 50.1 | 26.8  | 20.4  | 20.5  | 24.8  | 36.1 | 15.4  | 9.2   | 8.9   | 8.8   | 22.2   |
| PUF (%)  | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| UCLF (%) | 0.0   | 10.2 | 31.4 | 7.3   | 0.0   | 0.0   | 0.0   | 15.9 | 0.1   | 0.0   | 0.0   | 0.0   | 5.4    |
| XUF (%)  | 17.9  | 17.1 | 18.7 | 19.5  | 20.4  | 20.5  | 24.8  | 20.2 | 15.3  | 9.2   | 8.9   | 8.8   | 16.8   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THROUGHOUT THE YEAR UNIT OPERATED AT A REDUCED POWER LEVEL BETWEEN 75-90% OF FULL POWER FOR RATIONALIZATION OF GENERATION WITH RESPECT TO GRID DEMAND.

**5. Historical Summary**

Date of Construction Start: 01 Sep 1989      Lifetime Generation: 5807.3 GW(e).h  
 Date of First Criticality: 26 Sep 2000      Cumulative Energy Availability Factor: 81.0%  
 Date of Grid Connection: 12 Oct 2000      Cumulative Load Factor: 79.5%  
 Date of Commercial Operation: 16 Nov 2000      Cumulative Unit Capability Factor: 83.7%  
    Cumulative Energy Unavailability Factor: 19.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2000 | 192.3          | 200.0          | 0.0  | 0.0    | 84.4                              | 100.0  | 50.1               | 0.0    | 1173               | 61.1   |
| 2001 | 1241.1         | 200.0          | 75.8   | 75.8   | 70.4                              | 70.4   | 70.8               | 70.8   | 6316               | 72.1   |
| 2002 | 1692.9         | 202.0          | 95.6   | 85.8   | 92.4                              | 81.4   | 95.7               | 83.3   | 8082               | 92.3   |
| 2003 | 1336.0         | 202.0          | 87.5   | 86.3   | 83.4                              | 82.1   | 75.5               | 80.7   | 7255               | 82.8   |
| 2004 | 1344.9         | 202.0          | 94.6   | 88.4   | 77.8                              | 81.0   | 75.8               | 79.5   | 8181               | 93.1   |

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## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 26 Feb | 158.1 | 25.6    | UF4  | A12  | REACTOR TRIPPED DUE TO SIMULTANEOUS FAILURE OF DPHS REACTOR REGULATING SYSTEM A&B. |
| 04 Mar | 2.9   | 0.5     | UF2  | A31  | TG TRIPPED DUE TO OIL LEAK FROM RELAY OIL IMPULSE LINE.                            |
| 04 Mar | 202.2 | 32.4    | UF5  | A11  | UNIT TRIPPED MANUALLY TO ATTEND MODERATOR PUMP#5 SEAL LEAK.                        |
| 31 Mar | 86.8  | 13.8    | UF5  | Z14  | UNIT TRIPPED MANUALLY TO ATTEND NITROGEN LEAK FROM ECCS ACCUMULATOR.               |
| 04 Aug | 152.1 | 23.9    | XF4  | J13  | UNIT TRIPPED ON PHT HIGH PRESSURE DUE TO GRID DISTURBANCE.                         |
| 02 Sep | 1.1   | 0.2     | XP2  | J13  | UNIT CAME ON HOUSE LOAD DUE TO GRID DISTURBANCES.                                  |

## 7. Full Outages, Analysis by Cause

| Outage Cause                              | 2004 Hours Lost |           |          | 2000 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                |                 | 363       |          |  | 728       |          |
| B. Refuelling without a maintenance       |                 |           |          |  | 36        |          |
| E. Testing of plant systems or components |                 |           |          | 23                                       |           |          |
| J. Grid failure or grid unavailability    |                 |           | 152      |  |           | 242      |
| Z. Others                                 |                 | 86        |          |  | 26        |          |
| Subtotal                                  | 0               | 449       | 152      | 23                                       | 790       | 242      |
| Total                                     |                 | 601       |          |  | 1055      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 2000 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    | 202             | 20                                       |
| 12. Reactor I&C Systems                        | 158             | 32                                       |
| 13. Reactor Auxiliary Systems                  |                 | 10                                       |
| 15. Reactor Cooling Systems                    |                 | 31                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 43                                       |
| 21. Fuel Handling and Storage Facilities       |                 | 99                                       |
| 31. Turbine and auxiliaries                    | 2               | 93                                       |
| 32. Feedwater and Main Steam System            |                 | 51                                       |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     |                 | 317                                      |
| 42. Electrical Power Supply Systems            |                 | 8  |
| XX. Miscellaneous Systems                      |                 | 19                                       |
| Total  | 362             | 723                                      |

**IN-14 KAIGA-2**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 202.0 MW(e)  
 Design Net RUP: 220.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 1290.2 GW(e).h  
 Energy Availability Factor: 74.7%  
 Load Factor: 72.7%  
 Operating Factor: 88.0%  
 Energy Unavailability Factor: 25.3%  
 Total Off-line Time: 1052 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 120.9 | 114.4 | 121.6 | 115.4 | 112.8 | 11.0 | 76.6 | 108.3 | 111.4 | 133.4 | 129.3 | 135.3 | 1290.2 |
| EAF (%)  | 82.4  | 83.3  | 82.9  | 81.3  | 77.0  | 9.5  | 53.0 | 74.0  | 78.6  | 90.7  | 90.9  | 92.0  | 74.7   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 96.9  | 34.6 | 73.3 | 93.2  | 93.7  | 100.0 | 99.9  | 100.0 | 91.0   |
| LF (%)   | 80.4  | 81.3  | 80.9  | 79.3  | 75.0  | 7.5  | 51.0 | 72.0  | 76.6  | 88.7  | 88.9  | 90.0  | 72.7   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 96.0  | 10.3 | 65.6 | 91.4  | 92.4  | 100.0 | 99.9  | 100.0 | 88.0   |
| EUF (%)  | 17.6  | 16.7  | 17.1  | 18.7  | 23.0  | 90.5 | 47.0 | 26.0  | 21.4  | 9.3   | 9.1   | 8.0   | 25.3   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 65.4 | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.4    |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 3.1   | 0.0  | 26.7 | 6.8   | 6.3   | 0.0   | 0.1   | 0.0   | 3.6    |
| XUF (%)  | 17.6  | 16.7  | 17.1  | 18.7  | 19.8  | 25.1 | 20.4 | 19.2  | 15.1  | 9.3   | 9.0   | 8.0   | 16.3   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Dec 1989      Lifetime Generation: 6657.5 GW(e).h  
 Date of First Criticality: 24 Sep 1999      Cumulative Energy Availability Factor: 80.4%  
 Date of Grid Connection: 02 Dec 1999      Cumulative Load Factor: 78.8%  
 Date of Commercial Operation: 16 Mar 2000      Cumulative Unit Capability Factor: 83.7%  
    Cumulative Energy Unavailability Factor: 19.6%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 2000 | 1086.5            | 200.0             | 0.0  | 0.0    | 72.2                                 | 100.0  | 61.8               | 0.0    | 5975                  | 68.0   |
| 2001 | 1308.6            | 200.0             | 82.1   | 82.1   | 74.2                                 | 74.2   | 74.7               | 74.7   | 6670                  | 76.1   |
| 2002 | 1559.2            | 202.0             | 87.5   | 84.8   | 85.8                                 | 80.0   | 88.1               | 81.4   | 7455                  | 85.1   |
| 2003 | 1413.0            | 202.0             | 88.8   | 86.1   | 86.9                                 | 82.3   | 79.9               | 80.9   | 7535                  | 86.0   |
| 2004 | 1290.2            | 202.0             | 91.0   | 87.4   | 74.7                                 | 80.4   | 72.7               | 78.8   | 7732                  | 88.0   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 30 May | 29.9  | 4.7     | UF5  | E42  | REACTOR TRIPPED ON PHT HIGH PRESSURE DUE TO LOSS OF POWER SUPPLY TO PCPS.          |
| 01 Jun | 645.6 | 95.1    | PF   | D    | ANNUAL MAINTENANCE OUTAGE.   |
| 04 Jul | 255.6 | 40.1    | UF4  | A12  | REACTOR TRIPPED ON LOGIC ONE OR MORE PSS ROD LEAVING PARKED POSITION.              |
| 04 Aug | 64.0  | 10.2    | XF4  | J13  | REACTOR TRIPPED ON PHT HIGH PRESSURE DUE TO GRID DISTURBANCES.                     |
| 02 Sep | 55.0  | 9.2     | XF4  | J15  | REACTOR TRIPPED ON NO PCP RUNNING DUE TO CLASS-IV FAILURE DUE TO GRID DISTURBANCE. |
| 28 Nov | 0.6   | 0.1     | UP2  | Z42  | UNIT CAME ON HOUSE LOAD DUE TO ACTUATION OF BUS BAR DIFFERENTIAL PROTECTION.       |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2000 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                              |                 | 255       |          |  | 961       |          |
| D. Inspection, maintenance or repair without refuelling | 645             |           |          | 203                                      |           |          |
| E. Testing of plant systems or components               |                 | 29        |          |  |           |          |
| J. Grid failure or grid unavailability                  |                 |           | 119      |  |           | 271      |
| Z. Others   |                 |           |          |  | 11        |          |
| Subtotal  | 645             | 284       | 119      | 203                                      | 972       | 271      |
| Total   |                 | 1048      |          |  | 1446      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 2000 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 20                                       |
| 12. Reactor I&C Systems                        | 255             | 162                                      |
| 13. Reactor Auxiliary Systems                  |                 | 20                                       |
| 15. Reactor Cooling Systems                    |                 | 81                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 73                                       |
| 31. Turbine and auxiliaries                    |                 | 439                                      |
| 32. Feedwater and Main Steam System            |                 | 73                                       |
| 41. Main Generator Systems                     |                 | 14                                       |
| 42. Electrical Power Supply Systems            |                 | 77                                       |
| Total  | 255             | 959                                      |

# IN-9 KAKRAPAR-1

**Operator:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**Contractor:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 202.0 MW(e)  
**Design Net RUP:** 220.0 MW(e)  
**Design Discharge Burnup:** 6700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1064.4 GW(e).h  
**Energy Availability Factor:** 89.1%  
**Load Factor:** 60.0%  
**Operating Factor:** 84.4%  
**Energy Unavailability Factor:** 10.9%  
**Total Off-line Time:** 1368 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb  | Mar   | Apr  | May  | Jun  | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|------|-------|------|------|------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 108.7 | 95.4 | 101.5 | 72.6 | 0.0  | 75.5 | 105.8 | 103.9 | 80.1 | 107.7 | 104.3 | 108.9 | 1064.4 |
| <b>EAF (%)</b>  | 100.0 | 94.6 | 95.2  | 79.0 | 29.7 | 84.4 | 100.0 | 100.0 | 86.0 | 100.0 | 100.0 | 100.0 | 89.1   |
| <b>UCF (%)</b>  | 100.0 | 94.6 | 95.2  | 79.0 | 29.7 | 84.4 | 100.0 | 100.0 | 86.0 | 100.0 | 100.0 | 100.0 | 89.1   |
| <b>LF (%)</b>   | 72.3  | 67.9 | 67.5  | 49.9 | 0.0  | 51.9 | 70.4  | 69.1  | 55.1 | 71.7  | 71.7  | 72.5  | 60.0   |
| <b>OF (%)</b>   | 100.0 | 92.2 | 93.1  | 70.1 | 0.0  | 77.8 | 100.0 | 100.0 | 80.0 | 100.0 | 100.0 | 100.0 | 84.4   |
| <b>EUF (%)</b>  | 0.0   | 5.4  | 4.8   | 21.0 | 70.3 | 15.6 | 0.0   | 0.0   | 14.0 | 0.0   | 0.0   | 0.0   | 10.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 5.4  | 4.8   | 21.0 | 70.3 | 15.6 | 0.0   | 0.0   | 14.0 | 0.0   | 0.0   | 0.0   | 10.9   |
| <b>XUF (%)</b>  | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THROUGHOUT THE YEAR UNIT OPERATED AT A REDUCED POWER LEVEL OF ABOUT 75% FULL POWER.

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1984  
**Date of First Criticality:** 03 Sep 1992  
**Date of Grid Connection:** 24 Nov 1992  
**Date of Commercial Operation:** 06 May 1993

**Lifetime Generation:** 13264.1 GW(e).h  
**Cumulative Energy Availability Factor:** 73.3%  
**Cumulative Load Factor:** 69.9%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 26.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1994 | 130.3          | 194.0          | 13.2   | 13.2   | 12.0                              | 12.0   | 7.7                | 7.7    | 1049               | 12.0   |
| 1995 | 1089.1         | 195.0          | 70.5   | 42.0   | 66.5                              | 39.3   | 63.8               | 35.8   | 6225               | 71.1   |
| 1996 | 1295.8         | 195.0          | 84.6   | 56.2   | 75.7                              | 51.5   | 75.7               | 49.1   | 7539               | 85.8   |
| 1997 | 906.7          | 195.0          | 58.4   | 56.8   | 52.9                              | 51.8   | 53.1               | 50.1   | 5140               | 58.7   |
| 1998 | 1090.6         | 195.0          | 67.0   | 58.8   | 63.1                              | 54.1   | 63.8               | 52.9   | 5987               | 68.3   |
| 1999 | 1407.1         | 195.0          | 87.7   | 63.6   | 85.1                              | 59.2   | 82.4               | 57.8   | 7450               | 85.0   |
| 2000 | 1645.4         | 195.0          | 95.2   | 68.2   | 94.5                              | 64.3   | 96.1               | 63.3   | 8445               | 96.1   |
| 2001 | 1517.5         | 195.0          | 86.5   | 70.4   | 86.5                              | 67.1   | 88.8               | 66.5   | 7690               | 87.8   |
| 2002 | 1697.8         | 202.0          | 96.8   | 73.5   | 96.7                              | 70.5   | 95.9               | 69.8   | 8488               | 96.9   |
| 2003 | 1419.4         | 202.0          | 87.5   | 74.9   | 81.9                              | 71.6   | 80.2               | 70.9   | 7622               | 87.0   |
| 2004 | 1064.4         | 202.0          | 89.1   | 76.2   | 89.1                              | 73.3   | 60.0               | 69.9   | 7416               | 84.4   |

## IN-9 KAKRAPAR-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 8784.0 | 468.5   | XP   | K42  | THIS UNIT HAS BEEN OPERATING AT A REDUCED POWER LEVEL OF ABOUT 75% FULL POWER DUE TO LOW DEMAND FROM GRID.   |
| 11 Feb | 53.8   | 7.6     | UF5  | L31  | TURBINE TRIPPED ON LOW CONDENSER VACUUM DUE TO INADVERTENT MANUAL OPENING OF VACUUM BREAK VALVE OF UNIT-1 INSTEAD OF UNIT-2. REACTOR GOT POISONED OUT. |
| 10 Mar | 50.6   | 7.2     | UF4  | A12  | REACTOR TRIPPED ON HIGH DIFFERENTIAL TEMPERATURE ACROSS STEAM GENERATOR DUE TO LOSS OF POWER SUPPLY TO REACTOR REGULATING SYSTEM.                      |
| 22 Apr | 1069.8 | 151.9   | UF5  | H    | REACTOR WAS MANUALLY TRIPPED AS PER THE REQUIREMENT OF REGULATORY BODY.  |
| 14 Jun | 49.0   | 7.0     | UF5  | L21  | DURING THE REFUELLING ALPAS CAM ACTUATED LEADING TO REACTOR POISONING OUT.   |
| 10 Sep | 143.7  | 20.4    | UF4  | A15  | REACTOR TRIPPED ON PHT PRESSURE HIGH.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1994 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 194       |          |  | 625       |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 1151                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 29        |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 30       |
| H. Nuclear regulatory requirements   |                 | 1069      |          |  | 5         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 82       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 16        | 13       |
| L. Human factor related  |                 | 102       |          |  |           |          |
| Subtotal   | 0               | 1365      | 0        | 1151                                     | 675       | 125      |
| Total  |                 | 1365      |          |  | 1951      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1994 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 64                                       |
| 12. Reactor I&C Systems                        | 50              | 59                                       |
| 13. Reactor Auxiliary Systems                  |                 | 22                                       |
| 15. Reactor Cooling Systems                    | 143             | 133                                      |
| 16. Steam generation systems                   |                 | 17                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 21                                       |
| 31. Turbine and auxiliaries                    |                 | 153                                      |
| 32. Feedwater and Main Steam System            |                 | 21                                       |
| 35. All other I&C Systems                      |                 | 21                                       |
| 41. Main Generator Systems                     |                 | 18                                       |
| 42. Electrical Power Supply Systems            |                 | 61                                       |
| Total  | 193             | 590                                      |

**IN-10 KAKRAPAR-2**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 202.0 MW(e)  
 Design Net RUP: 220.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 1142.0 GW(e).h  
 Energy Availability Factor: 90.9%  
 Load Factor: 64.4%  
 Operating Factor: 87.2%  
 Energy Unavailability Factor: 9.1%  
 Total Off-line Time: 1126 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb  | Mar   | Apr   | May  | Jun  | Jul   | Aug   | Sep  | Oct  | Nov   | Dec   | Annual |
|----------|-------|------|-------|-------|------|------|-------|-------|------|------|-------|-------|--------|
| GW(e).h  | 108.4 | 73.8 | 111.3 | 106.5 | 70.1 | 39.5 | 107.0 | 107.3 | 89.6 | 91.7 | 113.0 | 123.9 | 1142.0 |
| EAF (%)  | 98.9  | 80.8 | 100.0 | 100.0 | 76.2 | 58.9 | 100.0 | 100.0 | 89.1 | 85.4 | 100.0 | 100.0 | 90.9   |
| UCF (%)  | 98.9  | 80.8 | 100.0 | 100.0 | 76.2 | 58.9 | 100.0 | 100.0 | 89.1 | 85.4 | 100.0 | 100.0 | 90.9   |
| LF (%)   | 72.1  | 52.5 | 74.1  | 73.2  | 46.7 | 27.1 | 71.2  | 71.4  | 61.6 | 61.0 | 77.7  | 82.5  | 64.4   |
| OF (%)   | 98.4  | 72.7 | 100.0 | 100.0 | 66.1 | 41.5 | 100.0 | 100.0 | 85.4 | 80.4 | 100.0 | 100.0 | 87.2   |
| EUF (%)  | 1.1   | 19.2 | 0.0   | 0.0   | 23.8 | 41.1 | 0.0   | 0.0   | 10.9 | 14.6 | 0.0   | 0.0   | 9.1    |
| PUF (%)  | 0.0   | 13.2 | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 1.0    |
| UCLF (%) | 1.1   | 6.0  | 0.0   | 0.0   | 23.8 | 41.1 | 0.0   | 0.0   | 10.9 | 14.6 | 0.0   | 0.0   | 8.1    |
| XUF (%)  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

DURING THE YEAR UNIT OPERATED AT A REDUCED POWER LEVEL OF BETWEEN 75-85% FULL POWER.

**5. Historical Summary**

Date of Construction Start: 01 Apr 1985      Lifetime Generation: 13577.3 GW(e).h  
 Date of First Criticality: 08 Jan 1995      Cumulative Energy Availability Factor: 84.8%  
 Date of Grid Connection: 04 Mar 1995      Cumulative Load Factor: 81.9%  
 Date of Commercial Operation: 01 Sep 1995      Cumulative Unit Capability Factor: 81.9%  
    Cumulative Energy Unavailability Factor: 15.2%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1995 | 825.5             | 196.0             | 0.0  | 0.0    | 83.2                                 | 100.0  | 48.7               | 0.0    | 5401                  | 62.4   |
| 1996 | 1326.8            | 195.0             | 86.3   | 86.3   | 77.5                                 | 77.5   | 77.5               | 77.5   | 7663                  | 87.2   |
| 1997 | 1093.4            | 195.0             | 66.7   | 76.5   | 63.8                                 | 70.6   | 64.0               | 70.7   | 6139                  | 70.1   |
| 1998 | 1291.6            | 195.0             | 78.7   | 77.2   | 76.6                                 | 72.6   | 75.6               | 72.4   | 6932                  | 79.1   |
| 1999 | 1512.3            | 195.0             | 92.4   | 81.0   | 91.1                                 | 77.3   | 88.5               | 76.4   | 7955                  | 90.8   |
| 2000 | 1489.9            | 195.0             | 85.8   | 82.0   | 85.6                                 | 78.9   | 87.0               | 78.5   | 7697                  | 87.6   |
| 2001 | 1685.4            | 195.0             | 96.0   | 84.3   | 95.3                                 | 81.6   | 98.7               | 81.9   | 8500                  | 97.0   |
| 2002 | 1597.1            | 202.0             | 89.5   | 85.1   | 89.2                                 | 82.8   | 90.3               | 83.1   | 7940                  | 90.6   |
| 2003 | 1613.2            | 202.0             | 97.3   | 86.6   | 92.3                                 | 84.0   | 91.2               | 84.1   | 8515                  | 97.2   |
| 2004 | 1142.0            | 202.0             | 90.9   | 87.1   | 90.9                                 | 84.8   | 64.4               | 81.9   | 7658                  | 87.2   |



## IN-10 KAKRAPAR-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 6264.0 | 334.1   | XP   | K    | POWER WAS REDUCED TO ABOUT 75% FULL POWER FOR RATIONALIZATION OF GENERATION WITH RESPECT TO GRID DEMAND.                            |
| 17 Jan | 11.7   | 1.7     | UF   | Z41  | UNIT WAS SHUTDOWN DUE TO TG TRIP ON CLASS-A PROTECTION.   |
| 02 Feb | 130.7  | 18.6    | PF   | E14  | UNIT WAS SHUTDOWN FOR CARRYING OUT VARIOUS SURVEILLANCE TESTS.  |
| 11 Feb | 59.1   | 8.4     | UF5  | A31  | TURBINE WAS TRIPPED FOR ATTENDING TO LP TURBINE REAR GLAND HOUSING AND BELLOW LEAK. SUBSEQUENTLY REACTOR WAS TRIPPED MANUALLY.      |
| 21 May | 672.7  | 95.5    | UF2  | H    | UNIT WAS SHUTDOWN AS DESIRED BY REGULATORY BODY TO INCORPORATE CERTAIN MODIFICATIONS AS A RESULT OF OPERATING EXPERIENCE OF UNIT-1. |
| 18 Sep | 1608.0 | 70.8    | XP   | K    | UNIT POWER WAS RAISED TO 80% FULL POWER FROM 75% FULL POWER TO RATIONALIZE THE GENERATION WITH RESPECT TO GRID DEMAND.              |
| 20 Sep | 105.1  | 15.9    | UF2  | A31  | UNIT WAS MANUALLY SHUTDOWN TO ATTEND TO HP GOVERNOR VALVE PROBLEM.  |
| 18 Oct | 145.6  | 22.0    | UF2  | A13  | UNIT WAS MANUALLY SHUTDOWN TO ATTEND OIL LEAK IN THE PUMP ROOM.   |
| 24 Nov | 912.0  | 30.0    | XP1  | K    | POWER WAS RAISED TO 85% FULL POWER FROM 80% FULL POWER IN ORDER TO RATIONALIZE THE GENERATION WITH RESPECT TO GRID DEMAND.          |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1995 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 309       |          |  | 520       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 14        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 390                                      |           |          |
| E. Testing of plant systems or components  | 130             |           |          | 1  | 34        |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 6        |
| H. Nuclear regulatory requirements   |                 | 672       |          |  | 21        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 45       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 5         |          |
| Z. Others  |                 | 11        |          |  |           |          |
| Subtotal   | 130             | 992       | 0        | 391                                      | 594       | 51       |
| Total  |                 | 1122      |          |  | 1036      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1995 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 41                                       |
| 13. Reactor Auxiliary Systems                  | 145             |  |
| 14. Safety Systems                             |                 | 16                                       |
| 15. Reactor Cooling Systems                    |                 | 35                                       |
| 16. Steam generation systems                   |                 | 16                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 54                                       |
| 31. Turbine and auxiliaries                    | 164             | 130                                      |
| 32. Feedwater and Main Steam System            |                 | 28                                       |
| 35. All other I&C Systems                      |                 | 5  |
| 41. Main Generator Systems                     |                 | 92                                       |
| 42. Electrical Power Supply Systems            |                 | 83                                       |
| Total  | 309             | 500                                      |

**IN-5 MADRAS-1**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power at the beginning of 2004: 155.0 MW(e)  
 Design Net RUP: 220.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 0.0 GW(e).h  
 Energy Availability Factor: 0.0%  
 Load Factor: 0.0%  
 Operating Factor: 0.0%  
 Energy Unavailability Factor: 100.0%  
 Total Off-line Time: 8784 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| EAF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| UCF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| LF (%)   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| OF (%)   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| EUF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| PUF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THIS UNIT REMAINED SHUTDOWN THROUGHOUT THE YEAR FOR COMPLETE RETUBING OF THE REACTOR VESSEL AND SAFETY SYSTEM UPGRADATION WORK.

**5. Historical Summary**

Date of Construction Start: 01 Jan 1971      Lifetime Generation: 17458.7 GW(e).h  
 Date of First Criticality: 02 Jul 1983      Cumulative Energy Availability Factor: 56.5%  
 Date of Grid Connection: 23 Jul 1983      Cumulative Load Factor: 50.7%  
 Date of Commercial Operation: 27 Jan 1984      Cumulative Unit Capability Factor: 78.1%  
    Cumulative Energy Unavailability Factor: 43.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 1115.8         | 210.0          | 61.0   | 61.0   | 60.5                              | 60.5   | 60.5               | 60.5   | 6333               | 72.1   |
| 1985 | 822.1          | 215.0          | 50.1   | 55.5   | 49.5                              | 54.9   | 43.6               | 52.0   | 4827               | 55.1   |
| 1986 | 757.1          | 220.0          | 40.7   | 50.5   | 39.3                              | 49.6   | 39.3               | 47.7   | 4629               | 52.8   |
| 1987 | 1100.0         | 220.0          | 61.0   | 53.1   | 57.1                              | 51.5   | 57.1               | 50.1   | 6047               | 69.0   |
| 1988 | 1258.0         | 220.0          | 65.7   | 55.7   | 65.1                              | 54.3   | 65.1               | 53.1   | 6691               | 76.2   |
| 1989 | 404.6          | 220.0          | 21.0   | 49.9   | 21.0                              | 48.7   | 21.0               | 47.7   | 4350               | 49.7   |
| 1990 | 863.7          | 215.0          | 47.8   | 49.6   | 45.6                              | 48.2   | 45.9               | 47.4   | 7320               | 83.6   |
| 1991 | 499.9          | 215.0          | 44.9   | 49.0   | 44.4                              | 47.7   | 26.5               | 44.9   | 3546               | 40.5   |
| 1992 | 1082.6         | 194.0          | 87.3   | 52.8   | 84.6                              | 51.5   | 63.5               | 46.7   | 7412               | 84.4   |
| 1993 | 538.9          | 194.0          | 46.3   | 52.2   | 43.9                              | 50.8   | 31.7               | 45.4   | 3836               | 43.8   |
| 1994 | 809.0          | 194.0          | 72.5   | 53.9   | 66.6                              | 52.1   | 47.6               | 45.5   | 5974               | 68.2   |
| 1995 | 1085.2         | 194.0          | 98.4   | 57.4   | 86.8                              | 54.8   | 63.9               | 47.0   | 7584               | 86.6   |
| 1996 | 617.1          | 161.0          | 50.6   | 57.0   | 50.6                              | 54.5   | 43.6               | 46.8   | 4348               | 49.5   |
| 1997 | 893.0          | 150.0          | 74.3   | 57.9   | 68.0                              | 55.2   | 68.0               | 47.9   | 6451               | 73.6   |
| 1998 | 703.4          | 150.0          | 56.1   | 57.8   | 55.5                              | 55.2   | 53.5               | 48.2   | 4858               | 55.5   |
| 1999 | 1182.4         | 150.0          | 92.5   | 59.5   | 92.5                              | 57.0   | 90.0               | 50.2   | 8095               | 92.4   |
| 2000 | 667.8          | 150.0          | 50.9   | 59.1   | 50.9                              | 56.8   | 50.7               | 50.2   | 4468               | 50.9   |
| 2001 | 1174.5         | 150.0          | 90.1   | 60.4   | 88.5                              | 58.1   | 89.4               | 51.9   | 7751               | 88.5   |
| 2002 | 895.8          | 155.0          | 69.7   | 60.8   | 67.7                              | 58.6   | 66.0               | 52.5   | 5885               | 67.2   |
| 2003 | 810.6          | 155.0          | 65.3   | 61.0   | 65.3                              | 58.8   | 59.7               | 52.8   | 5421               | 61.9   |
| 2004 | 0.0            | 155.0          | 0.0  | 58.6   | 0.0                               | 56.5   | 0.0                | 50.7   | 0                  | 0.0    |

**IN-5 MADRAS-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 8784.0 | 1361.5  | PF   | G    | THIS UNIT IS SHUTDOWN SINCE 20TH AUGUST 2003 FOR COMPLETE RETUBING OF THE REACTOR VESSEL AND SAFETY SYSTEM UPGRADATION WORK. THE OUTAGE TAKEN IN YEAR 2003 CONTINUED THIS YEAR ALSO. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 1042      | 8        |
| B. Refuelling without a maintenance  |                 |           |          |   | 8         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 699   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 14  | 26        |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      | 8784            |           |          |   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 755   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 9         | 125      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 24        |          |
| Subtotal   | 8784            | 0         | 0        | 1468  | 1109      | 133      |
| Total  |                 | 8784      |          |   | 2710      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 172   |
| 12. Reactor I&C Systems             |                    | 89  |
| 13. Reactor Auxiliary Systems       |                    | 25  |
| 15. Reactor Cooling Systems         |                    | 80  |
| 16. Steam generation systems        |                    | 34  |
| 31. Turbine and auxiliaries         |                    | 113   |
| 32. Feedwater and Main Steam System |                    | 36  |
| 35. All other I&C Systems           |                    | 2   |
| 41. Main Generator Systems          |                    | 33  |
| 42. Electrical Power Supply Systems |                    | 411   |
| XX. Miscellaneous Systems           |                    | 6   |
| Total                               | 0                  | 1001  |

## IN-6 MADRAS-2

**Operator:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**Contractor:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

### 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 155.0 MW(e)  
**Design Net RUP:** 220.0 MW(e)  
**Design Discharge Burnup:** 8400 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 1274.3 GW(e).h  
**Energy Availability Factor:** 90.9%  
**Load Factor:** 93.6%  
**Operating Factor:** 90.7%  
**Energy Unavailability Factor:** 9.1%  
**Total Off-line Time:** 814 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb  | Mar   | Apr  | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec  | Annual |
|-----------------|-------|------|-------|------|-------|-------|-------|------|-------|-------|-------|------|--------|
| <b>GW(e).h</b>  | 111.8 | 87.2 | 116.7 | 77.2 | 111.6 | 107.9 | 105.8 | 93.1 | 106.6 | 134.2 | 131.2 | 91.1 | 1274.3 |
| <b>EAF (%)</b>  | 100.0 | 84.7 | 100.0 | 73.0 | 100.0 | 100.0 | 95.6  | 83.1 | 89.6  | 100.0 | 100.0 | 64.5 | 90.9   |
| <b>UCF (%)</b>  | 100.0 | 84.7 | 100.0 | 73.0 | 100.0 | 100.0 | 95.6  | 83.1 | 89.6  | 100.0 | 100.0 | 81.5 | 92.4   |
| <b>LF (%)</b>   | 96.9  | 80.8 | 101.2 | 69.3 | 96.7  | 96.7  | 91.8  | 80.7 | 95.5  | 116.2 | 117.5 | 79.0 | 93.6   |
| <b>OF (%)</b>   | 100.0 | 83.5 | 100.0 | 72.7 | 100.0 | 100.0 | 96.4  | 83.5 | 87.8  | 99.9  | 100.0 | 64.5 | 90.7   |
| <b>EUF (%)</b>  | 0.0   | 15.3 | 0.0   | 27.0 | 0.0   | 0.0   | 4.4   | 16.9 | 10.4  | 0.0   | 0.0   | 35.5 | 9.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 15.3 | 0.0   | 27.0 | 0.0   | 0.0   | 4.4   | 16.9 | 10.4  | 0.0   | 0.0   | 18.5 | 7.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 17.0 | 1.4    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Oct 1972  
**Date of First Criticality:** 12 Aug 1985  
**Date of Grid Connection:** 20 Sep 1985  
**Date of Commercial Operation:** 21 Mar 1986

**Lifetime Generation:** 16300.5 GW(e).h  
**Cumulative Energy Availability Factor:** 60.3%  
**Cumulative Load Factor:** 54.4%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 39.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 783.7          | 220.0          | 0.0  | 0.0    | 40.7                              | 100.0  | 40.7               | 0.0    | 5303               | 60.5   |
| 1987 | 1066.0         | 220.0          | 62.5   | 62.5   | 55.5                              | 55.5   | 55.3               | 55.3   | 6382               | 72.9   |
| 1988 | 642.0          | 220.0          | 33.2   | 47.8   | 33.2                              | 44.3   | 33.2               | 44.3   | 3535               | 40.2   |
| 1989 | 438.2          | 220.0          | 22.8   | 39.5   | 22.7                              | 37.1   | 22.7               | 37.1   | 4350               | 49.7   |
| 1990 | 1082.4         | 215.0          | 61.6   | 44.9   | 57.2                              | 42.1   | 57.5               | 42.1   | 7726               | 88.2   |
| 1991 | 1083.0         | 215.0          | 87.2   | 53.2   | 86.6                              | 50.8   | 57.5               | 45.1   | 7642               | 87.2   |
| 1992 | 665.2          | 194.0          | 55.2   | 53.5   | 54.2                              | 51.4   | 39.0               | 44.2   | 4751               | 54.1   |
| 1993 | 950.3          | 205.0          | 80.2   | 57.2   | 77.1                              | 54.9   | 52.9               | 45.4   | 6625               | 75.6   |
| 1994 | 1032.1         | 194.0          | 85.5   | 60.5   | 80.9                              | 57.9   | 60.7               | 47.2   | 7071               | 80.7   |
| 1995 | 274.7          | 194.0          | 22.7   | 56.6   | 21.4                              | 54.1   | 16.2               | 44.0   | 1871               | 21.4   |
| 1996 | 1061.9         | 161.0          | 84.7   | 58.8   | 82.2                              | 56.3   | 75.1               | 46.4   | 7256               | 82.6   |
| 1997 | 958.2          | 150.0          | 75.6   | 59.9   | 72.4                              | 57.4   | 72.9               | 48.2   | 6464               | 73.8   |
| 1998 | 1104.2         | 150.0          | 87.0   | 61.7   | 85.4                              | 59.2   | 84.0               | 50.5   | 7478               | 85.4   |
| 1999 | 879.9          | 150.0          | 68.0   | 62.1   | 65.7                              | 59.6   | 67.0               | 51.5   | 5755               | 65.7   |
| 2000 | 1273.4         | 150.0          | 95.7   | 64.0   | 94.6                              | 61.6   | 96.6               | 54.1   | 8304               | 94.5   |
| 2001 | 1119.1         | 150.0          | 88.5   | 65.3   | 87.6                              | 63.0   | 85.2               | 55.8   | 7671               | 87.6   |
| 2002 | 22.7           | 155.0          | 1.7  | 61.9   | 1.7                               | 59.8   | 1.7                | 52.9   | 183                | 2.1    |
| 2003 | 589.1          | 155.0          | 40.0   | 60.9   | 40.0                              | 58.8   | 43.4               | 52.4   | 3135               | 35.8   |
| 2004 | 1274.3         | 155.0          | 92.4   | 62.4   | 90.9                              | 60.3   | 93.6               | 54.4   | 7970               | 90.7   |

## IN-6 MADRAS-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 11 Feb | 114.8 | 17.1    | UF2  | A15  | UNIT WAS SHUTDOWN DUE TO HEAVY WATER LEAK FROM THE BONNET OF AN ISOLATING VALVE IN PRIMARY COOLANT SYSTEM.           |
| 05 Apr | 195.9 | 29.2    | UF2  | A15  | UNIT WAS SHUTDOWN DUE TO NON-AVAILABILITY OF BOTH THE MAIN PRESSURISING PUMPS OF PRIMARY COOLANT SYSTEMS.            |
| 31 Jul | 102.3 | 15.2    | UF2  | A11  | UNIT WAS SHUTDOWN DUE TO LEAK FROM A BIOLOGICAL SHIELD COOLING COIL.   |
| 21 Aug | 47.8  | 7.1     | UF2  | A14  | UNIT WAS SHUTDOWN AFTER PLANNED LOAD REDUCTION TO ATTEND TO FIRE WATER LEAK IN THE FIRE WATER PUMP DISCHARGE HEADER. |
| 13 Sep | 87.5  | 13.7    | UF2  | A15  | UNIT WAS SHUTDOWN AFTER PLANNED LOAD REDUCTION FOR REPLACEMENT OF MOTOR BEARINGS OF A PRIMARY COOLANT PUMP.          |
| 17 Dec | 137.6 | 21.3    | UF2  | A11  | UNIT WAS SHUTDOWN TO ATTEND LEAK FROM DRAIN VALVE IN MODERATOR SYSTEM INLET PIPING.                                  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 685       |          |  | 917       | 7        |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 703                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 30                                       | 10        |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          | 673                                      |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 169                                      | 6         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 4         | 112      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 8         | 19       |
| Subtotal   | 0               | 685       | 0        | 1575                                     | 954       | 138      |
| Total  |                 | 685       |          |  | 2667      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              | 239             | 277                                      |
| 12. Reactor I&C Systems                  |                 | 64                                       |
| 13. Reactor Auxiliary Systems            |                 | 12                                       |
| 14. Safety Systems                       | 47              | 3  |
| 15. Reactor Cooling Systems              | 398             | 157                                      |
| 16. Steam generation systems             |                 | 41                                       |
| 21. Fuel Handling and Storage Facilities |                 | 9  |
| 31. Turbine and auxiliaries              |                 | 78                                       |
| 32. Feedwater and Main Steam System      |                 | 29                                       |
| 35. All other I&C Systems                |                 | 4  |
| 41. Main Generator Systems               |                 | 56                                       |
| 42. Electrical Power Supply Systems      |                 | 61                                       |
| XX. Miscellaneous Systems                |                 | 16                                       |
| Total                                    | 684             | 807                                      |

**IN-7 NARORA-1**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power at the beginning of 2004: 202.0 MW(e)  
 Design Net RUP: 220.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 1120.6 GW(e).h  
 Energy Availability Factor: 64.8%  
 Load Factor: 63.2%  
 Operating Factor: 78.1%  
 Energy Unavailability Factor: 35.2%  
 Total Off-line Time: 1924 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|--------|
| GW(e).h  | 134.9 | 115.4 | 122.1 | 115.7 | 116.5 | 110.4 | 0.0  | 0.0   | 40.2 | 118.9 | 120.0 | 126.6 | 1120.6 |
| EAF (%)  | 91.7  | 84.1  | 83.2  | 81.6  | 79.5  | 77.9  | 0.1  | -0.1  | 29.6 | 81.1  | 84.5  | 86.2  | 64.8   |
| UCF (%)  | 100.0 | 100.0 | 96.7  | 100.0 | 100.0 | 99.9  | 21.6 | 21.6  | 52.6 | 100.0 | 100.0 | 100.0 | 82.5   |
| LF (%)   | 89.8  | 82.1  | 81.2  | 79.6  | 77.5  | 75.9  | 0.0  | 0.0   | 27.6 | 79.1  | 82.5  | 84.2  | 63.2   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 0.0  | 0.0   | 39.6 | 100.0 | 100.0 | 100.0 | 78.1   |
| EUF (%)  | 8.3   | 15.9  | 16.8  | 18.4  | 20.5  | 22.1  | 99.9 | 100.1 | 70.4 | 18.9  | 15.5  | 13.8  | 35.2   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 78.4 | 78.4  | 47.4 | 0.0   | 0.0   | 0.0   | 17.2   |
| UCLF (%) | 0.0   | 0.0   | 3.4   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.3    |
| XUF (%)  | 8.3   | 15.9  | 13.5  | 18.4  | 20.5  | 22.1  | 21.5 | 21.7  | 23.0 | 18.9  | 15.5  | 13.8  | 17.7   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

DURING THE YEAR THIS UNIT OPERATED AT A REDUCED POWER BETWEEN 80-90% OF FULL POWER.

**5. Historical Summary**

Date of Construction Start: 01 Dec 1976      Lifetime Generation: 15010.3 GW(e).h  
 Date of First Criticality: 12 Mar 1989      Cumulative Energy Availability Factor: 64.0%  
 Date of Grid Connection: 29 Jul 1989      Cumulative Load Factor: 60.8%  
 Date of Commercial Operation: 01 Jan 1991      Cumulative Unit Capability Factor: 79.7%  
    Cumulative Energy Unavailability Factor: 36.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1991 | 449.3          | 210.0          | 42.8   | 42.8   | 42.3                              | 42.3   | 24.4               | 24.4   | 4331               | 49.4   |
| 1992 | 742.7          | 200.0          | 42.8   | 42.8   | 42.3                              | 42.3   | 42.3               | 33.1   | 5514               | 62.8   |
| 1993 | 339.6          | 200.0          | 19.4   | 35.1   | 19.4                              | 34.8   | 19.4               | 28.6   | 2032               | 23.2   |
| 1994 | 0.0            | 200.0          | 0.0  | 26.4   | 0.0                               | 26.2   | 0.0                | 21.6   | 0                  | 0.0    |
| 1995 | 944.4          | 200.0          | 68.3   | 34.7   | 66.0                              | 34.1   | 53.9               | 28.0   | 5740               | 65.5   |
| 1996 | 1162.3         | 200.0          | 76.9   | 41.7   | 66.2                              | 39.4   | 66.2               | 34.3   | 6407               | 72.9   |
| 1997 | 1585.2         | 200.0          | 92.8   | 49.0   | 89.3                              | 46.5   | 90.5               | 42.3   | 8128               | 92.8   |
| 1998 | 1485.6         | 200.0          | 90.8   | 54.2   | 83.9                              | 51.1   | 84.8               | 47.5   | 7986               | 91.2   |
| 1999 | 1128.6         | 200.0          | 76.8   | 56.7   | 76.5                              | 53.9   | 64.4               | 49.4   | 6703               | 76.5   |
| 2000 | 1386.3         | 200.0          | 87.2   | 59.7   | 83.4                              | 56.8   | 78.9               | 52.3   | 7452               | 84.8   |
| 2001 | 1563.0         | 200.0          | 91.9   | 62.6   | 89.2                              | 59.8   | 89.2               | 55.7   | 8157               | 93.1   |
| 2002 | 1574.5         | 202.0          | 89.3   | 64.9   | 88.0                              | 62.1   | 89.0               | 58.5   | 7912               | 90.3   |
| 2003 | 1528.2         | 202.0          | 95.1   | 67.2   | 86.0                              | 64.0   | 86.4               | 60.6   | 8254               | 94.2   |
| 2004 | 1120.6         | 202.0          | 82.5   | 68.3   | 64.8                              | 64.0   | 63.2               | 60.8   | 6860               | 78.1   |

## IN-7 NARORA-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jul | 1924.0 | 304.8   | PF   | H11  | UNIT WAS TAKEN UNDER PLANNED SHUTDOWN TO CARRY OUT ISI JOBS AND OTHER ANNUAL SHUTDOWN ACTIVITIES. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1991 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 1225      |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 140   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 922   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 33  | 26        |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |   | 24        |          |
| H. Nuclear regulatory requirements   | 1924            |           |          |   | 14        |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 81       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 17       |
| Z. Others  |                 |           |          |   |           | 4        |
| Subtotal   | 1924            | 0         | 0        | 1095  | 1291      | 102      |
| Total  |                 | 1924      |          |   | 2488      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1991 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 35  |
| 12. Reactor I&C Systems                        |                    | 83  |
| 13. Reactor Auxiliary Systems                  |                    | 32  |
| 15. Reactor Cooling Systems                    |                    | 140   |
| 16. Steam generation systems                   |                    | 13  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 42  |
| 21. Fuel Handling and Storage Facilities       |                    | 3   |
| 31. Turbine and auxiliaries                    |                    | 614   |
| 32. Feedwater and Main Steam System            |                    | 28  |
| 33. Circulating Water System                   |                    | 3   |
| 41. Main Generator Systems                     |                    | 105   |
| 42. Electrical Power Supply Systems            |                    | 76  |
| XX. Miscellaneous Systems                      |                    | 3   |
| Total  | 0                  | 1177  |

# IN-8 NARORA-2

**Operator:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)  
**Contractor:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 202.0 MW(e)  
**Design Net RUP:** 220.0 MW(e)  
**Design Discharge Burnup:** 6700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1364.6 GW(e).h  
**Energy Availability Factor:** 78.9%  
**Load Factor:** 76.9%  
**Operating Factor:** 96.2%  
**Energy Unavailability Factor:** 21.1%  
**Total Off-line Time:** 337 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 133.1 | 113.9 | 120.6 | 116.5 | 116.4 | 83.9 | 103.8 | 105.9 | 114.7 | 121.1 | 118.5 | 116.1 | 1364.6 |
| <b>EAF (%)</b>  | 90.6  | 83.0  | 82.3  | 82.0  | 79.5  | 59.7 | 71.0  | 72.4  | 80.9  | 82.5  | 83.5  | 79.2  | 78.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 96.7  | 100.0 | 100.0 | 81.3 | 93.9  | 93.8  | 100.0 | 100.0 | 100.0 | 94.9  | 96.7   |
| <b>LF (%)</b>   | 88.6  | 81.0  | 80.3  | 80.1  | 77.5  | 57.7 | 69.0  | 70.5  | 78.9  | 80.6  | 81.5  | 77.2  | 76.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 76.1 | 92.2  | 92.1  | 100.0 | 100.0 | 100.0 | 93.5  | 96.2   |
| <b>EUF (%)</b>  | 9.4   | 17.0  | 17.7  | 18.0  | 20.5  | 40.3 | 29.0  | 27.6  | 19.1  | 17.5  | 16.5  | 20.8  | 21.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 18.7 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 3.4   | 0.0   | 0.0   | 0.0  | 6.1   | 6.2   | 0.0   | 0.0   | 0.0   | 5.1   | 1.8    |
| <b>XUF (%)</b>  | 9.4   | 17.0  | 14.4  | 18.0  | 20.5  | 21.6 | 22.9  | 21.4  | 19.1  | 17.5  | 16.5  | 15.7  | 17.8   |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING THE YEAR UNIT OPERATED AT A REDUCED POWER LEVEL BETWEEN 80-90% OF FULL POWER.

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1977      **Lifetime Generation:** 15032.4 GW(e).h  
**Date of First Criticality:** 24 Oct 1991      **Cumulative Energy Availability Factor:** 69.5%  
**Date of Grid Connection:** 05 Jan 1992      **Cumulative Load Factor:** 68.6%  
**Date of Commercial Operation:** 01 Jul 1992      **Cumulative Unit Capability Factor:** 80.7%  
**Cumulative Energy Unavailability Factor:** 30.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1992 | 567.0          | 201.0          | 0.0  | 0.0    | 82.0                              | 100.0  | 32.2               | 0.0    | 3553               | 40.6   |
| 1993 | 83.3           | 200.0          | 4.8  | 4.8    | 4.8                               | 4.8    | 4.8                | 4.8    | 548                | 6.3    |
| 1994 | 761.7          | 200.0          | 53.1   | 29.0   | 43.5                              | 24.2   | 43.5               | 24.1   | 5494               | 62.7   |
| 1995 | 1036.8         | 200.0          | 68.6   | 42.2   | 66.1                              | 38.2   | 59.2               | 35.8   | 5798               | 66.2   |
| 1996 | 1227.5         | 200.0          | 79.4   | 51.5   | 69.9                              | 46.1   | 69.9               | 44.3   | 6572               | 74.8   |
| 1997 | 1568.7         | 200.0          | 91.4   | 59.5   | 89.2                              | 54.7   | 89.5               | 53.4   | 8121               | 92.7   |
| 1998 | 1333.2         | 200.0          | 80.0   | 62.9   | 75.1                              | 58.1   | 76.1               | 57.2   | 6829               | 78.0   |
| 1999 | 1425.9         | 200.0          | 87.0   | 66.4   | 85.8                              | 62.1   | 81.4               | 60.6   | 7468               | 85.3   |
| 2000 | 1340.8         | 200.0          | 80.6   | 68.1   | 79.9                              | 64.3   | 76.3               | 62.6   | 7182               | 81.8   |
| 2001 | 1343.0         | 200.0          | 75.4   | 69.0   | 74.5                              | 65.4   | 76.7               | 64.1   | 6897               | 78.7   |
| 2002 | 1692.8         | 202.0          | 95.7   | 71.7   | 94.8                              | 68.4   | 95.7               | 67.3   | 8416               | 96.1   |
| 2003 | 1287.1         | 202.0          | 85.4   | 72.9   | 70.7                              | 68.6   | 72.7               | 67.8   | 7458               | 85.1   |
| 2004 | 1364.6         | 202.0          | 96.7   | 74.9   | 78.9                              | 69.5   | 76.9               | 68.6   | 8447               | 96.2   |



## IN-8 NARORA-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 19 Jun | 172.0 | 27.2    | PF   | E11  | UNIT WAS PLANNED SHUTDOWN FOR CARRYING OUT SURVEILLANCE TESTS.   |
| 22 Jul | 58.0  | 9.2     | UF4  | A42  | REACTOR TRIPPED ON NO PRIMARY COOLANT PUMP RUNNING PARAMETER DUE TO TOTAL CLASS-IV EXTERNAL POWER SUPPLY FAILURE INITIATED BY STATION UNIT TRANSFORMER LIGHTENING ARRESTOR RANDOM FAILURE. |
| 18 Aug | 59.0  | 9.3     | UF4  | A42  | REACTOR TRIPPED ON NO PRIMARY COOLANT PUMP RUNNING PARAMETER DUE TO TOTAL CLASS IV EXTERNAL POWER SUPPLY FALIURE INITIATED BY 220 KV LINE-3 CVT FAILURE.                                   |
| 16 Dec | 48.0  | 7.6     | UF4  | A42  | REACTOR TRIPPED ON HIGH DIFFERENTIAL TEMPERATURE ACROSS ONE STEAM GENERATOR DURING TRANSIENT INITIATED BY BREAKER FAILURE RELAY ACTUATION OF 220 KV LINE-1.                                |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1992 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 165       |          |  | 640       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 99                                       |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 969                                      |           |          |
| E. Testing of plant systems or components  | 172             |           |          |  | 31        |          |
| H. Nuclear regulatory requirements   |                 |           |          | 19                                       | 35        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 3         | 127      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         |          |
| Subtotal   | 172             | 165       | 0        | 1087                                     | 729       | 127      |
| Total  |                 | 337       |          |  | 1943      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1992 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 59                                       |
| 12. Reactor I&C Systems                        |                 | 48                                       |
| 13. Reactor Auxiliary Systems                  |                 | 7  |
| 15. Reactor Cooling Systems                    |                 | 77                                       |
| 16. Steam generation systems                   |                 | 3  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 18                                       |
| 31. Turbine and auxiliaries                    |                 | 244                                      |
| 32. Feedwater and Main Steam System            |                 | 33                                       |
| 41. Main Generator Systems                     |                 | 33                                       |
| 42. Electrical Power Supply Systems            | 165             | 80                                       |
| Total  | 165             | 602                                      |

## IN-3 RAJASTHAN-1

**Operator:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**Contractor:** AECL (ATOMIC ENERGY OF CANADA LTD.)

### 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 134.0 MW(e)  
**Design Net RUP:** 207.0 MW(e)  
**Design Discharge Burnup:** 6700 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 303.8 GW(e).h  
**Energy Availability Factor:** 56.8%  
**Load Factor:** 25.8%  
**Operating Factor:** 43.1%  
**Energy Unavailability Factor:** 43.2%  
**Total Off-line Time:** 4999 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|------|------|------|------|------|------|------|------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 10.8 | 52.9 | 37.5 | 49.4 | 59.4 | 38.0 | 43.3 | 6.6  | 5.8  | 0.0   | 0.0   | 303.8  |
| <b>EAF (%)</b>  | 0.0   | 75.2 | 90.1 | 75.1 | 88.7 | 98.7 | 78.9 | 82.6 | 47.0 | 45.9 | 0.0   | 0.0   | 56.8   |
| <b>UCF (%)</b>  | 0.0   | 75.2 | 90.1 | 75.1 | 88.7 | 98.7 | 78.9 | 82.6 | 47.0 | 46.0 | 0.0   | 0.0   | 56.8   |
| <b>LF (%)</b>   | 0.0   | 11.5 | 53.1 | 39.0 | 49.6 | 61.6 | 38.1 | 43.5 | 6.8  | 5.8  | 0.0   | 0.0   | 25.8   |
| <b>OF (%)</b>   | 0.0   | 23.7 | 84.1 | 60.4 | 82.0 | 97.9 | 66.4 | 72.3 | 15.4 | 13.7 | 0.0   | 0.0   | 43.1   |
| <b>EUF (%)</b>  | 100.0 | 24.8 | 9.9  | 24.9 | 11.3 | 1.3  | 21.1 | 17.4 | 53.0 | 54.1 | 100.0 | 100.0 | 43.2   |
| <b>PUF (%)</b>  | 78.5  | 24.8 | 9.9  | 24.9 | 11.3 | 1.3  | 5.2  | 17.4 | 53.0 | 54.1 | 100.0 | 100.0 | 40.1   |
| <b>UCLF (%)</b> | 21.5  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 15.8 | 0.0  | 0.0  | 0.0  | 0.0   | 0.0   | 3.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

UNIT WAS SYNCHRONIZED ON 8TH FEBRUARY 2004 AFTER COOLANT CHANNEL LIFE MANAGEMENT AND SAFETY UPGRADATION JOBS. IT OPERATED FOR A FEW MONTHS THEN AGAIN SHUTDOWN ON 9TH OCTOBER 2004.

### 5. Historical Summary

**Date of Construction Start:** 01 Aug 1965  
**Date of First Criticality:** 11 Aug 1972  
**Date of Grid Connection:** 30 Nov 1972  
**Date of Commercial Operation:** 16 Dec 1973

**Lifetime Generation:** 10138.4 GW(e).h  
**Cumulative Energy Availability Factor:** 26.4%  
**Cumulative Load Factor:** 22.7%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 73.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 0.0            | 202.0          | 0.0  | 35.4   | 0.0                               | 29.1   | 0.0                | 29.0   | 0                  | 0.0    |
| 1984 | 0.0            | 180.0          | 0.0  | 32.6   | 0.0                               | 26.8   | 0.0                | 26.7   | 0                  | 0.0    |
| 1985 | 226.2          | 204.0          | 12.7   | 30.9   | 12.7                              | 25.6   | 12.7               | 25.5   | 1914               | 21.8   |
| 1986 | 0.0            | 207.0          | 0.0  | 28.5   | 0.0                               | 23.6   | 0.0                | 23.5   | 0                  | 0.0    |
| 1987 | 169.9          | 207.0          | 16.6   | 27.6   | 9.4                               | 22.6   | 9.4                | 22.5   | 2555               | 29.2   |
| 1988 | 376.5          | 207.0          | 25.3   | 27.5   | 20.7                              | 22.4   | 20.7               | 22.4   | 5793               | 65.9   |
| 1989 | 312.8          | 207.0          | 18.7   | 26.9   | 17.3                              | 22.1   | 17.3               | 22.0   | 4779               | 54.6   |
| 1990 | 364.1          | 192.0          | 22.3   | 26.7   | 19.4                              | 22.0   | 21.6               | 22.0   | 5789               | 66.1   |
| 1991 | 197.5          | 192.0          | 74.8   | 29.2   | 74.8                              | 24.7   | 11.7               | 21.5   | 2858               | 32.6   |
| 1992 | 57.7           | 84.0           | 12.2   | 28.8   | 12.2                              | 24.4   | 7.8                | 21.2   | 1070               | 12.2   |
| 1993 | 167.6          | 84.0           | 22.8   | 28.7   | 22.8                              | 24.4   | 22.8               | 21.2   | 2435               | 27.8   |
| 1994 | 2.9            | 84.0           | 2.2  | 28.1   | 2.2                               | 23.9   | 0.4                | 20.8   | 195                | 2.2    |
| 1995 | 0.0            | 84.0           | 0.0  | 27.5   | 0.0                               | 23.4   | 0.0                | 20.3   | 0                  | 0.0    |
| 1996 | 0.0            | 84.0           | 0.0  | 27.0   | 0.0                               | 23.0   | 0.0                | 19.9   | 0                  | 0.0    |
| 1997 | 264.6          | 84.0           | 39.1   | 27.2   | 31.9                              | 23.1   | 36.0               | 20.2   | 2792               | 31.9   |
| 1998 | 567.4          | 134.0          | 63.8   | 28.3   | 62.2                              | 24.3   | 48.3               | 21.1   | 5448               | 62.2   |
| 1999 | 795.0          | 134.0          | 81.0   | 29.9   | 73.6                              | 25.8   | 67.7               | 22.5   | 6443               | 73.6   |
| 2000 | 681.3          | 134.0          | 57.5   | 30.7   | 57.0                              | 26.7   | 57.9               | 23.6   | 5008               | 57.0   |
| 2001 | 173.2          | 134.0          | 10.5   | 30.2   | 10.0                              | 26.3   | 14.8               | 23.3   | 860                | 9.8    |
| 2003 | 0.0            | 134.0          | 0.0  | 29.3   | 0.0                               | 25.5   | 0.0                | 22.7   | 0                  | 0.0    |
| 2004 | 303.8          | 134.0          | 56.8   | 30.1   | 56.8                              | 26.4   | 25.8               | 22.7   | 3785               | 43.1   |

## IN-3 RAJASTHAN-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 935.4  | 101.4   | PF   | G    | UNIT WAS PLANNED SHUTDOWN FOR COOLANT CHANNEL ISI AND OTHER UPGRADATION WORK.  |
| 09 Feb | 87.0   | 7.3     | UF4  | A15  | REACTOR TRIPPED ON LOW PHT PRESSURE.   |
| 15 Feb | 169.0  | 14.2    | UF4  | A15  | REACTOR TRIPPED ON HIGH PHT PRESSURE DUE TO PROBLEMS IN PHT BLEED CONTROL VALVES.  |
| 26 Feb | 102.0  | 8.6     | PF   | D11  | UNIT WAS PLANNED SHUTDOWN TO ATTEND HEAVY WATER LEAKS.   |
| 31 Mar | 92.0   | 7.7     | PF   | D15  | UNIT WAS PLANNED SHUTDOWN TO ATTEND BLEED CONTROL VALVES.  |
| 15 Apr | 52.0   | 4.4     | PF   | D11  | UNIT WAS PLANNED SHUTDOWN DUE TO HIGH DAC AND HEAVY WATER LOSS.  |
| 20 Apr | 211.0  | 17.7    | PF   | D11  | UNIT WAS PLANNED SHUTDOWN TO ATTEND HEAVY WATER LEAK.  |
| 21 May | 82.0   | 6.9     | PF   | D11  | UNIT WAS PLANNED SHUTDOWN DUE TO INCREASING TREND OF STACK LOSS AND HIGH DAC.  |
| 30 Jun | 77.0   | 6.5     | PF   | D12  | UNIT WAS SHUTDOWN TO ATTEND ADJUSTER ROD SLUGGISH OPERATION AND ERRATIC BEHAVIOUR IN ITS MOVEMENT.   |
| 06 Jul | 44.0   | 3.7     | UF4  | A31  | UNIT TRIPPED ON HIGH PHT PRESSURE DUE TO OSCILLATION IN FEED FLOW CAUSING HUNTING IN REACTOR POWER AND TURBINE POWER.                        |
| 08 Jul | 75.0   | 6.3     | UF4  | A31  | UNIT TRIPPED ON HIGH PHT PRESSURE DUE TO HUNTING IN BPC MEDIAN.  |
| 15 Jul | 69.0   | 5.8     | UF4  | A12  | REACTOR POWER CAME DOWN DUE TO FUEL CHANNEL TEMPERATURE HIGH ALARM, RESULTING UNLOADING OF TURBINE. TURBINE TRIPPED ON LOW CONDENSER VACUUM. |
| 17 Aug | 146.0  | 12.3    | PF   | D21  | UNIT WAS PLANNED SHUTDOWN DUE TO FUELLING MACHINE PROBLEM.   |
| 29 Aug | 163.0  | 14.7    | PF   | D15  | UNIT WAS PLANNED TO ATTEND HEAVY WATER LEAK FROM DRAIN LINE OF 3332-P-2.   |
| 09 Sep | 620.0  | 55.8    | PF   | D11  | UNIT WAS PLANNED DUE TO HIGH HEAVY WATER ESCAPE FROM THE PHT SYSTEM.   |
| 09 Oct | 1993.0 | 179.4   | PF   | D    | UNIT IS SHUTDOWN FOR MAINTENANCE WORK.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 444       |          | 154                                      | 2518      |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 38        |          |
| D. Inspection, maintenance or repair without refuelling                              | 3538            |           |          | 2135                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 6         |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      | 935             |           |          | 9  | 21        |          |
| H. Nuclear regulatory requirements   |                 |           |          | 323                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 2         | 111      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 17                                       |           | 50       |
| Subtotal   | 4473            | 444       | 0        | 2638                                     | 2585      | 161      |
| Total  |                 | 4917      |          |  | 5384      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1973 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 1253                                     |
| 12. Reactor I&C Systems                        | 69              | 172                                      |
| 13. Reactor Auxiliary Systems                  |                 | 57                                       |
| 14. Safety Systems                             |                 | 33                                       |
| 15. Reactor Cooling Systems                    | 256             | 425                                      |
| 16. Steam generation systems                   |                 | 6  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    | 119             | 472                                      |
| 32. Feedwater and Main Steam System            |                 | 11                                       |
| 41. Main Generator Systems                     |                 | 102                                      |
| 42. Electrical Power Supply Systems            |                 | 111                                      |
| XX. Miscellaneous Systems                      |                 | 7  |
| Total  | 444             | 2650                                     |

**IN-4 RAJASTHAN-2**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: AECL/DAE (ATOMIC ENERGY OF CANADA Ltd AND DEPARTMENT OF ATOMIC ENERGY(INDIA))

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power at the beginning of 2004: 187.0 MW(e)  
 Design Net RUP: 207.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 1047.7 GW(e).h  
 Energy Availability Factor: 77.8%  
 Load Factor: 63.8%  
 Operating Factor: 77.5%  
 Energy Unavailability Factor: 22.2%  
 Total Off-line Time: 1978 hours

**3. 2004 Monthly Performance Data**

|          | Jan  | Feb  | Mar   | Apr  | May  | Jun  | Jul  | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|------|------|-------|------|------|------|------|------|-------|-------|-------|-------|--------|
| GW(e).h  | 80.7 | 66.1 | 109.1 | 94.1 | 73.3 | 85.7 | 16.7 | 53.9 | 114.5 | 119.6 | 118.0 | 116.0 | 1047.7 |
| EAF (%)  | 69.2 | 61.6 | 93.2  | 88.4 | 67.4 | 83.3 | 18.2 | 53.7 | 100.0 | 100.0 | 100.0 | 100.0 | 77.8   |
| UCF (%)  | 69.2 | 61.6 | 93.2  | 88.4 | 67.4 | 83.3 | 18.2 | 53.7 | 100.0 | 100.0 | 100.0 | 100.0 | 77.8   |
| LF (%)   | 58.0 | 50.8 | 78.4  | 70.0 | 52.7 | 63.7 | 12.0 | 38.7 | 85.1  | 85.8  | 87.7  | 83.4  | 63.8   |
| OF (%)   | 68.7 | 60.9 | 93.1  | 88.3 | 66.8 | 83.1 | 16.9 | 53.0 | 100.0 | 99.9  | 100.0 | 100.0 | 77.5   |
| EUF (%)  | 30.8 | 38.4 | 6.8   | 11.6 | 32.6 | 16.7 | 81.8 | 46.3 | 0.0   | 0.0   | 0.0   | 0.0   | 22.2   |
| PUF (%)  | 0.0  | 0.0  | 0.0   | 11.6 | 32.6 | 0.0  | 81.8 | 46.3 | 0.0   | 0.0   | 0.0   | 0.0   | 14.6   |
| UCLF (%) | 30.8 | 38.4 | 6.8   | 0.0  | 0.0  | 16.7 | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 7.6    |
| XUF (%)  | 0.0  | 0.0  | 0.0   | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE PERFORMANCE OF THE UNIT WAS SATISFACTORY. DURING THIS YEAR ANNUAL MAINTENANCE OUTAGE OF THE UNIT WAS TAKEN UP.

**5. Historical Summary**

Date of Construction Start: 01 Apr 1968      Lifetime Generation: 21157.6 GW(e).h  
 Date of First Criticality: 08 Oct 1980      Cumulative Energy Availability Factor: 56.3%  
 Date of Grid Connection: 01 Nov 1980      Cumulative Load Factor: 53.1%  
 Date of Commercial Operation: 01 Apr 1981      Cumulative Unit Capability Factor: 77.8%  
    Cumulative Energy Unavailability Factor: 43.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 908.7          | 185.0          | 56.1   | 43.1   | 49.1                              | 41.0   | 55.9               | 43.1   | 5870               | 66.8   |
| 1985 | 959.9          | 184.0          | 73.3   | 50.3   | 71.3                              | 48.1   | 59.6               | 47.0   | 6243               | 71.3   |
| 1986 | 1080.5         | 207.0          | 65.2   | 53.4   | 59.6                              | 50.5   | 59.6               | 49.6   | 6743               | 77.0   |
| 1987 | 1031.1         | 207.0          | 63.2   | 55.1   | 56.9                              | 51.6   | 56.9               | 50.9   | 6277               | 71.7   |
| 1988 | 1234.0         | 207.0          | 70.1   | 57.4   | 67.9                              | 54.0   | 67.9               | 53.4   | 7935               | 90.3   |
| 1989 | 1084.2         | 207.0          | 60.5   | 57.8   | 59.8                              | 54.8   | 59.8               | 54.2   | 6980               | 79.7   |
| 1990 | 1173.8         | 192.0          | 68.7   | 58.9   | 68.7                              | 56.3   | 69.8               | 55.9   | 7151               | 81.6   |
| 1991 | 895.1          | 192.0          | 63.0   | 59.3   | 62.9                              | 56.9   | 53.2               | 55.6   | 5416               | 61.8   |
| 1992 | 874.4          | 184.0          | 90.3   | 61.9   | 58.1                              | 57.0   | 54.1               | 55.5   | 5297               | 60.3   |
| 1993 | 1153.5         | 184.0          | 74.2   | 62.9   | 71.1                              | 58.1   | 71.6               | 56.8   | 6983               | 79.7   |
| 1994 | 519.4          | 184.0          | 39.4   | 61.2   | 32.2                              | 56.2   | 32.2               | 55.0   | 3244               | 37.0   |
| 1995 | 0.0            | 184.0          | 0.0  | 57.1   | 0.0                               | 52.4   | 0.0                | 51.3   | 0                  | 0.0    |
| 1996 | 0.0            | 184.0          | 0.0  | 53.5   | 0.0                               | 49.1   | 0.0                | 48.0   | 0                  | 0.0    |
| 1997 | 0.0            | 184.0          | 0.0  | 50.3   | 0.0                               | 46.2   | 0.0                | 45.2   | 0                  | 0.0    |
| 1998 | 512.4          | 184.0          | 49.6   | 50.2   | 49.6                              | 46.4   | 31.8               | 44.4   | 3728               | 42.6   |
| 1999 | 1162.3         | 184.0          | 87.6   | 52.2   | 83.1                              | 48.3   | 72.1               | 45.9   | 7264               | 82.9   |
| 2000 | 1308.1         | 184.0          | 92.3   | 54.3   | 92.3                              | 50.6   | 80.9               | 47.7   | 8104               | 92.3   |
| 2001 | 1348.3         | 184.0          | 86.9   | 55.8   | 85.5                              | 52.2   | 83.6               | 49.4   | 7486               | 85.5   |
| 2002 | 1430.9         | 187.0          | 90.7   | 57.4   | 89.0                              | 54.0   | 87.3               | 51.2   | 7768               | 88.7   |
| 2003 | 1391.5         | 187.0          | 92.3   | 59.0   | 84.7                              | 55.3   | 84.9               | 52.7   | 8018               | 91.5   |
| 2004 | 1047.7         | 187.0          | 77.8   | 59.8   | 77.8                              | 56.3   | 63.8               | 53.1   | 6806               | 77.5   |

## IN-4 RAJASTHAN-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 15 Jan | 186.0 | 34.2    | UF4  | Z42  | REACTOR TRIPPED ON HIGH PHT PRESSURE DUE TO DISTURBANCE IN 48V CONTROL POWER SUPPLY.  |
| 25 Jan | 46.0  | 8.5     | UF4  | A32  | TURBINE TRIPPED ON BOILER LEVEL VERY HIGH PROTECTION FOR ONE OF THE BOILER.   |
| 10 Feb | 109.0 | 20.1    | UF4  | Z42  | REACTOR TRIPPED ON LOW PHT PRESSURE DUE TO DISTURBANCE IN CONTROL POWER SUPPLY.   |
| 18 Feb | 163.0 | 30.0    | UF5  | Z31  | TURBINE TRIPPED MANUALLY DUE TO PROBLEM IN SPEEDER CONTROL CIRCUIT.   |
| 25 Mar | 51.0  | 9.4     | UF5  | Z16  | REACTOR SETBACK INITIATED DUE TO BLEED CONDENSER LEVEL HIGH. TURBINE TRIPPED ON BOILER LEVEL VERY HIGH. SUBSEQUENTLY, REACTOR GOT POISONED OUT. |
| 07 Apr | 85.0  | 15.6    | PF   | D15  | UNIT WAS PLANNED SHUTDOWN TO ATTEND ONE OF THE PRIMARY CIRCULATING PUMP.  |
| 12 May | 247.0 | 45.4    | PF   | D11  | UNIT WAS PLANNED SHUTDOWN DUE TO HIGH DAC IN BOILER ROOM AND HIGH STACK LOSS.   |
| 04 Jun | 61.0  | 11.2    | UF4  | Z33  | REACTOR TRIPPED ON HIGH PHT PRESSURE DUE TO REACTOR SETBACK ON BLEED CONDENSER LEVEL HIGH.  |
| 16 Jun | 61.0  | 11.2    | UF4  | Z16  | REACTOR TRIPPED ON LOW PHT PRESSURE DUE TO INCREASE IN FEED WATER FLOW IN BOILER.   |
| 06 Jul | 968.0 | 181.0   | PF   | D    | UNIT WAS PLANNED SHUTDOWN FOR ANNUAL MAINTENANCE.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 46        |          |  | 842       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 115                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 1300            |           |          | 1530                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 15        |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 17       |
| H. Nuclear regulatory requirements   |                 |           |          | 146                                      | 2         | 2        |
| J. Grid failure or grid unavailability   |                 |           |          |  | 29        | 196      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 53                                       | 23        | 2        |
| Z. Others  |                 | 631       |          |  | 1         | 2        |
| Subtotal   | 1300            | 677       | 0        | 1844                                     | 918       | 219      |
| Total  |                 | 1977      |          |  | 2981      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 24                                       |
| 12. Reactor I&C Systems                        |                 | 156                                      |
| 13. Reactor Auxiliary Systems                  |                 | 16                                       |
| 14. Safety Systems                             |                 | 31                                       |
| 15. Reactor Cooling Systems                    |                 | 88                                       |
| 16. Steam generation systems                   |                 | 9  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 286                                      |
| 32. Feedwater and Main Steam System            | 46              | 44                                       |
| 35. All other I&C Systems                      |                 | 17                                       |
| 41. Main Generator Systems                     |                 | 73                                       |
| 42. Electrical Power Supply Systems            |                 | 61                                       |
| XX. Miscellaneous Systems                      |                 | 12                                       |
| Total  | 46              | 818                                      |

**IN-11 RAJASTHAN-3**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 202.0 MW(e)  
 Design Net RUP: 220.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 1260.3 GW(e).h  
 Energy Availability Factor: 72.3%  
 Load Factor: 71.0%  
 Operating Factor: 87.8%  
 Energy Unavailability Factor: 27.7%  
 Total Off-line Time: 1073 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep  | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|------|------|-------|-------|-------|--------|
| GW(e).h  | 124.9 | 115.7 | 109.7 | 117.5 | 121.8 | 116.5 | 111.4 | 47.1 | 36.5 | 123.8 | 120.6 | 114.9 | 1260.3 |
| EAF (%)  | 82.6  | 83.2  | 75.0  | 82.6  | 82.6  | 82.6  | 77.3  | 35.1 | 29.5 | 81.5  | 80.9  | 74.8  | 72.3   |
| UCF (%)  | 100.0 | 100.0 | 92.4  | 100.0 | 100.0 | 100.0 | 94.7  | 52.5 | 46.9 | 100.0 | 100.0 | 93.9  | 90.0   |
| LF (%)   | 83.1  | 82.3  | 73.0  | 80.8  | 81.0  | 80.1  | 74.1  | 31.3 | 25.1 | 82.4  | 82.9  | 76.5  | 71.0   |
| OF (%)   | 100.0 | 100.0 | 90.7  | 100.0 | 100.0 | 100.0 | 93.5  | 41.8 | 35.3 | 100.0 | 100.0 | 92.3  | 87.8   |
| EUF (%)  | 17.4  | 16.8  | 25.0  | 17.4  | 17.4  | 17.4  | 22.7  | 64.9 | 70.5 | 18.5  | 19.1  | 25.2  | 27.7   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 42.2 | 42.2 | 0.0   | 0.0   | 0.0   | 7.0    |
| UCLF (%) | 0.0   | 0.0   | 7.6   | 0.0   | 0.0   | 0.0   | 5.3   | 5.2  | 10.9 | 0.0   | 0.0   | 6.2   | 2.9    |
| XUF (%)  | 17.4  | 16.8  | 17.4  | 17.4  | 17.4  | 17.4  | 17.4  | 17.4 | 17.4 | 18.5  | 19.1  | 19.1  | 17.7   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THROUGHOUT THE YEAR UNIT OPERATED AT A REDUCED POWER LEVEL BETWEEN 85-95% IN RATIONALIZATION WITH RESPECT TO GRID DEMAND.

**5. Historical Summary**

Date of Construction Start: 01 Feb 1990      Lifetime Generation: 6280.2 GW(e).h  
 Date of First Criticality: 24 Dec 1999      Cumulative Energy Availability Factor: 79.0%  
 Date of Grid Connection: 10 Mar 2000      Cumulative Load Factor: 76.2%  
 Date of Commercial Operation: 01 Jun 2000      Cumulative Unit Capability Factor: 83.7%  
    Cumulative Energy Unavailability Factor: 21.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2000 | 893.8          | 200.0          | 0.0  | 0.0    | 69.2                              | 100.0  | 62.9               | 0.0    | 4794               | 67.5   |
| 2001 | 1366.1         | 200.0          | 84.8   | 84.8   | 83.6                              | 83.6   | 78.0               | 78.0   | 7317               | 83.5   |
| 2002 | 1317.9         | 202.0          | 81.2   | 83.0   | 75.5                              | 79.5   | 74.5               | 76.2   | 6715               | 76.7   |
| 2003 | 1442.1         | 202.0          | 95.3   | 87.1   | 84.5                              | 81.2   | 81.5               | 78.0   | 8285               | 94.6   |
| 2004 | 1260.3         | 202.0          | 90.0   | 87.8   | 72.3                              | 79.0   | 71.0               | 76.2   | 7711               | 87.8   |

## IN-11 RAJASTHAN-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 27 Mar | 69.0  | 11.4    | UF4  | A12  | REACTOR TRIPPED ON LOW PHT PRESSURE DUE TO IRV-2 OPENING.  |
| 09 Jul | 48.2  | 7.9     | UF5  | A31  | REACTOR WAS MANUALLY SHUTDOWN TO ATTEND TO LIGHT WATER LEAK FROM SHUTDOWN HEAT EXCHANGER-1 SHELL SIDE PROCESS WATER DRAIN VALVE UPSTREAM FLANGE. |
| 03 Aug | 46.7  | 7.9     | UF5  | A42  | REACTOR WAS SHUTDOWN DUE TO GT BREAKER TRIPPING ON BUS BAR PROTECTION. REACTOR GOT POISONED OUT.   |
| 15 Aug | 757.6 | 124.9   | PF   | D12  | REACTOR WAS TRIPPED MANUALLY FOR CARRYING OUT ANNUAL SHUTDOWN JOBS.  |
| 16 Sep | 0.5   | 0.1     | UF2  | A42  | TURBINE TRIPPED AS UT TAKEN ON SERVICE.  |
| 16 Sep | 5.8   | 1.0     | UF2  | A41  | TG TRIPPED ON LOSS OF EXCITATION.  |
| 22 Sep | 88.7  | 14.8    | UF4  | A12  | REACTOR TRIPPED AS ONE PSS ROD LEFT PARKED POSITION.   |
| 23 Dec | 57.3  | 9.2     | UF4  | A41  | REACTOR TRIPPED DUE TO STATOR WATER LOW FLOW WHILE SUT-3 WAS UNDER MAINTENANCE.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2000 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                              |                 | 316       |          |  | 660       |          |
| D. Inspection, maintenance or repair without refuelling | 757             |           |          | 260                                      |           |          |
| E. Testing of plant systems or components               |                 |           |          |  | 40        |          |
| J. Grid failure or grid unavailability                  |                 |           |          |  |           | 125      |
| L. Human factor related                                 |                 |           |          |  | 24        |          |
| Subtotal  | 757             | 316       | 0        | 260                                      | 724       | 125      |
| Total   |                 | 1073      |          |  | 1109      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2000 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 157             | 193                                      |
| 15. Reactor Cooling Systems         |                 | 52                                       |
| 16. Steam generation systems        |                 | 81                                       |
| 31. Turbine and auxiliaries         | 48              | 111                                      |
| 32. Feedwater and Main Steam System |                 | 95                                       |
| 41. Main Generator Systems          | 63              | 46                                       |
| 42. Electrical Power Supply Systems | 47              | 35                                       |
| Total                               | 315             | 613                                      |

**IN-12 RAJASTHAN-4**

Operator: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

Contractor: NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)

**1. Station Details**

Type: PHWR  
 Net Reference Unit Power  
 at the beginning of 2004: 202.0 MW(e)  
 Design Net RUP: 220.0 MW(e)  
 Design Discharge Burnup: 6700 MW.d/t

**2. Production Summary 2004**

Energy Production: 1447.7 GW(e).h  
 Energy Availability Factor: 79.5%  
 Load Factor: 81.6%  
 Operating Factor: 94.8%  
 Energy Unavailability Factor: 20.5%  
 Total Off-line Time: 455 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 132.6 | 121.3 | 127.4 | 121.4 | 102.1 | 119.9 | 124.5 | 112.5 | 105.2 | 101.1 | 135.5 | 144.5 | 1447.7 |
| EAF (%)  | 82.6  | 82.7  | 82.6  | 82.6  | 69.0  | 82.6  | 80.4  | 74.8  | 73.1  | 65.8  | 90.2  | 88.0  | 79.5   |
| UCF (%)  | 100.0 | 99.5  | 100.0 | 100.0 | 86.5  | 100.0 | 100.0 | 94.5  | 89.5  | 80.0  | 100.0 | 100.0 | 95.8   |
| LF (%)   | 88.2  | 86.3  | 84.8  | 83.5  | 67.9  | 82.4  | 82.8  | 74.8  | 72.3  | 67.3  | 93.2  | 96.1  | 81.6   |
| OF (%)   | 100.0 | 99.4  | 100.0 | 100.0 | 83.5  | 100.0 | 100.0 | 93.0  | 87.2  | 76.3  | 100.0 | 98.9  | 94.8   |
| EUF (%)  | 17.4  | 17.3  | 17.4  | 17.4  | 31.0  | 17.4  | 19.6  | 25.2  | 26.9  | 34.2  | 9.8   | 12.0  | 20.5   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| UCLF (%) | 0.0   | 0.5   | 0.0   | 0.0   | 13.5  | 0.0   | 0.0   | 5.6   | 10.5  | 20.1  | 0.0   | 0.0   | 4.2    |
| XUF (%)  | 17.4  | 16.8  | 17.4  | 17.4  | 17.4  | 17.4  | 19.6  | 19.6  | 16.3  | 14.2  | 9.8   | 12.0  | 16.3   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THROUGHOUT THE YEAR UNIT OPERATED AT A REDUCED POWER LEVEL BETWEEN 85-95% DUE TO RATIONALIZATION OF GENERATION WITH RESPECT TO GRID DEMAND.

**5. Historical Summary**

Date of Construction Start: 01 Oct 1990      Lifetime Generation: 5695.8 GW(e).h  
 Date of First Criticality: 03 Nov 2000      Cumulative Energy Availability Factor: 79.9%  
 Date of Grid Connection: 17 Nov 2000      Cumulative Load Factor: 79.8%  
 Date of Commercial Operation: 23 Dec 2000      Cumulative Unit Capability Factor: 83.7%  
    Cumulative Energy Unavailability Factor: 20.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2000 | 57.5           | 200.0          | 0.0  | 0.0    | 51.3                              | 100.0  | 27.2               | 0.0    | 518                | 49.1   |
| 2001 | 1200.8         | 200.0          | 82.0   | 82.0   | 71.0                              | 71.0   | 68.5               | 68.5   | 6214               | 70.9   |
| 2002 | 1671.5         | 202.0          | 96.5   | 89.3   | 94.3                              | 82.7   | 94.5               | 81.6   | 8255               | 94.2   |
| 2003 | 1318.2         | 202.0          | 87.5   | 88.7   | 74.8                              | 80.1   | 74.5               | 79.2   | 7633               | 87.1   |
| 2004 | 1447.7         | 202.0          | 95.8   | 90.5   | 79.5                              | 79.9   | 81.6               | 79.8   | 8329               | 94.8   |



## IN-12 RAJASTHAN-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Feb | 4.5   | 0.7     | UF2  | A16  | TG TRIPPED ON SG-1 LEVEL VERY HIGH.  |
| 13 May | 123.5 | 20.4    | UF5  | A11  | REACTOR SHUTDOWN WAS TAKEN TO ATTEND MODERATOR PUMP-4 SEAL LEAK.   |
| 03 Aug | 52.0  | 8.3     | UF4  | A42  | REACTOR TRIPPED ON HIGH PHT PRESSURE DUE TO SUT-4 TRIPPING AND PARTIAL FAILURE OF 6.6. KV AUTO TRANSFER.   |
| 01 Sep | 91.6  | 15.3    | UF5  | A12  | UNIT WAS MANUALLY SHUTDOWN DUE TO UNAVAILABILITY OF 3335-MV-4.   |
| 17 Oct | 175.8 | 30.1    | UF5  | A21  | REACTOR SHUTDOWN DUE TO FUELLING MACHINE (N) HAVING BEEN INCAPACITATED TO SEAL PLUG ON E-9 DOWN STREAM DURING REFUELLING OPERATION OF THE CHANNEL. |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2000 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                              |                 | 447       |          |  | 233       |          |
| D. Inspection, maintenance or repair without refuelling |                 |           |          | 136                                      |           |          |
| J. Grid failure or grid unavailability                  |                 |           |          |  |           | 210      |
| Subtotal  | 0               | 447       | 0        | 136                                      | 233       | 210      |
| Total   |                 | 447       |          |  | 579       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 2000 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              | 123             |  |
| 12. Reactor I&C Systems                  | 91              | 62                                       |
| 15. Reactor Cooling Systems              |                 | 30                                       |
| 16. Steam generation systems             | 4               | 14                                       |
| 21. Fuel Handling and Storage Facilities | 175             |  |
| 31. Turbine and auxiliaries              |                 | 14                                       |
| 32. Feedwater and Main Steam System      |                 | 38                                       |
| 41. Main Generator Systems               |                 | 16                                       |
| 42. Electrical Power Supply Systems      | 52              | 55                                       |
| Total                                    | 445             | 229                                      |

# IN-1 TARAPUR-1

**Operator:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 150.0 MW(e)  
**Design Net RUP:** 200.0 MW(e)  
**Design Discharge Burnup:** 24000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1148.6 GW(e).h  
**Energy Availability Factor:** 89.0%  
**Load Factor:** 87.2%  
**Operating Factor:** 92.3%  
**Energy Unavailability Factor:** 11.0%  
**Total Off-line Time:** 673 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov  | Dec  | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|------|------|--------|
| <b>GW(e).h</b>  | 107.7 | 95.2  | 109.9 | 106.1 | 106.1 | 104.0 | 106.5 | 97.8 | 103.2 | 104.1 | 64.7 | 43.3 | 1148.6 |
| <b>EAF (%)</b>  | 99.5  | 92.1  | 100.0 | 100.0 | 98.0  | 99.3  | 98.4  | 90.0 | 98.4  | 96.2  | 59.9 | 36.1 | 89.0   |
| <b>UCF (%)</b>  | 99.5  | 100.0 | 100.0 | 100.0 | 98.0  | 99.3  | 98.4  | 98.2 | 98.4  | 96.3  | 67.7 | 36.1 | 90.9   |
| <b>LF (%)</b>   | 96.5  | 91.2  | 98.4  | 98.4  | 95.1  | 96.3  | 95.5  | 87.6 | 95.5  | 93.2  | 59.9 | 38.8 | 87.2   |
| <b>OF (%)</b>   | 100.0 | 95.8  | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 94.8 | 100.0 | 99.9  | 69.7 | 48.0 | 92.3   |
| <b>EUF (%)</b>  | 0.5   | 7.9   | 0.0   | 0.0   | 2.0   | 0.7   | 1.6   | 10.0 | 1.6   | 3.8   | 40.1 | 63.9 | 11.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 32.3 | 63.9 | 8.1    |
| <b>UCLF (%)</b> | 0.5   | 0.0   | 0.0   | 0.0   | 2.0   | 0.7   | 1.6   | 1.8  | 1.6   | 3.8   | 0.0  | 0.0  | 1.0    |
| <b>XUF (%)</b>  | 0.0   | 7.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.2  | 0.0   | 0.0   | 7.8  | 0.0  | 2.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING THE YEAR UNIT UNDERWENT 18TH REFUELLING OUTAGE, WHICH WAS COMPLETED IN 25 DAYS.

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1964      **Lifetime Generation:** 31705.6 GW(e).h  
**Date of First Criticality:** 01 Feb 1969      **Cumulative Energy Availability Factor:** 64.0%  
**Date of Grid Connection:** 01 Apr 1969      **Cumulative Load Factor:** 58.4%  
**Date of Commercial Operation:** 28 Oct 1969      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 36.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 730.0          | 200.0          | 100.0  | 80.8   | 41.7                              | 55.4   | 41.7               | 50.0   | 5396               | 61.6   |
| 1984 | 826.9          | 200.0          | 90.3   | 81.4   | 89.6                              | 57.7   | 47.1               | 49.8   | 7688               | 87.5   |
| 1985 | 790.9          | 170.0          | 64.6   | 80.5   | 64.6                              | 58.0   | 53.1               | 50.0   | 6194               | 70.7   |
| 1986 | 1090.2         | 150.0          | 84.5   | 80.7   | 83.0                              | 59.1   | 83.0               | 51.5   | 7954               | 90.8   |
| 1987 | 193.4          | 150.0          | 14.7   | 77.9   | 14.7                              | 57.3   | 14.7               | 49.9   | 1533               | 17.5   |
| 1988 | 1085.5         | 150.0          | 83.8   | 78.1   | 82.4                              | 58.3   | 82.4               | 51.2   | 8010               | 91.2   |
| 1989 | 800.3          | 150.0          | 61.6   | 77.5   | 61.4                              | 58.4   | 60.9               | 51.6   | 6177               | 70.5   |
| 1990 | 1045.2         | 150.0          | 80.5   | 77.6   | 80.2                              | 59.2   | 79.5               | 52.7   | 7772               | 88.7   |
| 1991 | 566.9          | 150.0          | 82.4   | 77.8   | 80.4                              | 60.0   | 43.1               | 52.3   | 6536               | 74.6   |
| 1992 | 762.3          | 150.0          | 58.7   | 77.1   | 57.9                              | 59.9   | 57.9               | 52.5   | 5487               | 62.5   |
| 1993 | 967.7          | 150.0          | 76.9   | 77.1   | 74.4                              | 60.4   | 73.6               | 53.2   | 7291               | 83.2   |
| 1994 | 280.6          | 150.0          | 22.9   | 75.3   | 21.4                              | 59.1   | 21.4               | 52.2   | 2450               | 28.0   |
| 1995 | 1092.3         | 150.0          | 91.0   | 75.8   | 83.1                              | 59.9   | 83.1               | 53.2   | 7893               | 90.1   |
| 1996 | 403.3          | 150.0          | 32.3   | 74.5   | 30.6                              | 59.0   | 30.6               | 52.5   | 3872               | 44.1   |
| 1997 | 985.5          | 150.0          | 75.9   | 74.5   | 75.0                              | 59.5   | 75.0               | 53.1   | 7347               | 83.9   |
| 1998 | 1162.6         | 150.0          | 92.8   | 75.1   | 91.6                              | 60.4   | 88.5               | 54.2   | 8283               | 94.6   |
| 1999 | 852.6          | 150.0          | 67.9   | 74.9   | 67.0                              | 60.6   | 64.9               | 54.5   | 6405               | 73.1   |
| 2000 | 1181.1         | 150.0          | 91.6   | 75.3   | 91.6                              | 61.4   | 89.6               | 55.4   | 8337               | 94.9   |
| 2001 | 1084.2         | 150.0          | 84.3   | 75.6   | 83.6                              | 62.0   | 82.5               | 56.1   | 7635               | 87.2   |
| 2002 | 1180.7         | 150.0          | 93.8   | 76.0   | 92.0                              | 62.8   | 89.9               | 57.0   | 8394               | 95.8   |
| 2003 | 1100.4         | 150.0          | 86.9   | 76.3   | 85.2                              | 63.4   | 83.7               | 57.7   | 7901               | 90.2   |
| 2004 | 1148.6         | 150.0          | 90.9   | 76.7   | 89.0                              | 64.0   | 87.2               | 58.4   | 8111               | 92.3   |

# IN-1 TARAPUR-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 05 Feb | 29.0  | 8.3     | XF4  | J42  | REACTOR SCRAMMED ON DE-ENERGIZATION OF SAFETY SYSTEM RELAYS CAUSED DUE TO TOTAL LOSS OF OFF-SITE POWER. |
| 03 Aug | 39.0  | 9.2     | XF4  | J42  | REACTOR SCRAMMED ON PRM HIGH FLUX CAUSED DUE TO GRID DISTURBANCE.                                       |
| 21 Nov | 599.0 | 106.2   | PF   | C11  | UNIT WAS SHUTDOWN FOR REFUELLING OUTAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 366       | 1        |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 599             |           |          | 1427                                     | 21        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 225                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 6  |           |          |
| J. Grid failure or grid unavailability   |                 |           | 68       |  | 0         | 50       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  | 2         | 4        |
| Subtotal   | 599             | 0         | 68       | 1658                                     | 389       | 55       |
| Total  |                 | 667       |          |  | 2102      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 4  |
| 12. Reactor I&C Systems                        |                 | 11                                       |
| 13. Reactor Auxiliary Systems                  |                 | 1  |
| 14. Safety Systems                             |                 | 2  |
| 15. Reactor Cooling Systems                    |                 | 61                                       |
| 16. Steam generation systems                   |                 | 20                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 174                                      |
| 32. Feedwater and Main Steam System            |                 | 52                                       |
| 41. Main Generator Systems                     |                 | 0  |
| 42. Electrical Power Supply Systems            |                 | 36                                       |
| XX. Miscellaneous Systems                      |                 | 0  |
| Total  | 0               | 362                                      |

# IN-2 TARAPUR-2

**Operator:** NPCIL (NUCLEAR POWER CORPORATION OF INDIA LTD.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 150.0 MW(e)  
**Design Net RUP:** 200.0 MW(e)  
**Design Discharge Burnup:** 24000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1238.3 GW(e).h  
**Energy Availability Factor:** 94.5%  
**Load Factor:** 94.0%  
**Operating Factor:** 96.3%  
**Energy Unavailability Factor:** 5.5%  
**Total Off-line Time:** 329 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug  | Sep   | Oct   | Nov   | Dec  | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|------|--------|
| <b>GW(e).h</b>  | 104.3 | 100.3 | 113.5 | 109.6 | 100.7 | 99.8 | 108.7 | 86.0 | 108.0 | 109.7 | 105.0 | 92.5 | 1238.3 |
| <b>EAF (%)</b>  | 91.5  | 98.9  | 100.0 | 100.0 | 89.7  | 92.1 | 100.0 | 77.1 | 100.0 | 100.0 | 100.0 | 85.6 | 94.5   |
| <b>UCF (%)</b>  | 91.5  | 100.0 | 100.0 | 100.0 | 89.7  | 92.1 | 100.0 | 84.8 | 100.0 | 100.0 | 100.0 | 85.6 | 95.3   |
| <b>LF (%)</b>   | 93.5  | 96.1  | 101.7 | 101.6 | 90.2  | 92.4 | 97.4  | 77.1 | 100.0 | 98.1  | 97.2  | 82.9 | 94.0   |
| <b>OF (%)</b>   | 94.2  | 96.6  | 100.0 | 100.1 | 93.1  | 94.3 | 100.0 | 82.5 | 100.0 | 99.9  | 100.0 | 94.6 | 96.3   |
| <b>EUF (%)</b>  | 8.5   | 1.1   | 0.0   | 0.0   | 10.3  | 7.9  | 0.0   | 22.9 | 0.0   | 0.0   | 0.0   | 14.4 | 5.5    |
| <b>PUF (%)</b>  | 8.5   | 0.0   | 0.0   | 0.0   | 10.3  | 7.9  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 14.3 | 3.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 15.2 | 0.0   | 0.0   | 0.0   | 0.1  | 1.3    |
| <b>XUF (%)</b>  | 0.0   | 1.1   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 7.7  | 0.0   | 0.0   | 0.0   | 0.0  | 0.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1964  
**Date of First Criticality:** 28 Feb 1969  
**Date of Grid Connection:** 05 May 1969  
**Date of Commercial Operation:** 28 Oct 1969

**Lifetime Generation:** 31805.1 GW(e).h  
**Cumulative Energy Availability Factor:** 63.2%  
**Cumulative Load Factor:** 58.6%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 36.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 867.7          | 200.0          | 100.0  | 79.2   | 49.5                              | 56.7   | 49.5               | 50.6   | 7519               | 85.8   |
| 1984 | 803.1          | 200.0          | 70.6   | 78.6   | 69.6                              | 57.5   | 45.7               | 50.3   | 5615               | 63.9   |
| 1985 | 1070.9         | 170.0          | 83.5   | 78.8   | 83.5                              | 58.8   | 71.9               | 51.4   | 8059               | 92.0   |
| 1986 | 769.5          | 150.0          | 58.9   | 78.0   | 58.6                              | 58.8   | 58.6               | 51.7   | 5615               | 64.1   |
| 1987 | 1167.2         | 150.0          | 91.5   | 78.5   | 88.8                              | 60.1   | 88.8               | 53.3   | 8221               | 93.8   |
| 1988 | 813.5          | 150.0          | 62.1   | 77.9   | 61.7                              | 60.2   | 61.7               | 53.6   | 6077               | 69.2   |
| 1989 | 427.1          | 150.0          | 34.8   | 76.2   | 34.8                              | 59.2   | 32.5               | 52.8   | 3052               | 34.8   |
| 1990 | 762.4          | 150.0          | 58.7   | 75.6   | 58.7                              | 59.2   | 58.0               | 53.0   | 7827               | 89.3   |
| 1991 | 848.5          | 150.0          | 76.4   | 75.6   | 75.0                              | 59.7   | 64.6               | 53.4   | 6265               | 71.5   |
| 1992 | 819.8          | 150.0          | 62.8   | 75.2   | 62.2                              | 59.8   | 62.2               | 53.7   | 6076               | 69.2   |
| 1993 | 779.7          | 150.0          | 60.7   | 74.7   | 59.3                              | 59.8   | 59.3               | 53.9   | 5750               | 65.6   |
| 1994 | 843.6          | 150.0          | 64.9   | 74.3   | 64.2                              | 59.9   | 64.2               | 54.2   | 6722               | 76.7   |
| 1995 | 640.0          | 150.0          | 55.6   | 73.8   | 48.7                              | 59.6   | 48.7               | 54.0   | 4911               | 56.1   |
| 1996 | 361.2          | 150.0          | 30.4   | 72.4   | 27.4                              | 58.6   | 27.4               | 53.2   | 3203               | 36.5   |
| 1997 | 775.7          | 150.0          | 59.6   | 72.1   | 59.0                              | 58.6   | 59.0               | 53.4   | 6978               | 79.7   |
| 1998 | 881.1          | 150.0          | 71.2   | 72.0   | 67.8                              | 58.9   | 67.1               | 53.8   | 6522               | 74.5   |
| 1999 | 1103.5         | 150.0          | 87.6   | 72.5   | 86.4                              | 59.7   | 84.0               | 54.6   | 7711               | 88.0   |
| 2000 | 1023.1         | 150.0          | 79.0   | 72.7   | 79.0                              | 60.2   | 77.6               | 55.3   | 7162               | 81.5   |
| 2001 | 1197.4         | 150.0          | 93.9   | 73.2   | 93.3                              | 61.1   | 91.1               | 56.2   | 8364               | 95.5   |
| 2002 | 1163.3         | 150.0          | 90.8   | 73.7   | 90.2                              | 61.8   | 88.5               | 57.0   | 7978               | 91.1   |
| 2003 | 1117.1         | 150.0          | 86.1   | 74.0   | 85.9                              | 62.4   | 85.0               | 57.7   | 7890               | 90.1   |
| 2004 | 1238.3         | 150.0          | 95.3   | 74.5   | 94.5                              | 63.2   | 94.0               | 58.6   | 8455               | 96.3   |

## IN-2 TARAPUR-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 06 Jan | 43.0  | 9.5     | PF   | D15  | REACTOR WAS SHUTDOWN FOR ATTENDING TO PRIMARY SYSTEM LEAKS REPAIR INSIDE DRYWELL.                 |
| 21 May | 51.0  | 11.5    | PF   | D33  | REACTOR WAS SHUTDOWN FOR ATTENDING TO CIRCULATING WATER SOUTH OUTLET EXPANSION JOINT LEAK REPAIR. |
| 08 Jun | 41.0  | 8.6     | PF   | D15  | REACTOR WAS SHUTDOWN FOR ATTENDING TO PRIMARY SYSTEM LEAKS REPAIR INSIDE DRYWELL.                 |
| 03 Aug | 42.0  | 8.6     | XF4  | J12  | REACTOR SCRAMMED ON PRM HIGH FLUX CAUSED DUE TO GRID DISTURBANCE.                                 |
| 16 Aug | 74.0  | 17.0    | UF2  | A31  | REACTOR WAS SHUTDOWN FOR MAIN CONDENSER TUBE LEAK CHECKS AND REPAIR.                              |
| 06 Dec | 40.0  | 16.0    | PF   | D15  | REACTOR WAS SHUTDOWN FOR PRIMARY SYSTEM LEAKS AND REPAIR.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 74        |          |  | 606       | 2        |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1448                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 175             |           |          | 204                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 4         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 7         |          |
| J. Grid failure or grid unavailability   |                 |           | 42       |  |           | 35       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1         | 16       |
| Subtotal   | 175             | 74        | 42       | 1654                                     | 620       | 53       |
| Total  |                 | 291       |          |  | 2327      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 22                                       |
| 12. Reactor I&C Systems             |                 | 5  |
| 13. Reactor Auxiliary Systems       |                 | 52                                       |
| 14. Safety Systems                  |                 | 5  |
| 15. Reactor Cooling Systems         |                 | 87                                       |
| 16. Steam generation systems        |                 | 17                                       |
| 31. Turbine and auxiliaries         | 74              | 73                                       |
| 32. Feedwater and Main Steam System |                 | 69                                       |
| 41. Main Generator Systems          |                 | 120                                      |
| 42. Electrical Power Supply Systems |                 | 130                                      |
| XX. Miscellaneous Systems           |                 | 14                                       |
| Total                               | 74              | 594                                      |

**JP-5 FUKUSHIMA-DAIICHI-1**

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 439.0 MW(e)  
**Design Net RUP:** 439.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 0.0 GW(e).h  
**Energy Availability Factor:** 0.0%  
**Load Factor:** 0.0%  
**Operating Factor:** 0.0%  
**Energy Unavailability Factor:** 100.0%  
**Total Off-line Time:** 8784 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>PUF (%)</b>  | 100.0 | 93.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.8   |
| <b>UCLF (%)</b> | 0.0   | 6.9   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 84.2   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 25 Jul 1967  
**Date of First Criticality:** 10 Oct 1970  
**Date of Grid Connection:** 17 Nov 1970  
**Date of Commercial Operation:** 26 Mar 1971

**Lifetime Generation:** 69270.2 GW(e).h  
**Cumulative Energy Availability Factor:** 53.3%  
**Cumulative Load Factor:** 52.7%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 46.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3019.5         | 439.0          | 78.5   | 47.2   | 78.5                              | 43.2   | 78.5               | 42.3   | 7384               | 84.3   |
| 1984 | 2669.8         | 439.0          | 69.5   | 48.9   | 69.5                              | 45.3   | 69.2               | 44.4   | 6222               | 70.8   |
| 1985 | 1699.3         | 439.0          | 44.4   | 48.6   | 44.4                              | 45.2   | 44.2               | 44.4   | 4005               | 45.7   |
| 1986 | 2524.7         | 439.0          | 66.1   | 49.8   | 66.1                              | 46.6   | 65.7               | 45.8   | 5836               | 66.6   |
| 1987 | 3308.9         | 439.0          | 87.8   | 52.1   | 87.3                              | 49.1   | 86.0               | 48.3   | 7727               | 88.2   |
| 1988 | 2794.5         | 439.0          | 72.8   | 53.4   | 72.8                              | 50.5   | 72.5               | 49.7   | 6431               | 73.2   |
| 1989 | 1440.8         | 439.0          | 38.6   | 52.5   | 38.6                              | 49.8   | 37.5               | 49.0   | 3457               | 39.5   |
| 1990 | 2352.4         | 439.0          | 61.4   | 53.0   | 61.4                              | 50.4   | 61.2               | 49.7   | 5487               | 62.6   |
| 1991 | 1280.0         | 439.0          | 33.4   | 52.0   | 33.4                              | 49.6   | 33.3               | 48.9   | 2985               | 34.1   |
| 1992 | 1794.1         | 439.0          | 46.9   | 51.8   | 46.9                              | 49.5   | 46.5               | 48.7   | 4166               | 47.4   |
| 1993 | 2500.7         | 439.0          | 65.5   | 52.4   | 65.4                              | 50.2   | 65.0               | 49.5   | 5811               | 66.3   |
| 1994 | 3337.5         | 439.0          | 87.2   | 53.9   | 87.2                              | 51.8   | 86.8               | 51.1   | 7667               | 87.5   |
| 1995 | 3030.8         | 439.0          | 79.3   | 55.0   | 79.3                              | 52.9   | 78.8               | 52.2   | 6977               | 79.6   |
| 1996 | 2298.6         | 439.0          | 60.0   | 55.2   | 60.0                              | 53.2   | 59.6               | 52.5   | 5276               | 60.1   |
| 1997 | 3258.9         | 439.0          | 85.0   | 56.3   | 85.0                              | 54.4   | 84.7               | 53.8   | 7445               | 85.0   |
| 1998 | 3287.2         | 439.0          | 86.2   | 57.4   | 85.9                              | 55.6   | 85.5               | 54.9   | 7581               | 86.5   |
| 1999 | 2556.9         | 439.0          | 67.0   | 57.8   | 67.0                              | 56.0   | 66.5               | 55.4   | 5876               | 67.1   |
| 2000 | 3706.3         | 439.0          | 96.9   | 59.1   | 96.9                              | 57.4   | 96.1               | 56.8   | 8517               | 97.0   |
| 2001 | 487.5          | 439.0          | 12.9   | 57.6   | 12.9                              | 55.9   | 12.7               | 55.3   | 1131               | 12.9   |
| 2002 | 3120.2         | 439.0          | 81.6   | 58.3   | 81.6                              | 56.8   | 81.1               | 56.1   | 7146               | 81.6   |
| 2003 | 0.0            | 439.0          | 0.0  | 56.5   | 0.0                               | 55.0   | 0.0                | 54.4   | 0                  | 0.0    |
| 2004 | 0.0            | 439.0          | 0.0  | 54.8   | 0.0                               | 53.3   | 0.0                | 52.7   | 0                  | 0.0    |

**JP-5 FUKUSHIMA-DAIICHI-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1392.0 | 611.1   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 28 Feb | 7392.0 | 3245.1  | UF3  | A13  | EXTENSION OF PERIODICAL INSPECTION DUE TO THE REPAIR OF REACTOR BUILDING CLOSED COOLING WATER SYSTEM,ETC. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 7392      |          |   | 465       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1392            |           |          | 2978  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 84  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 10        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 44        |          |
| Subtotal   | 1392            | 7392      | 0        | 3062  | 519       | 0        |
| Total  |                 | 8784      |          |   | 3581      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 61  |
| 13. Reactor Auxiliary Systems       | 7392               | 69  |
| 14. Safety Systems                  |                    | 6   |
| 15. Reactor Cooling Systems         |                    | 9   |
| 31. Turbine and auxiliaries         |                    | 10  |
| 32. Feedwater and Main Steam System |                    | 2   |
| 41. Main Generator Systems          |                    | 29  |
| 42. Electrical Power Supply Systems |                    | 4   |
| XX. Miscellaneous Systems           |                    | 0   |
| Total                               | 7392               | 190   |

## JP-9 FUKUSHIMA-DAIICHI-2

Operator: TEPCO (TOKYO ELECTRIC POWER CO.)

Contractor: TOSHI/GE (TOSHIBA CORPORATION/GENERAL ELECTRIC CO.)

### 1. Station Details

Type: BWR  
 Net Reference Unit Power at the beginning of 2004: 760.0 MW(e)  
 Design Net RUP: 760.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

### 2. Production Summary 2004

Energy Production: 3671.5 GW(e).h  
 Energy Availability Factor: 55.7%  
 Load Factor: 55.0%  
 Operating Factor: 56.3%  
 Energy Unavailability Factor: 44.3%  
 Total Off-line Time: 3835 hours

### 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 0.0   | 0.0   | 374.4 | 559.8 | 542.0 | 560.0 | 560.2 | 474.4 | 0.0   | 470.7 | 130.0 | 3671.5 |
| EAF (%)  | 0.0   | 0.0   | 0.0   | 69.1  | 100.0 | 100.0 | 100.0 | 100.0 | 87.5  | 0.0   | 87.0  | 25.2  | 55.7   |
| UCF (%)  | 0.0   | 0.0   | 0.0   | 69.1  | 100.0 | 100.0 | 100.0 | 100.0 | 87.6  | 0.0   | 87.0  | 25.2  | 55.7   |
| LF (%)   | 0.0   | 0.0   | 0.0   | 68.4  | 99.0  | 99.1  | 99.0  | 99.1  | 86.7  | 0.0   | 86.0  | 23.0  | 55.0   |
| OF (%)   | 0.0   | 0.0   | 0.0   | 69.0  | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 0.0   | 88.9  | 25.5  | 56.3   |
| EUF (%)  | 100.0 | 100.0 | 100.0 | 30.9  | 0.0   | 0.0   | 0.0   | 0.0   | 12.5  | 100.0 | 13.0  | 74.8  | 44.3   |
| PUF (%)  | 100.0 | 0.0   | 0.0   | 11.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.4    |
| UCLF (%) | 0.0   | 100.0 | 100.0 | 19.2  | 0.0   | 0.0   | 0.0   | 0.0   | 12.4  | 100.0 | 13.0  | 74.8  | 34.9   |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

Date of Construction Start: 09 Jun 1969  
 Date of First Criticality: 10 May 1973  
 Date of Grid Connection: 24 Dec 1973  
 Date of Commercial Operation: 18 Jul 1974

Lifetime Generation: 121680.7 GW(e).h  
 Cumulative Energy Availability Factor: 59.8%  
 Cumulative Load Factor: 59.0%  
 Cumulative Unit Capability Factor: 77.4%  
 Cumulative Energy Unavailability Factor: 40.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3422.7         | 760.0          | 51.4   | 45.5   | 51.4                              | 45.5   | 51.4               | 45.3   | 4934               | 56.3   |
| 1984 | 3698.7         | 760.0          | 56.0   | 46.6   | 56.0                              | 46.6   | 55.4               | 46.3   | 5069               | 57.7   |
| 1985 | 4266.3         | 760.0          | 65.1   | 48.3   | 65.1                              | 48.2   | 64.1               | 47.9   | 5952               | 67.9   |
| 1986 | 5541.1         | 760.0          | 84.3   | 51.3   | 84.3                              | 51.2   | 83.2               | 50.9   | 7478               | 85.4   |
| 1987 | 3851.1         | 760.0          | 58.6   | 51.8   | 58.6                              | 51.8   | 57.8               | 51.4   | 5260               | 60.0   |
| 1988 | 4101.3         | 760.0          | 62.3   | 52.6   | 62.3                              | 52.6   | 61.4               | 52.1   | 5724               | 65.2   |
| 1989 | 6516.4         | 760.0          | 100.0  | 55.7   | 97.9                              | 55.7   | 97.9               | 55.2   | 8760               | 100.0  |
| 1990 | 3122.8         | 760.0          | 47.6   | 55.2   | 47.6                              | 55.2   | 46.9               | 54.7   | 4385               | 50.1   |
| 1991 | 3853.1         | 760.0          | 59.3   | 55.5   | 59.3                              | 55.5   | 57.9               | 54.8   | 5291               | 60.4   |
| 1992 | 4568.5         | 760.0          | 69.8   | 56.3   | 69.7                              | 56.3   | 68.4               | 55.6   | 6261               | 71.3   |
| 1993 | 4186.7         | 760.0          | 64.3   | 56.7   | 64.3                              | 56.7   | 62.9               | 56.0   | 5659               | 64.6   |
| 1994 | 2266.0         | 760.0          | 36.0   | 55.6   | 34.7                              | 55.6   | 34.0               | 54.9   | 3138               | 35.8   |
| 1995 | 6396.5         | 760.0          | 97.2   | 57.6   | 97.2                              | 57.6   | 96.1               | 56.8   | 8520               | 97.3   |
| 1996 | 5192.3         | 760.0          | 78.8   | 58.6   | 78.8                              | 58.5   | 77.8               | 57.8   | 6948               | 79.1   |
| 1997 | 4618.9         | 760.0          | 70.3   | 59.1   | 70.3                              | 59.0   | 69.4               | 58.3   | 6197               | 70.7   |
| 1998 | 3976.2         | 760.0          | 60.9   | 59.2   | 60.6                              | 59.1   | 59.7               | 58.4   | 5352               | 61.1   |
| 1999 | 3158.4         | 760.0          | 48.1   | 58.7   | 48.1                              | 58.7   | 47.4               | 57.9   | 4216               | 48.1   |
| 2000 | 5167.2         | 760.0          | 78.5   | 59.5   | 78.6                              | 59.4   | 77.4               | 58.7   | 6904               | 78.6   |
| 2001 | 5996.5         | 760.0          | 91.3   | 60.7   | 91.3                              | 60.6   | 90.1               | 59.8   | 8036               | 91.7   |
| 2002 | 5101.0         | 760.0          | 77.8   | 61.3   | 77.8                              | 61.2   | 76.6               | 60.4   | 6815               | 77.8   |
| 2003 | 1601.1         | 760.0          | 24.3   | 60.0   | 24.3                              | 60.0   | 24.0               | 59.2   | 2136               | 24.4   |
| 2004 | 3671.5         | 760.0          | 55.7   | 59.9   | 55.7                              | 59.8   | 55.0               | 59.0   | 4949               | 56.3   |



**JP-9 FUKUSHIMA-DAIICHI-2****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 744.0  | 565.4   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |
| 01 Feb | 1662.0 | 1263.5  | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE LEAK RATE INSPECTION OF PRIMARY CONTAINMENT VESSEL,ETC. |
| 06 Sep | 99.0   | 39.3    | UP1  | A31  | MAIN CONDENSER REPAIR.   |
| 29 Sep | 870.0  | 661.9   | UF2  | A12  | FORCED OUTAGE DUE TO THE TROUBLE OF THE PRIMARY LOOP RECIRCULATION PUMP(B).  |
| 08 Dec | 558.0  | 422.7   | UF1  | A31  | PLANNED INSPECTION DUE TO THE REPAIR OF THE LEAK FROM THE MOISTURE SEPARATOR PIPING.                               |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 1428      |          |   | 151       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 49        |          |
| C. Inspection, maintenance or repair combined with refuelling | 744             |           |          | 2724  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 110   |           |          |
| H. Nuclear regulatory requirements                            |                 |           |          |   |           | 15       |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 2        |
| Z. Others   |                 | 1662      |          |   |           |          |
| Subtotal  | 744             | 3090      | 0        | 2834  | 200       | 17       |
| Total   |                 | 3834      |          |   | 3051      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             | 870                | 59  |
| 15. Reactor Cooling Systems         |                    | 19  |
| 31. Turbine and auxiliaries         | 558                | 23  |
| 32. Feedwater and Main Steam System |                    | 43  |
| 42. Electrical Power Supply Systems |                    | 5   |
| Total                               | 1428               | 149   |

# JP-10 FUKUSHIMA-DAIICHI-3

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 760.0 MW(e)  
**Design Net RUP:** 760.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3969.7 GW(e).h  
**Energy Availability Factor:** 59.5%  
**Load Factor:** 59.5%  
**Operating Factor:** 59.5%  
**Energy Unavailability Factor:** 40.5%  
**Total Off-line Time:** 3559 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 567.2 | 530.2 | 567.2 | 548.4 | 566.3 | 547.1 | 563.0 | 80.4 | 0.0   | 0.0   | 0.0   | 0.0   | 3969.7 |
| <b>EAF (%)</b>  | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 15.5 | 0.0   | 0.0   | 0.0   | 0.0   | 59.5   |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 15.5 | 0.0   | 0.0   | 0.0   | 0.0   | 59.5   |
| <b>LF (%)</b>   | 100.3 | 100.2 | 100.3 | 100.2 | 100.1 | 100.0 | 99.6  | 14.2 | 0.0   | 0.0   | 0.0   | 0.0   | 59.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 15.2 | 0.0   | 0.0   | 0.0   | 0.0   | 59.5   |
| <b>EUF (%)</b>  | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 84.5 | 100.0 | 100.0 | 100.0 | 100.0 | 40.5   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 74.2 | 100.0 | 100.0 | 100.0 | 64.5  | 36.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3 | 0.0   | 0.0   | 0.0   | 35.5  | 3.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 28 Dec 1970  
**Date of First Criticality:** 06 Sep 1974  
**Date of Grid Connection:** 26 Oct 1974  
**Date of Commercial Operation:** 27 Mar 1976

**Lifetime Generation:** 126581.9 GW(e).h  
**Cumulative Energy Availability Factor:** 63.9%  
**Cumulative Load Factor:** 63.5%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 36.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4034.0         | 760.0          | 60.6   | 53.1   | 60.6                              | 53.1   | 60.6               | 53.1   | 5643               | 64.4   |
| 1984 | 4497.3         | 760.0          | 67.7   | 54.9   | 67.7                              | 54.9   | 67.4               | 54.9   | 6041               | 68.8   |
| 1985 | 5798.6         | 760.0          | 87.7   | 58.5   | 87.7                              | 58.5   | 87.1               | 58.5   | 7738               | 88.3   |
| 1986 | 4234.2         | 760.0          | 63.5   | 59.0   | 63.5                              | 59.0   | 63.6               | 59.0   | 5621               | 64.2   |
| 1987 | 3748.8         | 760.0          | 57.4   | 58.9   | 56.7                              | 58.8   | 56.3               | 58.8   | 5086               | 58.1   |
| 1988 | 5123.0         | 760.0          | 77.0   | 60.4   | 77.0                              | 60.3   | 76.7               | 60.3   | 6822               | 77.7   |
| 1989 | 5706.7         | 760.0          | 86.2   | 62.4   | 86.2                              | 62.3   | 85.7               | 62.2   | 7616               | 86.9   |
| 1990 | 2919.5         | 760.0          | 44.3   | 61.1   | 44.3                              | 61.0   | 43.9               | 60.9   | 3985               | 45.5   |
| 1991 | 4491.0         | 760.0          | 68.0   | 61.5   | 68.0                              | 61.5   | 67.5               | 61.3   | 6003               | 68.5   |
| 1992 | 6098.7         | 760.0          | 92.0   | 63.5   | 92.0                              | 63.4   | 91.4               | 63.2   | 8120               | 92.4   |
| 1993 | 4204.3         | 760.0          | 63.7   | 63.5   | 63.7                              | 63.4   | 63.2               | 63.2   | 5655               | 64.6   |
| 1994 | 4202.3         | 760.0          | 63.6   | 63.5   | 63.6                              | 63.4   | 63.1               | 63.2   | 5647               | 64.5   |
| 1995 | 5966.5         | 760.0          | 90.2   | 64.9   | 90.2                              | 64.8   | 89.6               | 64.6   | 8036               | 91.7   |
| 1996 | 4909.7         | 760.0          | 73.9   | 65.3   | 73.9                              | 65.3   | 73.5               | 65.0   | 6525               | 74.3   |
| 1997 | 2516.7         | 760.0          | 38.0   | 64.0   | 38.1                              | 64.0   | 37.8               | 63.8   | 3345               | 38.2   |
| 1998 | 2632.7         | 760.0          | 42.2   | 63.0   | 42.2                              | 63.0   | 39.5               | 62.7   | 3622               | 41.3   |
| 1999 | 5116.1         | 760.0          | 77.4   | 63.7   | 77.3                              | 63.6   | 76.8               | 63.3   | 6792               | 77.5   |
| 2000 | 5932.5         | 760.0          | 89.5   | 64.7   | 89.4                              | 64.7   | 88.9               | 64.3   | 7859               | 89.5   |
| 2001 | 5637.3         | 760.0          | 85.6   | 65.6   | 85.5                              | 65.5   | 84.7               | 65.2   | 7506               | 85.7   |
| 2002 | 3567.3         | 760.0          | 54.1   | 65.1   | 54.0                              | 65.1   | 53.6               | 64.7   | 4747               | 54.2   |
| 2003 | 2483.6         | 760.0          | 37.6   | 64.1   | 37.6                              | 64.1   | 37.3               | 63.7   | 3290               | 37.6   |
| 2004 | 3969.7         | 760.0          | 59.5   | 64.0   | 59.5                              | 63.9   | 59.5               | 63.5   | 5225               | 59.5   |

**JP-10 FUKUSHIMA-DAIICHI-3****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 05 Aug | 79.0   | 58.1    | UF1  | A42  | PLANNED INSPECTION DUE TO THE INSPECTION OF THE MAIN TRANSFORMERS.   |
| 09 Aug | 3216.0 | 2444.2  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |
| 21 Dec | 264.0  | 200.6   | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE LEAK RATE INSPECTION OF PRIMARY CONTAINMENT VESSEL,ETC. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 79        |          |   | 248       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 3216            |           |          | 2501  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 39  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 25  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 0         | 0        |
| Z. Others  |                 | 264       |          |   |           |          |
| Subtotal   | 3216            | 343       | 0        | 2565  | 248       | 0        |
| Total  |                 | 3559      |          |   | 2813      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1976 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 181   |
| 13. Reactor Auxiliary Systems       |                    | 0   |
| 15. Reactor Cooling Systems         |                    | 46  |
| 31. Turbine and auxiliaries         |                    | 18  |
| 42. Electrical Power Supply Systems | 79                 | 0   |
| Total                               | 79                 | 245   |

**JP-16 FUKUSHIMA-DAIICHI-4**

Operator: TEPCO (TOKYO ELECTRIC POWER CO.)

Contractor: HITACHI (HITACHI LTD.)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 760.0 MW(e)  
 Design Net RUP: 760.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 4729.0 GW(e).h  
 Energy Availability Factor: 71.2%  
 Load Factor: 70.8%  
 Operating Factor: 71.3%  
 Energy Unavailability Factor: 28.8%  
 Total Off-line Time: 2522 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 0.0   | 154.6 | 544.5 | 563.6 | 543.7 | 563.1 | 563.4 | 545.6 | 564.0 | 546.0 | 140.4 | 4729.0 |
| EAF (%)  | 0.0   | 0.0   | 28.3  | 99.8  | 100.0 | 99.7  | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 26.2  | 71.2   |
| UCF (%)  | 0.0   | 0.0   | 28.4  | 99.8  | 100.0 | 99.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 26.2  | 71.2   |
| LF (%)   | 0.0   | 0.0   | 27.3  | 99.6  | 99.7  | 99.4  | 99.6  | 99.6  | 99.7  | 99.6  | 99.8  | 24.8  | 70.8   |
| OF (%)   | 0.0   | 0.0   | 28.4  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 26.2  | 71.3   |
| EUF (%)  | 100.0 | 100.0 | 71.7  | 0.2   | 0.0   | 0.3   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 73.8  | 28.8   |
| PUF (%)  | 100.0 | 0.0   | 2.9   | 0.0   | 0.0   | 0.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.7    |
| UCLF (%) | 0.0   | 100.0 | 68.8  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 73.8  | 20.0   |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 12 Feb 1973      Lifetime Generation: 126667.1 GW(e).h  
 Date of First Criticality: 28 Jan 1978      Cumulative Energy Availability Factor: 71.5%  
 Date of Grid Connection: 24 Feb 1978      Cumulative Load Factor: 71.3%  
 Date of Commercial Operation: 12 Oct 1978      Cumulative Unit Capability Factor: 77.5%  
    Cumulative Energy Unavailability Factor: 28.5%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 4818.2            | 760.0             | 72.4   | 70.4   | 72.4                                 | 70.4   | 72.4               | 70.4   | 6485                  | 74.0   |
| 1984 | 4433.2            | 760.0             | 66.8   | 69.8   | 66.8                                 | 69.8   | 66.4               | 69.8   | 5924                  | 67.4   |
| 1985 | 4409.0            | 760.0             | 66.6   | 69.3   | 66.6                                 | 69.3   | 66.2               | 69.2   | 5889                  | 67.2   |
| 1986 | 4315.2            | 760.0             | 65.0   | 68.8   | 65.0                                 | 68.8   | 64.8               | 68.7   | 5733                  | 65.4   |
| 1987 | 5964.0            | 760.0             | 89.9   | 71.1   | 89.9                                 | 71.1   | 89.6               | 71.0   | 7927                  | 90.5   |
| 1988 | 5309.9            | 760.0             | 79.7   | 72.0   | 79.7                                 | 72.0   | 79.5               | 71.9   | 7066                  | 80.4   |
| 1989 | 4232.6            | 760.0             | 63.8   | 71.3   | 63.8                                 | 71.3   | 63.6               | 71.1   | 5661                  | 64.6   |
| 1990 | 4273.8            | 760.0             | 64.6   | 70.7   | 64.6                                 | 70.7   | 64.2               | 70.5   | 5715                  | 65.2   |
| 1991 | 6483.4            | 760.0             | 98.0   | 72.8   | 98.0                                 | 72.8   | 97.4               | 72.6   | 8630                  | 98.5   |
| 1992 | 4082.7            | 760.0             | 61.4   | 72.0   | 61.4                                 | 72.0   | 61.2               | 71.8   | 5475                  | 62.3   |
| 1993 | 4206.6            | 760.0             | 63.5   | 71.4   | 63.4                                 | 71.4   | 63.2               | 71.2   | 5597                  | 63.9   |
| 1994 | 6323.3            | 760.0             | 95.3   | 72.9   | 95.3                                 | 72.9   | 95.0               | 72.7   | 8416                  | 96.1   |
| 1995 | 5485.7            | 760.0             | 82.8   | 73.5   | 82.7                                 | 73.5   | 82.4               | 73.3   | 7339                  | 83.8   |
| 1996 | 4949.9            | 760.0             | 74.4   | 73.5   | 74.4                                 | 73.5   | 74.1               | 73.3   | 6545                  | 74.5   |
| 1997 | 4556.8            | 760.0             | 68.6   | 73.3   | 68.6                                 | 73.3   | 68.4               | 73.1   | 6038                  | 68.9   |
| 1998 | 5441.4            | 760.0             | 82.0   | 73.7   | 82.0                                 | 73.7   | 81.7               | 73.5   | 7216                  | 82.4   |
| 1999 | 5890.5            | 760.0             | 88.8   | 74.4   | 88.8                                 | 74.4   | 88.5               | 74.2   | 7826                  | 89.3   |
| 2000 | 4415.9            | 760.0             | 66.5   | 74.1   | 66.5                                 | 74.1   | 66.1               | 73.8   | 5856                  | 66.7   |
| 2001 | 5858.5            | 760.0             | 88.7   | 74.7   | 88.4                                 | 74.7   | 88.0               | 74.5   | 7772                  | 88.7   |
| 2002 | 4687.7            | 760.0             | 70.9   | 74.5   | 70.9                                 | 74.5   | 70.4               | 74.3   | 6191                  | 70.7   |
| 2003 | 0.0               | 760.0             | 0.0  | 71.6   | 0.0                                  | 71.6   | 0.0                | 71.3   | 0                     | 0.0    |
| 2004 | 4729.0            | 760.0             | 71.2   | 71.6   | 71.2                                 | 71.5   | 70.8               | 71.3   | 6262                  | 71.3   |

## JP-16 FUKUSHIMA-DAIICHI-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 744.0  | 565.4   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |
| 01 Feb | 1229.0 | 934.1   | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION.  |
| 09 Dec | 549.0  | 417.4   | UF1  | A15  | PLANNED INSPECTION DUE TO THE REPAIR OF THE LEAK FROM THE CONDENSATION WATER PIPING OF THE TURBINE OF REACTOR FEED WATER PUMP. |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 549       |          |  | 310       |          |
| C. Inspection, maintenance or repair combined with refuelling | 744             |           |          | 1805                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 29                                       |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 0  |           |          |
| Z. Others   |                 | 1229      |          |  |           |          |
| Subtotal  | 744             | 1778      | 0        | 1834                                     | 310       | 0        |
| Total   |                 | 2522      |          |  | 2144      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 280                                      |
| 12. Reactor I&C Systems             |                 | 4  |
| 13. Reactor Auxiliary Systems       |                 | 7  |
| 15. Reactor Cooling Systems         | 549             | 4  |
| 31. Turbine and auxiliaries         |                 | 3  |
| 41. Main Generator Systems          |                 | 10                                       |
| 42. Electrical Power Supply Systems |                 | 0  |
| Total                               | 549             | 308                                      |

**JP-17 FUKUSHIMA-DAIICHI-5**

Operator: TEPCO (TOKYO ELECTRIC POWER CO.)

Contractor: TOSHIBA (TOSHIBA CORPORATION)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 760.0 MW(e)  
 Design Net RUP: 760.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 5471.3 GW(e).h  
 Energy Availability Factor: 82.8%  
 Load Factor: 82.0%  
 Operating Factor: 82.9%  
 Energy Unavailability Factor: 17.2%  
 Total Off-line Time: 1503 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 561.4 | 524.6 | 561.4 | 543.2 | 561.4 | 542.9 | 559.6 | 558.8 | 539.5 | 367.1 | 151.6 | 0.0   | 5471.3 |
| EAF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.8  | 99.5  | 66.3  | 29.3  | 0.0   | 82.8   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 66.5  | 29.4  | 0.0   | 82.9   |
| LF (%)   | 99.3  | 99.2  | 99.3  | 99.4  | 99.3  | 99.2  | 99.0  | 98.8  | 98.6  | 64.8  | 27.7  | 0.0   | 82.0   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 69.0  | 26.5  | 0.0   | 82.9   |
| EUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.2   | 0.5   | 33.7  | 70.7  | 100.0 | 17.2   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 70.6  | 100.0 | 14.3   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 33.5  | 0.0   | 0.0   | 2.8    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.2   | 0.5   | 0.2   | 0.1   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 22 May 1972      Lifetime Generation: 129188.6 GW(e).h  
 Date of First Criticality: 26 Aug 1977      Cumulative Energy Availability Factor: 71.9%  
 Date of Grid Connection: 22 Sep 1977      Cumulative Load Factor: 71.3%  
 Date of Commercial Operation: 18 Apr 1978      Cumulative Unit Capability Factor: 77.5%  
    Cumulative Energy Unavailability Factor: 28.1%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 5338.8            | 760.0             | 80.2   | 66.4   | 80.2                                 | 66.4   | 80.2               | 66.5   | 7328                  | 83.7   |
| 1984 | 4691.5            | 760.0             | 71.0   | 67.2   | 70.9                                 | 67.2   | 70.3               | 67.1   | 6293                  | 71.6   |
| 1985 | 4112.4            | 760.0             | 62.1   | 66.4   | 62.1                                 | 66.4   | 61.8               | 66.3   | 5547                  | 63.3   |
| 1986 | 4157.4            | 760.0             | 63.2   | 66.0   | 63.2                                 | 66.0   | 62.4               | 65.9   | 5622                  | 64.2   |
| 1987 | 3995.0            | 760.0             | 60.8   | 65.5   | 60.5                                 | 65.4   | 60.0               | 65.2   | 5399                  | 61.6   |
| 1988 | 5952.7            | 760.0             | 90.0   | 67.9   | 90.0                                 | 67.9   | 89.2               | 67.6   | 7973                  | 90.8   |
| 1989 | 4766.5            | 760.0             | 72.2   | 68.3   | 72.2                                 | 68.3   | 71.6               | 68.0   | 6401                  | 73.1   |
| 1990 | 3956.5            | 760.0             | 60.2   | 67.6   | 60.2                                 | 67.6   | 59.4               | 67.3   | 5354                  | 61.1   |
| 1991 | 6575.8            | 760.0             | 100.0  | 70.1   | 98.8                                 | 70.1   | 98.8               | 69.7   | 8760                  | 100.0  |
| 1992 | 4841.2            | 760.0             | 73.3   | 70.3   | 73.3                                 | 70.3   | 72.5               | 69.9   | 6488                  | 73.9   |
| 1993 | 4059.7            | 760.0             | 61.7   | 69.8   | 61.7                                 | 69.7   | 61.0               | 69.3   | 5448                  | 62.2   |
| 1994 | 4246.2            | 760.0             | 64.6   | 69.5   | 64.6                                 | 69.4   | 63.8               | 68.9   | 5723                  | 65.3   |
| 1995 | 5878.7            | 760.0             | 89.1   | 70.6   | 89.1                                 | 70.6   | 88.3               | 70.1   | 7885                  | 90.0   |
| 1996 | 5666.9            | 760.0             | 85.6   | 71.4   | 85.6                                 | 71.4   | 84.9               | 70.9   | 7521                  | 85.6   |
| 1997 | 4609.4            | 760.0             | 69.8   | 71.3   | 69.8                                 | 71.3   | 69.2               | 70.8   | 6139                  | 70.1   |
| 1998 | 5369.9            | 760.0             | 81.7   | 71.9   | 81.5                                 | 71.8   | 80.7               | 71.3   | 7217                  | 82.4   |
| 1999 | 6154.1            | 760.0             | 93.3   | 72.9   | 93.2                                 | 72.9   | 92.4               | 72.3   | 8184                  | 93.4   |
| 2000 | 1647.0            | 760.0             | 24.9   | 70.7   | 24.9                                 | 70.7   | 24.7               | 70.1   | 2187                  | 24.9   |
| 2001 | 5905.1            | 760.0             | 89.7   | 71.5   | 89.6                                 | 71.5   | 88.7               | 71.0   | 7869                  | 89.8   |
| 2002 | 6590.5            | 760.0             | 100.0  | 72.7   | 99.8                                 | 72.7   | 99.0               | 72.1   | 8760                  | 100.0  |
| 2003 | 2723.8            | 760.0             | 41.4   | 71.5   | 41.4                                 | 71.4   | 40.9               | 70.9   | 3627                  | 41.4   |
| 2004 | 5471.3            | 760.0             | 82.9   | 71.9   | 82.8                                 | 71.9   | 82.0               | 71.3   | 7281                  | 82.9   |

**JP-17 FUKUSHIMA-DAIICHI-5****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 12 Oct | 249.0  | 189.5   | UF1  | A32  | PLANNED INSPECTION DUE TO THE INSPECTION OF THE HEATER VENT SYSTEM PIPING. |
| 09 Nov | 1254.0 | 951.7   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.                                      |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 249       |          |   | 36        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1254            |           |          | 2053  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 29  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 0         |          |
| Z. Others  |                 |           |          |   | 59        |          |
| Subtotal   | 1254            | 249       | 0        | 2082  | 95        | 0        |
| Total  |                 | 1503      |          |   | 2177      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1978 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 14  |
| 13. Reactor Auxiliary Systems       |                    | 3   |
| 15. Reactor Cooling Systems         |                    | 8   |
| 31. Turbine and auxiliaries         |                    | 1   |
| 32. Feedwater and Main Steam System | 249                | 5   |
| 42. Electrical Power Supply Systems |                    | 2   |
| Total                               | 249                | 33  |

# JP-18 FUKUSHIMA-DAIICHI-6

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)

**Contractor:** TOSHI/GE (TOSHIBA CORPORATION/GENERAL ELECTRIC CO.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1067.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1088.8 GW(e).h  
**Energy Availability Factor:** 11.7%  
**Load Factor:** 11.6%  
**Operating Factor:** 11.7%  
**Energy Unavailability Factor:** 88.3%  
**Total Off-line Time:** 7756 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 608.3 | 480.5 | 1088.8 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 79.3  | 61.3  | 11.7   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 79.3  | 61.3  | 11.7   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 79.2  | 60.5  | 11.6   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 79.3  | 61.4  | 11.7   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 20.7  | 38.7  | 88.3   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 74.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.7   | 0.0   | 39.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 25.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 18.0  | 38.7  | 48.7   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 26 Oct 1973  
**Date of First Criticality:** 09 Mar 1979  
**Date of Grid Connection:** 04 May 1979  
**Date of Commercial Operation:** 24 Oct 1979

**Lifetime Generation:** 165125.3 GW(e).h  
**Cumulative Energy Availability Factor:** 69.7%  
**Cumulative Load Factor:** 69.3%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 30.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5387.8         | 1067.0         | 57.6   | 70.1   | 57.6                              | 70.1   | 57.6               | 69.6   | 5308               | 60.6   |
| 1984 | 5933.2         | 1067.0         | 64.2   | 68.9   | 64.2                              | 68.9   | 63.3               | 68.3   | 5708               | 65.0   |
| 1985 | 5384.8         | 1067.0         | 58.1   | 67.1   | 58.1                              | 67.1   | 57.6               | 66.5   | 5196               | 59.3   |
| 1986 | 7783.5         | 1067.0         | 84.3   | 69.5   | 84.3                              | 69.5   | 83.3               | 68.9   | 7390               | 84.4   |
| 1987 | 7789.2         | 1067.0         | 84.1   | 71.4   | 84.1                              | 71.4   | 83.3               | 70.7   | 7406               | 84.5   |
| 1988 | 5593.1         | 1067.0         | 60.1   | 70.1   | 60.1                              | 70.1   | 59.7               | 69.5   | 5385               | 61.3   |
| 1989 | 5128.4         | 1067.0         | 55.8   | 68.7   | 55.8                              | 68.7   | 54.9               | 68.0   | 4956               | 56.6   |
| 1990 | 7727.1         | 1067.0         | 82.9   | 70.0   | 82.9                              | 70.0   | 82.7               | 69.4   | 7394               | 84.4   |
| 1991 | 6948.7         | 1067.0         | 75.1   | 70.4   | 75.1                              | 70.4   | 74.3               | 69.8   | 6627               | 75.7   |
| 1992 | 5213.6         | 1067.0         | 56.0   | 69.3   | 56.0                              | 69.3   | 55.6               | 68.7   | 4993               | 56.8   |
| 1993 | 6530.9         | 1067.0         | 70.2   | 69.3   | 70.2                              | 69.4   | 69.9               | 68.8   | 6168               | 70.4   |
| 1994 | 8079.4         | 1067.0         | 86.8   | 70.5   | 86.7                              | 70.5   | 86.4               | 70.0   | 7679               | 87.7   |
| 1995 | 6850.8         | 1067.0         | 73.7   | 70.7   | 73.6                              | 70.7   | 73.3               | 70.2   | 6517               | 74.4   |
| 1996 | 6157.8         | 1067.0         | 66.0   | 70.4   | 66.0                              | 70.4   | 65.7               | 69.9   | 5804               | 66.1   |
| 1997 | 9307.7         | 1067.0         | 99.9   | 72.1   | 99.8                              | 72.1   | 99.6               | 71.5   | 8760               | 100.0  |
| 1998 | 6329.0         | 1067.0         | 68.1   | 71.9   | 68.0                              | 71.9   | 67.7               | 71.3   | 6026               | 68.8   |
| 1999 | 7960.5         | 1067.0         | 85.8   | 72.6   | 85.5                              | 72.5   | 85.2               | 72.0   | 7523               | 85.9   |
| 2000 | 7495.6         | 1067.0         | 80.4   | 72.9   | 80.4                              | 72.9   | 80.0               | 72.4   | 7074               | 80.5   |
| 2001 | 7778.9         | 1067.0         | 83.7   | 73.4   | 83.7                              | 73.4   | 83.2               | 72.9   | 7417               | 84.7   |
| 2002 | 6270.9         | 1067.0         | 67.5   | 73.2   | 67.5                              | 73.1   | 67.1               | 72.7   | 5912               | 67.5   |
| 2003 | 4623.9         | 1067.0         | 49.7   | 72.2   | 49.7                              | 72.2   | 49.5               | 71.7   | 4338               | 49.5   |
| 2004 | 1088.8         | 1067.0         | 11.7   | 69.8   | 11.7                              | 69.7   | 11.6               | 69.3   | 1028               | 11.7   |



**JP-18 FUKUSHIMA-DAIICHI-6****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 3456.0 | 3687.6  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 24 May | 4013.0 | 4282.0  | UF3  | A12  | EXTENSION OF PERIODICAL INSPECTION DUE TO THE REPAIR OF THE CONTROL ROD DRIVE SYSTEM PIPING.  |
| 19 Dec | 287.0  | 307.0   | UF1  | A13  | UNPLANNED INSPECTION DUE TO THE INCREASE OF THE AMOUNT OF INFLOW OF THE REACTOR WATER TO THE LOW CONDUCTIVITY WASTE SUMP IN THE PRIMARY CONTAINMENT VESSEL. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1979 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 4300      |          |   | 55        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 3456            |           |          | 1921  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 133   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 8         |          |
| Z. Others  |                 |           |          |   | 46        |          |
| Subtotal   | 3456            | 4300      | 0        | 2054  | 109       | 0        |
| Total  |                 | 7756      |          |   | 2163      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1979 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             | 4013               | 8   |
| 13. Reactor Auxiliary Systems       | 287                | 15  |
| 31. Turbine and auxiliaries         |                    | 8   |
| 32. Feedwater and Main Steam System |                    | 11  |
| 41. Main Generator Systems          |                    | 11  |
| Total                               | 4300               | 53  |

**JP-25 FUKUSHIMA-DAINI-1**

Operator: TEPCO (TOKYO ELECTRIC POWER CO.)

Contractor: TOSHIBA (TOSHIBA CORPORATION)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1067.0 MW(e)  
 Design Net RUP: 1067.0 MW(e)  
 Design Discharge Burnup: 33000 IN MW.d/t

**2. Production Summary 2004**

Energy Production: 6749.7 GW(e).h  
 Energy Availability Factor: 72.6%  
 Load Factor: 72.0%  
 Operating Factor: 74.2%  
 Energy Unavailability Factor: 27.4%  
 Total Off-line Time: 2262 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 792.0 | 638.2 | 790.8 | 765.0 | 789.5 | 763.4 | 785.1 | 779.4 | 646.1 | 0.0   | 0.0   | 0.0   | 6749.7 |
| EAF (%)  | 100.0 | 86.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.4  | 85.8  | 0.0   | 0.0   | 0.0   | 72.6   |
| UCF (%)  | 100.0 | 86.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.7  | 0.0   | 0.0   | 0.0   | 73.2   |
| LF (%)   | 99.8  | 85.9  | 99.6  | 99.6  | 99.5  | 99.4  | 98.9  | 98.2  | 84.1  | 0.0   | 0.0   | 0.0   | 72.0   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.5  | 0.0   | 0.0   | 0.0   | 74.2   |
| EUF (%)  | 0.0   | 13.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 14.2  | 100.0 | 100.0 | 100.0 | 27.4   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.3   | 100.0 | 100.0 | 100.0 | 25.7   |
| UCLF (%) | 0.0   | 13.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.1    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 7.0   | 0.0   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 16 Mar 1976      Lifetime Generation: 161642.7 GW(e).h  
 Date of First Criticality: 17 Jun 1981      Cumulative Energy Availability Factor: 75.3%  
 Date of Grid Connection: 31 Jul 1981      Cumulative Load Factor: 74.4%  
 Date of Commercial Operation: 20 Apr 1982      Cumulative Unit Capability Factor: 77.9%  
    Cumulative Energy Unavailability Factor: 24.7%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 6282.2            | 1067.0            | 67.2   | 67.2   | 67.2                                 | 67.2   | 67.2               | 67.2   | 6130                  | 70.0   |
| 1984 | 6344.4            | 1067.0            | 68.6   | 67.9   | 68.6                                 | 67.9   | 67.7               | 67.5   | 6175                  | 70.3   |
| 1985 | 8152.9            | 1067.0            | 88.0   | 74.6   | 88.0                                 | 74.6   | 87.2               | 74.0   | 7776                  | 88.8   |
| 1986 | 7741.0            | 1067.0            | 83.6   | 76.8   | 83.6                                 | 76.8   | 82.8               | 76.2   | 7404                  | 84.5   |
| 1987 | 6992.1            | 1067.0            | 75.8   | 76.6   | 75.8                                 | 76.6   | 74.8               | 75.9   | 6710                  | 76.6   |
| 1988 | 5959.3            | 1067.0            | 64.4   | 74.6   | 64.4                                 | 74.6   | 63.6               | 73.9   | 5744                  | 65.4   |
| 1989 | 6246.2            | 1067.0            | 67.4   | 73.6   | 67.4                                 | 73.6   | 66.8               | 72.9   | 6029                  | 68.8   |
| 1990 | 8217.0            | 1067.0            | 88.9   | 75.5   | 88.9                                 | 75.5   | 87.9               | 74.8   | 7914                  | 90.3   |
| 1991 | 6191.1            | 1067.0            | 67.2   | 74.6   | 67.2                                 | 74.6   | 66.2               | 73.8   | 5927                  | 67.7   |
| 1992 | 6901.5            | 1067.0            | 75.1   | 74.6   | 74.6                                 | 74.6   | 73.6               | 73.8   | 6656                  | 75.8   |
| 1993 | 5613.1            | 1067.0            | 60.9   | 73.4   | 60.9                                 | 73.3   | 60.1               | 72.5   | 5384                  | 61.5   |
| 1994 | 8309.1            | 1067.0            | 90.0   | 74.8   | 90.1                                 | 74.7   | 88.9               | 73.9   | 7936                  | 90.6   |
| 1995 | 7727.5            | 1067.0            | 83.5   | 75.4   | 83.5                                 | 75.4   | 82.7               | 74.6   | 7333                  | 83.7   |
| 1996 | 6761.4            | 1067.0            | 73.1   | 75.3   | 73.1                                 | 75.2   | 72.1               | 74.4   | 6425                  | 73.1   |
| 1997 | 7304.8            | 1067.0            | 79.2   | 75.5   | 79.2                                 | 75.5   | 78.2               | 74.7   | 6993                  | 79.8   |
| 1998 | 7694.1            | 1067.0            | 83.3   | 76.0   | 83.3                                 | 76.0   | 82.3               | 75.1   | 7318                  | 83.5   |
| 1999 | 7389.4            | 1067.0            | 80.0   | 76.3   | 80.0                                 | 76.2   | 79.1               | 75.4   | 7011                  | 80.0   |
| 2000 | 8229.0            | 1067.0            | 89.1   | 77.0   | 89.1                                 | 76.9   | 87.8               | 76.1   | 7824                  | 89.1   |
| 2001 | 5902.6            | 1067.0            | 64.4   | 76.3   | 64.4                                 | 76.3   | 63.2               | 75.4   | 5645                  | 64.4   |
| 2002 | 9238.2            | 1067.0            | 100.0  | 77.5   | 99.9                                 | 77.5   | 98.8               | 76.5   | 8760                  | 100.0  |
| 2003 | 3239.3            | 1067.0            | 34.9   | 75.5   | 34.9                                 | 75.4   | 34.7               | 74.6   | 3061                  | 34.9   |
| 2004 | 6749.7            | 1067.0            | 73.2   | 75.4   | 72.6                                 | 75.3   | 72.0               | 74.4   | 6522                  | 74.2   |

**JP-25 FUKUSHIMA-DAINI-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description                           |
|--------|--------|---------|------|------|---------------------------------------|
| 05 Feb | 98.0   | 34.4    | UP1  | A31  | MAIN CONDENSER REPAIR.                |
| 20 Feb | 155.0  | 67.9    | UP1  | A31  | MAIN CONDENSER REPAIR.                |
| 21 Aug | 921.0  | 58.2    | PP   | S    | COAST-DOWN.                           |
| 28 Sep | 2262.0 | 2411.7  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING. |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1981 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 346       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling | 2262            |           |          | 1471  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 39  |           |          |
| Subtotal  | 2262            | 0         | 0        | 1510  | 348       | 0        |
| Total   |                 | 2262      |          |   | 1858      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1981 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 113   |
| 15. Reactor Cooling Systems         |                    | 192   |
| 31. Turbine and auxiliaries         |                    | 21  |
| 41. Main Generator Systems          |                    | 2   |
| 42. Electrical Power Supply Systems |                    | 17  |
| Total                               | 0                  | 345   |

# JP-26 FUKUSHIMA-DAINI-2

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** HITACHI (HITACHI LTD.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1067.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** 33000IN. MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3169.8 GW(e).h  
**Energy Availability Factor:** 33.9%  
**Load Factor:** 33.8%  
**Operating Factor:** 33.9%  
**Energy Unavailability Factor:** 66.1%  
**Total Off-line Time:** 5806 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 39.5 | 767.7 | 795.6 | 770.6 | 796.5 | 3169.8 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7  | 100.0 | 100.0 | 100.0 | 100.0 | 33.9   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7  | 100.0 | 100.0 | 100.0 | 100.0 | 33.9   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.0  | 99.9  | 100.2 | 100.3 | 100.3 | 33.8   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7  | 100.0 | 100.0 | 100.0 | 100.0 | 33.9   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.3 | 0.0   | 0.0   | 0.0   | 0.0   | 66.1   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 0.0   | 0.0   | 0.0   | 0.0   | 1.9  | 0.0   | 0.0   | 0.0   | 0.0   | 25.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 100.0 | 100.0 | 100.0 | 100.0 | 91.4 | 0.0   | 0.0   | 0.0   | 0.0   | 41.1   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|                                      |             |   |                  |
|--------------------------------------|-------------|---|------------------|
| <b>Date of Construction Start:</b>   | 25 May 1979 | <b>Lifetime Generation:</b>                     | 144698.1 GW(e).h |
| <b>Date of First Criticality:</b>    | 26 Apr 1983 | <b>Cumulative Energy Availability Factor:</b>   | 72.4%            |
| <b>Date of Grid Connection:</b>      | 23 Jun 1983 | <b>Cumulative Load Factor:</b>                  | 71.8%            |
| <b>Date of Commercial Operation:</b> | 03 Feb 1984 | <b>Cumulative Unit Capability Factor:</b>       | 78.1%            |
|                                      |             | <b>Cumulative Energy Unavailability Factor:</b> | 27.6%            |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1601.2         | 1067.0         | 0.0  | 0.0    | 62.2                              | 100.0  | 18.2               | 0.0    | 2476               | 30.1   |
| 1984 | 8732.2         | 1067.0         | 0.0  | 0.0    | 93.2                              | 100.0  | 93.2               | 0.0    | 8315               | 94.7   |
| 1985 | 6760.1         | 1067.0         | 73.0   | 73.0   | 72.9                              | 72.9   | 72.3               | 72.3   | 6534               | 74.6   |
| 1986 | 7063.9         | 1067.0         | 76.2   | 74.6   | 76.2                              | 74.6   | 75.6               | 73.9   | 6727               | 76.8   |
| 1987 | 6844.9         | 1067.0         | 74.3   | 74.5   | 74.3                              | 74.5   | 73.2               | 73.7   | 6607               | 75.4   |
| 1988 | 7628.4         | 1067.0         | 82.1   | 76.4   | 82.1                              | 76.4   | 81.4               | 75.6   | 7238               | 82.4   |
| 1989 | 8308.8         | 1067.0         | 89.4   | 79.0   | 89.4                              | 79.0   | 88.9               | 78.3   | 7920               | 90.4   |
| 1990 | 6261.3         | 1067.0         | 67.3   | 77.0   | 67.3                              | 77.0   | 67.0               | 76.4   | 5956               | 68.0   |
| 1991 | 6887.3         | 1067.0         | 74.3   | 76.7   | 74.3                              | 76.7   | 73.7               | 76.0   | 6579               | 75.1   |
| 1992 | 8116.3         | 1067.0         | 87.1   | 78.0   | 87.1                              | 78.0   | 86.6               | 77.3   | 7656               | 87.2   |
| 1993 | 6785.7         | 1067.0         | 73.2   | 77.4   | 73.2                              | 77.4   | 72.6               | 76.8   | 6427               | 73.4   |
| 1994 | 7058.2         | 1067.0         | 76.0   | 77.3   | 76.0                              | 77.3   | 75.5               | 76.7   | 6696               | 76.4   |
| 1995 | 6786.7         | 1067.0         | 73.1   | 76.9   | 73.1                              | 76.9   | 72.6               | 76.3   | 6435               | 73.5   |
| 1996 | 9327.9         | 1067.0         | 100.0  | 78.8   | 100.0                             | 78.8   | 99.5               | 78.3   | 8784               | 100.0  |
| 1997 | 7405.6         | 1067.0         | 79.8   | 78.9   | 79.8                              | 78.9   | 79.2               | 78.3   | 7021               | 80.1   |
| 1998 | 7447.1         | 1067.0         | 80.2   | 79.0   | 80.2                              | 79.0   | 79.7               | 78.4   | 7104               | 81.1   |
| 1999 | 8231.6         | 1067.0         | 88.7   | 79.7   | 88.6                              | 79.6   | 88.1               | 79.1   | 7765               | 88.6   |
| 2000 | 8874.5         | 1067.0         | 95.2   | 80.6   | 95.2                              | 80.6   | 94.7               | 80.0   | 8372               | 95.3   |
| 2001 | 6761.9         | 1067.0         | 73.1   | 80.2   | 73.1                              | 80.2   | 72.3               | 79.6   | 6378               | 72.8   |
| 2002 | 4645.2         | 1067.0         | 50.2   | 78.5   | 50.2                              | 78.5   | 49.7               | 77.9   | 4398               | 50.2   |
| 2003 | 0.0            | 1067.0         | 0.0  | 74.4   | 0.0                               | 74.4   | 0.0                | 73.8   | 0                  | 0.0    |
| 2004 | 3169.8         | 1067.0         | 33.9   | 72.3   | 33.9                              | 72.4   | 33.8               | 71.8   | 2978               | 33.9   |

**JP-26 FUKUSHIMA-DAINI-2****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 2184.0 | 2330.3  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |
| 01 Apr | 3622.0 | 3864.9  | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE LEAK RATE INSPECTION OF PRIMARY CONTAINMENT VESSEL,ETC. |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 282       |          |
| C. Inspection, maintenance or repair combined with refuelling | 2184            |           |          | 1649  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 166   |           |          |
| Z. Others   |                 | 3622      |          |   |           |          |
| Subtotal  | 2184            | 3622      | 0        | 1815  | 282       | 0        |
| Total   |                 | 5806      |          |   | 2097      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                        | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|-------------------------------|--------------------|---|
| 11. Reactor and Accessories   |                    | 144   |
| 12. Reactor I&C Systems       |                    | 34  |
| 13. Reactor Auxiliary Systems |                    | 26  |
| 14. Safety Systems            |                    | 8   |
| 15. Reactor Cooling Systems   |                    | 69  |
| Total                         | 0                  | 281   |

**JP-35 FUKUSHIMA-DAINI-3**

Operator: TEPCO (TOKYO ELECTRIC POWER CO.)

Contractor: TOSHIBA (TOSHIBA CORPORATION)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1067.0 MW(e)  
 Design Net RUP: 1067.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6862.3 GW(e).h  
 Energy Availability Factor: 73.7%  
 Load Factor: 73.2%  
 Operating Factor: 74.1%  
 Energy Unavailability Factor: 26.3%  
 Total Off-line Time: 2276 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec  | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|--------|
| GW(e).h  | 0.0   | 0.0   | 636.2 | 767.3 | 792.8 | 767.1 | 789.6 | 786.8 | 760.2 | 788.8 | 764.3 | 9.3  | 6862.3 |
| EAF (%)  | 0.0   | 0.0   | 80.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 2.7  | 73.7   |
| UCF (%)  | 0.0   | 0.0   | 80.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 2.7  | 73.7   |
| LF (%)   | 0.0   | 0.0   | 80.1  | 100.0 | 99.9  | 99.9  | 99.5  | 99.1  | 98.9  | 99.2  | 99.5  | 1.2  | 73.2   |
| OF (%)   | 0.0   | 0.0   | 84.4  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 3.2  | 74.1   |
| EUF (%)  | 100.0 | 100.0 | 19.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 97.3 | 26.3   |
| PUF (%)  | 100.0 | 0.0   | 2.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 97.3 | 16.9   |
| UCLF (%) | 0.0   | 100.0 | 17.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 9.4    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 23 Mar 1981  
 Date of First Criticality: 18 Oct 1984  
 Date of Grid Connection: 14 Dec 1984  
 Date of Commercial Operation: 21 Jun 1985

Lifetime Generation: 122281.0 GW(e).h  
 Cumulative Energy Availability Factor: 66.0%  
 Cumulative Load Factor: 65.2%  
 Cumulative Unit Capability Factor: 78.2%  
 Cumulative Energy Unavailability Factor: 34.0%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1984 | 38.3              | 1067.0            | 0.0  | 0.0    | 95.3                                 | 100.0  | 0.4                | 0.0    | 240                   | 2.8    |
| 1985 | 6334.4            | 1067.0            | 0.0  | 0.0    | 97.3                                 | 100.0  | 67.8               | 0.0    | 6758                  | 77.1   |
| 1986 | 6837.4            | 1067.0            | 74.4   | 74.4   | 74.4                                 | 74.4   | 73.2               | 73.2   | 6559                  | 74.9   |
| 1987 | 7459.9            | 1067.0            | 80.8   | 77.6   | 80.8                                 | 77.6   | 79.8               | 76.5   | 7104                  | 81.1   |
| 1988 | 8389.1            | 1067.0            | 90.7   | 82.0   | 90.7                                 | 82.0   | 89.5               | 80.8   | 8126                  | 92.5   |
| 1989 | 120.2             | 1067.0            | 1.3  | 61.8   | 1.3                                  | 61.8   | 1.3                | 61.0   | 144                   | 1.6    |
| 1990 | 912.9             | 1067.0            | 9.8  | 51.4   | 9.8                                  | 51.4   | 9.8                | 50.7   | 1037                  | 11.8   |
| 1991 | 7695.1            | 1067.0            | 83.1   | 56.7   | 83.1                                 | 56.7   | 82.3               | 56.0   | 7344                  | 83.8   |
| 1992 | 7533.2            | 1067.0            | 81.3   | 60.2   | 81.3                                 | 60.2   | 80.4               | 59.5   | 7195                  | 81.9   |
| 1993 | 6810.5            | 1067.0            | 73.8   | 61.9   | 73.8                                 | 61.9   | 72.9               | 61.2   | 6494                  | 74.1   |
| 1994 | 4841.6            | 1067.0            | 52.5   | 60.9   | 52.5                                 | 60.9   | 51.8               | 60.1   | 4669                  | 53.3   |
| 1995 | 8992.5            | 1067.0            | 97.2   | 64.5   | 97.2                                 | 64.5   | 96.2               | 63.7   | 8557                  | 97.7   |
| 1996 | 8060.6            | 1067.0            | 87.0   | 66.5   | 87.0                                 | 66.5   | 86.0               | 65.8   | 7642                  | 87.0   |
| 1997 | 7487.4            | 1067.0            | 81.2   | 67.8   | 81.2                                 | 67.8   | 80.1               | 66.9   | 7120                  | 81.3   |
| 1998 | 8284.7            | 1067.0            | 89.9   | 69.5   | 89.7                                 | 69.4   | 88.6               | 68.6   | 7905                  | 90.2   |
| 1999 | 8566.8            | 1067.0            | 92.7   | 71.1   | 92.7                                 | 71.1   | 91.7               | 70.3   | 8127                  | 92.8   |
| 2000 | 7643.9            | 1067.0            | 82.5   | 71.9   | 82.5                                 | 71.9   | 81.6               | 71.0   | 7258                  | 82.6   |
| 2001 | 3288.0            | 1067.0            | 35.9   | 69.6   | 35.8                                 | 69.6   | 35.2               | 68.8   | 3185                  | 36.4   |
| 2002 | 6123.4            | 1067.0            | 66.3   | 69.4   | 66.3                                 | 69.4   | 65.5               | 68.6   | 5806                  | 66.3   |
| 2003 | 0.0               | 1067.0            | 0.0  | 65.6   | 0.0                                  | 65.6   | 0.0                | 64.8   | 0                     | 0.0    |
| 2004 | 6862.3            | 1067.0            | 73.7   | 66.0   | 73.7                                 | 66.0   | 73.2               | 65.2   | 6508                  | 74.1   |

**JP-35 FUKUSHIMA-DAINI-3****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 744.0 | 793.8   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |
| 01 Feb | 840.0 | 896.6   | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION, ETC. |
| 01 Dec | 677.0 | 772.8   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 502       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1421            |           |          | 1939  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 67  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 185       |          |
| Z. Others  |                 | 840       |          |   |           |          |
| Subtotal   | 1421            | 840       | 0        | 2006  | 687       | 0        |
| Total  |                 | 2261      |          |   | 2693      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 178   |
| 15. Reactor Cooling Systems         |                    | 308   |
| 32. Feedwater and Main Steam System |                    | 15  |
| Total                               | 0                  | 501   |

# JP-38 FUKUSHIMA-DAINI-4

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** HITACHI (HITACHI LTD.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1067.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1450.0 GW(e).h  
**Energy Availability Factor:** 15.5%  
**Load Factor:** 15.5%  
**Operating Factor:** 15.5%  
**Energy Unavailability Factor:** 84.5%  
**Total Off-line Time:** 7424 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 656.0 | 794.0 | 1450.0 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 85.5  | 100.0 | 15.5   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 85.5  | 100.0 | 15.5   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 85.4  | 100.0 | 15.5   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 85.6  | 100.0 | 15.5   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 14.5  | 0.0   | 84.5   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 71.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.7   | 0.0   | 22.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 29.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 11.8  | 0.0   | 61.9   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 28 May 1981  
**Date of First Criticality:** 24 Oct 1986  
**Date of Grid Connection:** 17 Dec 1986  
**Date of Commercial Operation:** 25 Aug 1987

**Lifetime Generation:** 121248.6 GW(e).h  
**Cumulative Energy Availability Factor:** 73.4%  
**Cumulative Load Factor:** 72.7%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 26.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 27.6           | 1067.0         | 0.0  | 0.0    | 0.3                               | 100.0  | 0.3                | 0.0    | 172                | 2.1    |
| 1987 | 5572.3         | 1067.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 59.6               | 0.0    | 6169               | 70.4   |
| 1988 | 7010.3         | 1067.0         | 75.5   | 75.5   | 75.5                              | 75.5   | 74.8               | 74.8   | 6739               | 76.7   |
| 1989 | 9137.9         | 1067.0         | 99.2   | 87.4   | 99.2                              | 87.4   | 97.8               | 86.3   | 8728               | 99.6   |
| 1990 | 7051.4         | 1067.0         | 76.0   | 83.6   | 76.0                              | 83.6   | 75.4               | 82.7   | 6757               | 77.1   |
| 1991 | 7278.9         | 1067.0         | 79.0   | 82.5   | 79.0                              | 82.5   | 77.9               | 81.5   | 7029               | 80.2   |
| 1992 | 5901.7         | 1067.0         | 63.8   | 78.7   | 63.5                              | 78.7   | 63.0               | 77.8   | 5646               | 64.3   |
| 1993 | 9049.0         | 1067.0         | 97.6   | 81.9   | 97.5                              | 81.8   | 96.8               | 80.9   | 8608               | 98.3   |
| 1994 | 6735.5         | 1067.0         | 73.5   | 80.7   | 72.7                              | 80.5   | 72.1               | 79.7   | 6481               | 74.0   |
| 1995 | 7782.7         | 1067.0         | 83.9   | 81.1   | 83.9                              | 80.9   | 83.3               | 80.1   | 7385               | 84.3   |
| 1996 | 6842.6         | 1067.0         | 73.7   | 80.3   | 73.7                              | 80.1   | 73.0               | 79.3   | 6470               | 73.7   |
| 1997 | 9275.9         | 1067.0         | 99.9   | 82.2   | 99.9                              | 82.1   | 99.2               | 81.3   | 8760               | 100.0  |
| 1998 | 8075.0         | 1067.0         | 87.2   | 82.7   | 87.2                              | 82.6   | 86.4               | 81.8   | 7678               | 87.6   |
| 1999 | 8136.0         | 1067.0         | 87.8   | 83.1   | 87.8                              | 83.0   | 87.0               | 82.2   | 7699               | 87.9   |
| 2000 | 6685.2         | 1067.0         | 72.0   | 82.2   | 72.0                              | 82.2   | 71.3               | 81.4   | 6329               | 72.1   |
| 2001 | 9250.2         | 1067.0         | 99.9   | 83.5   | 99.7                              | 83.4   | 99.0               | 82.6   | 8760               | 100.0  |
| 2002 | 5986.6         | 1067.0         | 64.7   | 82.3   | 64.7                              | 82.2   | 64.0               | 81.4   | 5668               | 64.7   |
| 2003 | 0.0            | 1067.0         | 0.0  | 77.1   | 0.0                               | 77.0   | 0.0                | 76.3   | 0                  | 0.0    |
| 2004 | 1450.0         | 1067.0         | 15.5   | 73.5   | 15.5                              | 73.4   | 15.5               | 72.7   | 1360               | 15.5   |



**JP-38 FUKUSHIMA-DAINI-4****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1968.0 | 2099.9  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 23 Mar | 5456.0 | 5821.7  | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION,ETC. |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 413       |          |
| C. Inspection, maintenance or repair combined with refuelling | 1968            |           |          | 1333  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 113   |           |          |
| Z. Others   |                 | 5456      |          |   |           |          |
| Subtotal  | 1968            | 5456      | 0        | 1446  | 413       | 0        |
| Total   |                 | 7424      |          |   | 1859      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                                   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 42  |
| 15. Reactor Cooling Systems              |                    | 337   |
| 21. Fuel Handling and Storage Facilities |                    | 31  |
| 33. Circulating Water System             |                    | 1   |
| Total                                    | 0                  | 411   |

# JP-12 GENKAI-1

**Operator:** KYUSHU (KYUSHU ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 529.0 MW(e)  
**Design Net RUP:** 529.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4768.4 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 102.6%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 406.1 | 379.8 | 406.2 | 392.8 | 404.2 | 391.3 | 401.1 | 400.1 | 388.1 | 403.0 | 391.1 | 404.7 | 4768.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 103.2 | 103.1 | 103.2 | 103.3 | 102.7 | 102.7 | 101.9 | 101.7 | 101.9 | 102.3 | 102.7 | 102.8 | 102.6  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|                                      |             |   |                 |
|--------------------------------------|-------------|---|-----------------|
| <b>Date of Construction Start:</b>   | 15 Sep 1971 | <b>Lifetime Generation:</b>                     | 99096.2 GW(e).h |
| <b>Date of First Criticality:</b>    | 28 Jan 1975 | <b>Cumulative Energy Availability Factor:</b>   | 71.9%           |
| <b>Date of Grid Connection:</b>      | 14 Feb 1975 | <b>Cumulative Load Factor:</b>                  | 72.1%           |
| <b>Date of Commercial Operation:</b> | 15 Oct 1975 | <b>Cumulative Unit Capability Factor:</b>       | 77.5%           |
|                                      |             | <b>Cumulative Energy Unavailability Factor:</b> | 28.1%           |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3960.5         | 529.0          | 85.4   | 72.5   | 85.4                              | 72.5   | 85.5               | 72.3   | 7678               | 87.6   |
| 1984 | 3139.7         | 529.0          | 67.5   | 71.9   | 67.5                              | 71.9   | 67.6               | 71.8   | 6072               | 69.1   |
| 1985 | 3089.7         | 529.0          | 66.7   | 71.4   | 66.7                              | 71.4   | 66.7               | 71.3   | 6056               | 69.1   |
| 1986 | 2867.2         | 529.0          | 61.8   | 70.5   | 61.8                              | 70.6   | 61.9               | 70.4   | 5425               | 61.9   |
| 1987 | 3762.7         | 529.0          | 81.3   | 71.4   | 81.1                              | 71.4   | 81.2               | 71.3   | 7285               | 83.2   |
| 1988 | 2365.6         | 529.0          | 51.0   | 69.9   | 50.9                              | 69.9   | 50.9               | 69.8   | 4743               | 54.0   |
| 1989 | 2183.2         | 529.0          | 47.1   | 68.3   | 47.1                              | 68.2   | 47.1               | 68.2   | 4310               | 49.2   |
| 1990 | 2725.7         | 529.0          | 58.9   | 67.6   | 58.8                              | 67.6   | 58.8               | 67.5   | 5159               | 58.9   |
| 1991 | 3357.5         | 529.0          | 72.7   | 67.9   | 72.4                              | 67.9   | 72.5               | 67.8   | 6542               | 74.7   |
| 1992 | 3291.7         | 529.0          | 70.8   | 68.1   | 70.7                              | 68.1   | 70.8               | 68.0   | 6397               | 72.8   |
| 1993 | 2797.4         | 529.0          | 60.3   | 67.7   | 60.3                              | 67.7   | 60.4               | 67.6   | 5459               | 62.3   |
| 1994 | 2530.6         | 529.0          | 54.5   | 67.0   | 54.5                              | 67.0   | 54.6               | 66.9   | 4787               | 54.6   |
| 1995 | 4151.0         | 529.0          | 89.4   | 68.1   | 89.4                              | 68.1   | 89.6               | 68.0   | 7842               | 89.5   |
| 1996 | 4107.8         | 529.0          | 88.3   | 69.1   | 88.3                              | 69.0   | 88.4               | 69.0   | 7829               | 89.1   |
| 1997 | 3653.4         | 529.0          | 78.7   | 69.5   | 78.7                              | 69.5   | 78.8               | 69.5   | 6984               | 79.7   |
| 1998 | 3703.2         | 529.0          | 79.8   | 70.0   | 79.8                              | 69.9   | 79.9               | 69.9   | 7057               | 80.6   |
| 1999 | 3305.9         | 529.0          | 71.2   | 70.0   | 71.2                              | 70.0   | 71.3               | 70.0   | 6362               | 72.6   |
| 2000 | 4435.5         | 529.0          | 95.3   | 71.0   | 95.3                              | 71.0   | 95.5               | 71.0   | 8400               | 95.6   |
| 2001 | 2512.3         | 529.0          | 54.1   | 70.4   | 54.1                              | 70.4   | 54.2               | 70.3   | 4745               | 54.2   |
| 2002 | 3822.9         | 529.0          | 81.0   | 70.8   | 81.0                              | 70.7   | 82.5               | 70.8   | 7097               | 81.0   |
| 2003 | 3622.8         | 529.0          | 76.3   | 71.0   | 76.4                              | 70.9   | 78.2               | 71.1   | 6692               | 76.4   |
| 2004 | 4768.4         | 529.0          | 100.0  | 72.0   | 100.0                             | 71.9   | 102.6              | 72.1   | 8784               | 100.0  |

## JP-12 GENKAI-1

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1975 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 160       |          |
| C. Inspection, maintenance or repair combined with refuelling | 2153            |           |          |   |           |          |
| D. Inspection, maintenance or repair without refuelling       | 23              |           |          |   |           |          |
| Subtotal  | 0               | 0         | 0        | 2176  | 160       | 0        |
| Total   | 0               |           |          | 2336  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1975 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 11  |
| 13. Reactor Auxiliary Systems       |                    | 55  |
| 15. Reactor Cooling Systems         |                    | 21  |
| 16. Steam generation systems        |                    | 69  |
| 42. Electrical Power Supply Systems |                    | 2   |
| Total                               | 0                  | 158   |

# JP-27 GENKAI-2

**Operator:** KYUSHU (KYUSHU ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 529.0 MW(e)  
**Design Net RUP:** 529.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3848.6 GW(e).h  
**Energy Availability Factor:** 80.2%  
**Load Factor:** 82.8%  
**Operating Factor:** 80.3%  
**Energy Unavailability Factor:** 19.8%  
**Total Off-line Time:** 1732 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 409.5 | 383.2 | 178.9 | 0.0   | 80.9 | 392.9 | 403.1 | 402.1 | 390.2 | 405.7 | 393.9 | 408.2 | 3848.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 43.8  | 0.0   | 20.2 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 43.8  | 0.0   | 20.2 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.3   |
| <b>LF (%)</b>   | 104.0 | 104.1 | 45.5  | 0.0   | 20.5 | 103.2 | 102.4 | 102.2 | 102.4 | 103.1 | 103.4 | 103.7 | 82.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 41.9  | 0.0   | 22.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 56.2  | 100.0 | 79.8 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 19.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 56.2  | 100.0 | 79.8 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 19.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1977  
**Date of First Criticality:** 21 May 1980  
**Date of Grid Connection:** 03 Jun 1980  
**Date of Commercial Operation:** 30 Mar 1981

**Lifetime Generation:** 92572.2 GW(e).h  
**Cumulative Energy Availability Factor:** 80.8%  
**Cumulative Load Factor:** 81.4%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 19.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3671.7         | 529.0          | 79.0   | 78.2   | 79.0                              | 78.2   | 79.2               | 78.4   | 7056               | 80.5   |
| 1984 | 3803.5         | 529.0          | 81.6   | 79.3   | 81.6                              | 79.3   | 81.9               | 79.6   | 7359               | 83.8   |
| 1985 | 3857.5         | 529.0          | 82.9   | 80.2   | 82.9                              | 80.2   | 83.2               | 80.5   | 7423               | 84.7   |
| 1986 | 4631.7         | 529.0          | 99.5   | 84.1   | 99.5                              | 84.1   | 99.9               | 84.4   | 8760               | 100.0  |
| 1987 | 3874.4         | 529.0          | 83.3   | 84.0   | 83.3                              | 83.9   | 83.6               | 84.3   | 7426               | 84.8   |
| 1988 | 3458.4         | 529.0          | 74.2   | 82.5   | 74.2                              | 82.5   | 74.4               | 82.8   | 6630               | 75.5   |
| 1989 | 3241.4         | 529.0          | 69.8   | 81.0   | 69.8                              | 81.0   | 69.9               | 81.2   | 6230               | 71.1   |
| 1990 | 4654.8         | 529.0          | 100.0  | 83.1   | 100.0                             | 83.1   | 100.4              | 83.4   | 8760               | 100.0  |
| 1991 | 3732.4         | 529.0          | 80.2   | 82.8   | 80.2                              | 82.8   | 80.5               | 83.1   | 7141               | 81.5   |
| 1992 | 3480.6         | 529.0          | 74.5   | 82.0   | 74.5                              | 82.0   | 74.9               | 82.3   | 6638               | 75.6   |
| 1993 | 3722.3         | 529.0          | 79.9   | 81.8   | 79.9                              | 81.8   | 80.3               | 82.2   | 7007               | 80.0   |
| 1994 | 4013.5         | 529.0          | 86.2   | 82.2   | 86.2                              | 82.2   | 86.6               | 82.5   | 7561               | 86.3   |
| 1995 | 3784.1         | 529.0          | 81.3   | 82.1   | 81.3                              | 82.1   | 81.7               | 82.5   | 7225               | 82.5   |
| 1996 | 3644.7         | 529.0          | 78.1   | 81.8   | 78.1                              | 81.8   | 78.4               | 82.2   | 6991               | 79.6   |
| 1997 | 3448.3         | 529.0          | 74.1   | 81.4   | 74.1                              | 81.4   | 74.4               | 81.7   | 6541               | 74.7   |
| 1998 | 3701.4         | 529.0          | 79.6   | 81.3   | 79.6                              | 81.3   | 79.9               | 81.6   | 6978               | 79.7   |
| 1999 | 4347.9         | 529.0          | 93.4   | 81.9   | 93.4                              | 81.9   | 93.8               | 82.3   | 8186               | 93.4   |
| 2000 | 3473.3         | 529.0          | 74.4   | 81.5   | 74.4                              | 81.5   | 74.7               | 81.9   | 6541               | 74.5   |
| 2001 | 2216.4         | 529.0          | 47.7   | 79.8   | 47.7                              | 79.8   | 47.8               | 80.2   | 4177               | 47.7   |
| 2002 | 4107.5         | 529.0          | 86.7   | 80.2   | 86.7                              | 80.2   | 88.6               | 80.6   | 7598               | 86.7   |
| 2003 | 4490.5         | 529.0          | 93.7   | 80.8   | 93.7                              | 80.8   | 96.9               | 81.3   | 8209               | 93.7   |
| 2004 | 3848.6         | 529.0          | 80.3   | 80.8   | 80.2                              | 80.8   | 82.8               | 81.4   | 7052               | 80.3   |

**JP-27 GENKAI-2****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description                           |
|--------|--------|---------|------|------|---------------------------------------|
| 14 Mar | 1732.0 | 916.4   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair<br>combined with refuelling | 1732            |           |          | 1537  | 22        |          |
| Subtotal   | 1732            | 0         | 0        | 1537  | 22        | 0        |
| Total  | 1732            |           |          | 1559  |           |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                       | 2004<br>Hours Lost | 1982 to 2004<br>Average Hours Lost Per Year |
|------------------------------|--------------------|---|
| 16. Steam generation systems |                    | 22  |
| Total                        | 0                  | 22  |

# JP-45 GENKAI-3

**Operator:** KYUSHU (KYUSHU ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1127.0 MW(e)  
**Design Net RUP:** 1127.0 MW(e)  
**Design Discharge Burnup:** 31000 AV MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8121.1 GW(e).h  
**Energy Availability Factor:** 79.9%  
**Load Factor:** 82.0%  
**Operating Factor:** 79.9%  
**Energy Unavailability Factor:** 20.1%  
**Total Off-line Time:** 1769 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 862.8 | 804.2 | 862.8 | 359.7 | 0.0   | 122.2 | 857.0 | 857.2 | 831.5 | 863.2 | 836.4 | 864.0 | 8121.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 42.9  | 0.0   | 14.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 79.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 42.9  | 0.0   | 14.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 79.9   |
| <b>LF (%)</b>   | 102.9 | 102.5 | 102.9 | 44.4  | 0.0   | 15.1  | 102.2 | 102.2 | 102.5 | 102.8 | 103.1 | 103.0 | 82.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 39.9  | 0.0   | 17.8  | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 79.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 57.1  | 100.0 | 85.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 20.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 57.1  | 100.0 | 85.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 20.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1988  
**Date of First Criticality:** 28 May 1993  
**Date of Grid Connection:** 15 Jun 1993  
**Date of Commercial Operation:** 18 Mar 1994

**Lifetime Generation:** 94079.3 GW(e).h  
**Cumulative Energy Availability Factor:** 83.6%  
**Cumulative Load Factor:** 84.4%  
**Cumulative Unit Capability Factor:** 81.5%  
**Cumulative Energy Unavailability Factor:** 16.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 1924.1         | 1127.0         | 0.0  | 0.0    | 20.3                              | 100.0  | 20.3               | 0.0    | 2897               | 34.4   |
| 1994 | 8795.8         | 1127.0         | 0.0  | 0.0    | 97.7                              | 100.0  | 89.1               | 0.0    | 7828               | 89.4   |
| 1995 | 7356.3         | 1127.0         | 74.1   | 74.1   | 74.1                              | 74.1   | 74.5               | 74.5   | 6588               | 75.2   |
| 1996 | 7444.9         | 1127.0         | 74.9   | 74.5   | 74.9                              | 74.5   | 75.2               | 74.9   | 6663               | 75.9   |
| 1997 | 8259.9         | 1127.0         | 83.3   | 77.4   | 83.3                              | 77.4   | 83.7               | 77.8   | 7358               | 84.0   |
| 1998 | 9633.1         | 1127.0         | 97.1   | 82.3   | 97.1                              | 82.4   | 97.6               | 82.7   | 8514               | 97.2   |
| 1999 | 7999.8         | 1127.0         | 80.7   | 82.0   | 80.7                              | 82.0   | 81.0               | 82.4   | 7068               | 80.7   |
| 2000 | 8109.7         | 1127.0         | 81.5   | 81.9   | 81.6                              | 81.9   | 81.9               | 82.3   | 7164               | 81.6   |
| 2001 | 8205.1         | 1127.0         | 82.7   | 82.0   | 82.7                              | 82.1   | 83.1               | 82.4   | 7249               | 82.8   |
| 2002 | 9561.5         | 1127.0         | 96.4   | 83.8   | 96.4                              | 83.8   | 96.9               | 84.2   | 8446               | 96.4   |
| 2003 | 8667.8         | 1127.0         | 85.6   | 84.0   | 85.6                              | 84.0   | 87.8               | 84.6   | 7497               | 85.6   |
| 2004 | 8121.1         | 1127.0         | 79.9   | 83.6   | 79.9                              | 83.6   | 82.0               | 84.4   | 7015               | 79.9   |

## JP-45 GENKAI-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                           |
|--------|--------|---------|------|------|---------------------------------------|
| 13 Apr | 1767.0 | 1991.7  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING. |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1994 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| C. Inspection, maintenance or repair combined with refuelling | 1767            |           |          | 1140  |           |          |
| Subtotal  | 1767            | 0         | 0        | 1140  | 0         | 0        |
| Total   |                 | 1767      |          |   | 1140      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System | 2004<br>Hours Lost | 1994 to 2004<br>Average Hours Lost Per Year |
|--------|--------------------|---|
|        |                    |   |

The reactor has not yet completed a full year of commercial operation.

**JP-46 GENKAI-4**

Operator: KYUSHU (KYUSHU ELECTRIC POWER CO.)

Contractor: M (MITSUBISHI HEAVY INDUSTRY LTD)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1127.0 MW(e)  
 Design Net RUP: 1127.0 MW(e)  
 Design Discharge Burnup: 31000 AV MW.d/t

**2. Production Summary 2004**

Energy Production: 8330.6 GW(e).h  
 Energy Availability Factor: 82.4%  
 Load Factor: 84.2%  
 Operating Factor: 82.5%  
 Energy Unavailability Factor: 17.6%  
 Total Off-line Time: 1541 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 233.2 | 856.8 | 828.4 | 855.9 | 827.2 | 854.2 | 854.0 | 477.3 | 854.7 | 830.2 | 858.6 | 8330.6 |
| EAF (%)  | 0.0   | 29.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 57.6  | 100.0 | 100.0 | 100.0 | 82.4   |
| UCF (%)  | 0.0   | 29.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 57.6  | 100.0 | 100.0 | 100.0 | 82.4   |
| LF (%)   | 0.0   | 29.7  | 102.2 | 102.2 | 102.1 | 101.9 | 101.9 | 101.9 | 58.8  | 101.8 | 102.3 | 102.4 | 84.2   |
| OF (%)   | 0.0   | 29.3  | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 57.6  | 99.9  | 100.0 | 100.0 | 82.5   |
| EUF (%)  | 100.0 | 70.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 42.4  | 0.0   | 0.0   | 0.0   | 17.6   |
| PUF (%)  | 100.0 | 70.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 14.1   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 42.4  | 0.0   | 0.0   | 0.0   | 3.5    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 15 Jul 1992      Lifetime Generation: 65908.4 GW(e).h  
 Date of First Criticality: 23 Oct 1996      Cumulative Energy Availability Factor: 85.6%  
 Date of Grid Connection: 12 Nov 1996      Cumulative Load Factor: 86.5%  
 Date of Commercial Operation: 25 Jul 1997      Cumulative Unit Capability Factor: 82.8%  
    Cumulative Energy Unavailability Factor: 14.4%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1996 | 210.5             | 1127.0            | 0.0  | 0.0    | 2.2                                  | 100.0  | 2.2                | 0.0    | 705                   | 8.3    |
| 1997 | 5841.0            | 1127.0            | 0.0  | 0.0    | 100.0                                | 100.0  | 59.2               | 0.0    | 5901                  | 67.4   |
| 1998 | 7634.5            | 1127.0            | 76.8   | 76.8   | 76.7                                 | 76.7   | 77.3               | 77.3   | 6783                  | 77.4   |
| 1999 | 9716.3            | 1127.0            | 97.7   | 87.2   | 97.7                                 | 87.2   | 98.4               | 87.9   | 8559                  | 97.7   |
| 2000 | 8181.2            | 1127.0            | 82.0   | 85.5   | 82.0                                 | 85.5   | 82.6               | 86.1   | 7205                  | 82.0   |
| 2001 | 8107.2            | 1127.0            | 81.5   | 84.5   | 81.5                                 | 84.5   | 82.1               | 85.1   | 7142                  | 81.5   |
| 2002 | 8208.3            | 1127.0            | 82.4   | 84.1   | 82.4                                 | 84.1   | 83.1               | 84.7   | 7217                  | 82.4   |
| 2003 | 9678.7            | 1127.0            | 96.1   | 86.1   | 96.1                                 | 86.1   | 98.0               | 86.9   | 8422                  | 96.1   |
| 2004 | 8330.6            | 1127.0            | 82.4   | 85.5   | 82.4                                 | 85.6   | 84.2               | 86.5   | 7243                  | 82.5   |



## JP-46 GENKAI-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1236.0 | 1393.3  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.<br>THE REASON FOR THE FACTOR OF THE UNPLANNED ENERGY LOSS IS THAT THE GENERATOR WAS STOPPED AND REPAIRED BECAUSE THE AMOUNT OF REPLENISHMENT OF THE HYDROGEN GAS FOR COOLING THE GENERATOR INCREASED. AS A RESULT OF THE CHECK, THE CRACK OCCURED IN THE SOCKET WELD OF THE STATOR COOLING WATER SYSTEM PIPING IN THE GENERATOR. THE CAUSE WAS DUE TO THE THE POOR WELD AND THE VIBRATION WHILE DRIVING. |
| 16 Sep | 305.0  | 344.0   | UF1  | A41  |  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1998 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 305       |          |   |           |          |
| C. Inspection, maintenance or repair combined with refuelling | 1236            |           |          | 1036  |           |          |
| Subtotal  | 1236            | 305       | 0        | 1036  | 0         | 0        |
| Total   |                 | 1541      |          |   | 1036      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                     | 2004<br>Hours Lost | 1998 to 2004<br>Average Hours Lost Per Year |
|----------------------------|--------------------|---|
| 41. Main Generator Systems | 305                |   |
| Total                      | 305                | 0   |

# JP-11 HAMAOKA-1

**Operator:** CHUBU (CHUBU ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 515.0 MW(e)  
**Design Net RUP:** 516.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 0.0 GW(e).h  
**Energy Availability Factor:** 0.0%  
**Load Factor:** 0.0%  
**Operating Factor:** 0.0%  
**Energy Unavailability Factor:** 100.0%  
**Total Off-line Time:** 8784 hours

## 3. 2004 Monthly Performance Data

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| EAF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| UCF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| LF (%)   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| OF (%)   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| EUF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| PUF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 10 Jun 1971  
**Date of First Criticality:** 20 Jun 1974  
**Date of Grid Connection:** 13 Aug 1974  
**Date of Commercial Operation:** 17 Mar 1976

**Lifetime Generation:** 73604.6 GW(e).h  
**Cumulative Energy Availability Factor:** 55.1%  
**Cumulative Load Factor:** 54.7%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 44.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3054.9         | 515.0          | 67.7   | 53.4   | 67.7                              | 53.4   | 67.7               | 53.4   | 6236               | 71.2   |
| 1984 | 2377.5         | 515.0          | 53.6   | 53.4   | 53.6                              | 53.4   | 52.6               | 53.3   | 4822               | 54.9   |
| 1985 | 4437.1         | 515.0          | 100.0  | 58.6   | 100.0                             | 58.6   | 98.4               | 58.3   | 8760               | 100.0  |
| 1986 | 2919.8         | 515.0          | 65.0   | 59.3   | 65.0                              | 59.2   | 64.7               | 58.9   | 5804               | 66.3   |
| 1987 | 3290.7         | 515.0          | 73.1   | 60.5   | 73.1                              | 60.5   | 72.9               | 60.2   | 6560               | 74.9   |
| 1988 | 1838.7         | 515.0          | 40.7   | 58.9   | 40.7                              | 58.9   | 40.6               | 58.6   | 3649               | 41.5   |
| 1989 | 1950.7         | 515.0          | 43.4   | 57.7   | 43.4                              | 57.7   | 43.2               | 57.4   | 3904               | 44.6   |
| 1990 | 2040.6         | 515.0          | 49.0   | 57.0   | 49.0                              | 57.1   | 45.2               | 56.5   | 4015               | 45.8   |
| 1991 | 2162.8         | 515.0          | 48.3   | 56.5   | 48.2                              | 56.5   | 47.9               | 55.9   | 4319               | 49.3   |
| 1992 | 2730.1         | 515.0          | 60.6   | 56.7   | 60.7                              | 56.7   | 60.3               | 56.2   | 5384               | 61.3   |
| 1993 | 2872.6         | 515.0          | 64.4   | 57.2   | 64.1                              | 57.2   | 63.7               | 56.7   | 5681               | 64.9   |
| 1994 | 1642.1         | 515.0          | 36.6   | 56.0   | 36.6                              | 56.0   | 36.4               | 55.5   | 3216               | 36.7   |
| 1995 | 3499.6         | 515.0          | 78.2   | 57.2   | 78.1                              | 57.2   | 77.6               | 56.7   | 6892               | 78.7   |
| 1996 | 3662.3         | 515.0          | 81.5   | 58.4   | 81.4                              | 58.4   | 81.0               | 57.9   | 7158               | 81.5   |
| 1997 | 4118.0         | 515.0          | 92.1   | 60.0   | 91.9                              | 60.0   | 91.3               | 59.5   | 8086               | 92.3   |
| 1998 | 3609.8         | 515.0          | 80.5   | 61.0   | 80.5                              | 60.9   | 80.0               | 60.4   | 7070               | 80.7   |
| 1999 | 2878.7         | 515.0          | 64.3   | 61.1   | 64.2                              | 61.1   | 63.8               | 60.6   | 5630               | 64.3   |
| 2000 | 3198.0         | 515.0          | 71.3   | 61.5   | 71.2                              | 61.5   | 70.7               | 61.0   | 6268               | 71.4   |
| 2001 | 3069.8         | 515.0          | 68.5   | 61.8   | 68.5                              | 61.8   | 68.0               | 61.3   | 6000               | 68.5   |
| 2002 | 0.0            | 515.0          | 0.0  | 59.4   | 0.0                               | 59.4   | 0.0                | 58.9   | 0                  | 0.0    |
| 2003 | 0.0            | 515.0          | 0.0  | 57.2   | 0.0                               | 57.2   | 0.0                | 56.7   | 0                  | 0.0    |
| 2004 | 0.0            | 515.0          | 0.0  | 55.2   | 0.0                               | 55.1   | 0.0                | 54.7   | 0                  | 0.0    |

## JP-11 HAMAOKA-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 8784.0 | 4523.8  | UF3  | A11  | EXTENSION OF PERIODICAL INSPECTION OF REFUELLING DUE TO REPLACEMENT OF CORE SHROUD AND PLR PIPINGS. |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 8784      |          |   | 927       |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 2332  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 100   |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 0   |           |          |
| Subtotal  | 0               | 8784      | 0        | 2432  | 927       | 0        |
| Total   |                 | 8784      |          |   | 3359      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              | 8784               | 392   |
| 12. Reactor I&C Systems                  |                    | 204   |
| 13. Reactor Auxiliary Systems            |                    | 130   |
| 15. Reactor Cooling Systems              |                    | 175   |
| 21. Fuel Handling and Storage Facilities |                    | 17  |
| 31. Turbine and auxiliaries              |                    | 0   |
| 32. Feedwater and Main Steam System      |                    | 6   |
| Total                                    | 8784               | 924   |

# JP-24 HAMAOKA-2

**Operator:** CHUBU (CHUBU ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 806.0 MW(e)  
**Design Net RUP:** 814.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 951.3 GW(e).h  
**Energy Availability Factor:** 13.3%  
**Load Factor:** 13.4%  
**Operating Factor:** 13.9%  
**Energy Unavailability Factor:** 86.7%  
**Total Off-line Time:** 7559 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 595.0 | 356.4 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 951.3  |
| <b>EAF (%)</b>  | 98.4  | 63.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.3   |
| <b>UCF (%)</b>  | 100.0 | 69.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 14.0   |
| <b>LF (%)</b>   | 99.2  | 63.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.4   |
| <b>OF (%)</b>   | 100.0 | 69.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.9   |
| <b>EUF (%)</b>  | 1.6   | 36.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.7   |
| <b>PUF (%)</b>  | 0.0   | 30.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 1.6   | 6.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 14 Jun 1974      **Lifetime Generation:** 129581.0 GW(e).h  
**Date of First Criticality:** 28 Mar 1978      **Cumulative Energy Availability Factor:** 68.7%  
**Date of Grid Connection:** 04 May 1978      **Cumulative Load Factor:** 68.8%  
**Date of Commercial Operation:** 29 Nov 1978      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 31.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4888.1         | 814.0          | 68.5   | 70.7   | 68.6                              | 70.7   | 68.6               | 70.7   | 6250               | 71.3   |
| 1984 | 4693.8         | 815.0          | 66.3   | 70.0   | 66.3                              | 70.0   | 65.6               | 69.8   | 5877               | 66.9   |
| 1985 | 4397.2         | 815.0          | 62.5   | 68.9   | 62.5                              | 68.9   | 61.6               | 68.7   | 5553               | 63.4   |
| 1986 | 4845.5         | 815.0          | 68.1   | 68.8   | 68.1                              | 68.8   | 67.9               | 68.6   | 6145               | 70.1   |
| 1987 | 7002.0         | 815.0          | 98.7   | 72.1   | 98.7                              | 72.1   | 98.1               | 71.8   | 8760               | 100.0  |
| 1988 | 4015.9         | 815.0          | 56.4   | 70.5   | 56.4                              | 70.5   | 56.1               | 70.3   | 5108               | 58.2   |
| 1989 | 4613.0         | 806.0          | 64.4   | 70.0   | 64.4                              | 70.0   | 65.3               | 69.8   | 5864               | 66.9   |
| 1990 | 5828.1         | 806.0          | 82.2   | 71.0   | 82.2                              | 71.0   | 82.5               | 70.9   | 7289               | 83.2   |
| 1991 | 5299.5         | 806.0          | 74.8   | 71.3   | 74.7                              | 71.3   | 75.1               | 71.2   | 6625               | 75.6   |
| 1992 | 4319.6         | 806.0          | 60.6   | 70.5   | 60.6                              | 70.5   | 61.0               | 70.5   | 5421               | 61.7   |
| 1993 | 5347.9         | 806.0          | 75.3   | 70.8   | 75.3                              | 70.8   | 75.7               | 70.8   | 6657               | 76.0   |
| 1994 | 4537.8         | 806.0          | 64.1   | 70.4   | 64.1                              | 70.4   | 64.3               | 70.4   | 5643               | 64.4   |
| 1995 | 6922.2         | 806.0          | 97.8   | 72.0   | 97.7                              | 72.0   | 98.0               | 72.0   | 8577               | 97.9   |
| 1996 | 6152.7         | 806.0          | 86.5   | 72.8   | 86.5                              | 72.8   | 86.9               | 72.8   | 7613               | 86.7   |
| 1997 | 5106.5         | 806.0          | 72.3   | 72.8   | 72.1                              | 72.8   | 72.3               | 72.8   | 6350               | 72.5   |
| 1998 | 5191.8         | 806.0          | 73.4   | 72.8   | 73.2                              | 72.8   | 73.5               | 72.9   | 6462               | 73.8   |
| 1999 | 5221.5         | 806.0          | 74.0   | 72.9   | 73.6                              | 72.8   | 74.0               | 72.9   | 6481               | 74.0   |
| 2000 | 4972.9         | 806.0          | 70.0   | 72.8   | 69.9                              | 72.7   | 70.2               | 72.8   | 6146               | 70.0   |
| 2001 | 5134.2         | 806.0          | 72.6   | 72.8   | 72.2                              | 72.7   | 72.7               | 72.8   | 6362               | 72.6   |
| 2002 | 164.0          | 806.0          | 2.3  | 69.8   | 2.3                               | 69.8   | 2.3                | 69.9   | 198                | 2.3    |
| 2003 | 6950.1         | 806.0          | 98.1   | 71.0   | 97.8                              | 70.9   | 98.4               | 71.0   | 8617               | 98.4   |
| 2004 | 951.3          | 806.0          | 14.0   | 68.8   | 13.3                              | 68.7   | 13.4               | 68.8   | 1225               | 13.9   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 15 Jan | 885.0  | 44.1    | XP   | S    | COAST-DOWN.  |
| 21 Feb | 5927.0 | 4775.9  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |
| 25 Oct | 1632.0 | 1315.4  | UF3  | Z11  | EXTENSION OF PERIODICAL INSPECTION AND REFUELLING DUE TO REPLACEMENT OF CORE SHROUD AND PLR PIPINGS. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 101       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 5927            |           |          | 1798                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 122                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 42        |          |
| Z. Others  |                 | 1632      |          |  | 181       |          |
| Subtotal   | 5927            | 1632      | 0        | 1920                                     | 324       | 0        |
| Total  |                 | 7559      |          |  | 2244      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 13. Reactor Auxiliary Systems       |                 | 67                                       |
| 32. Feedwater and Main Steam System |                 | 33                                       |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 0               | 100                                      |

**JP-36 HAMAOKA-3**

Operator: CHUBU (CHUBU ELECTRIC POWER CO.)

Contractor: TOSHIBA (TOSHIBA CORPORATION)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1056.0 MW(e)  
 Design Net RUP: 1056.0 MW(e)  
 Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 9342.5 GW(e).h  
 Energy Availability Factor: 100.0%  
 Load Factor: 100.7%  
 Operating Factor: 100.0%  
 Energy Unavailability Factor: 0.0%  
 Total Off-line Time: 0 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 796.6 | 744.8 | 796.1 | 768.0 | 793.1 | 764.6 | 787.9 | 785.9 | 760.7 | 788.4 | 764.7 | 791.7 | 9342.5 |
| EAF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| LF (%)   | 101.4 | 101.3 | 101.3 | 101.1 | 100.9 | 100.6 | 100.3 | 100.0 | 100.0 | 100.2 | 100.6 | 100.8 | 100.7  |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0  |
| EUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 18 Apr 1983      Lifetime Generation: 127312.1 GW(e).h  
 Date of First Criticality: 21 Nov 1986      Cumulative Energy Availability Factor: 78.0%  
 Date of Grid Connection: 20 Jan 1987      Cumulative Load Factor: 77.3%  
 Date of Commercial Operation: 28 Aug 1987      Cumulative Unit Capability Factor: 78.6%  
    Cumulative Energy Unavailability Factor: 22.0%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1987 | 5586.6            | 1066.0            | 0.0  | 0.0    | 99.8                                 | 100.0  | 59.8               | 0.0    | 6360                  | 72.6   |
| 1988 | 7066.8            | 1066.0            | 75.8   | 75.8   | 75.8                                 | 75.8   | 75.5               | 75.5   | 6862                  | 78.1   |
| 1989 | 8542.0            | 1066.0            | 92.4   | 84.1   | 92.4                                 | 84.1   | 91.5               | 83.5   | 8167                  | 93.2   |
| 1990 | 6601.3            | 1056.0            | 71.4   | 79.9   | 71.4                                 | 79.9   | 71.4               | 79.5   | 6366                  | 72.7   |
| 1991 | 6763.1            | 1056.0            | 73.5   | 78.3   | 73.5                                 | 78.3   | 73.1               | 77.9   | 6472                  | 73.9   |
| 1992 | 6585.4            | 1056.0            | 71.7   | 77.0   | 71.4                                 | 76.9   | 71.0               | 76.5   | 6371                  | 72.5   |
| 1993 | 8768.0            | 1056.0            | 95.3   | 80.0   | 95.3                                 | 80.0   | 94.8               | 79.5   | 8359                  | 95.4   |
| 1994 | 6490.5            | 1056.0            | 77.4   | 79.7   | 77.4                                 | 79.6   | 70.2               | 78.2   | 6784                  | 77.4   |
| 1995 | 7725.7            | 1056.0            | 84.7   | 80.3   | 84.1                                 | 80.2   | 83.5               | 78.9   | 7429                  | 84.8   |
| 1996 | 6891.6            | 1056.0            | 74.8   | 79.7   | 74.7                                 | 79.6   | 74.3               | 78.4   | 6573                  | 74.8   |
| 1997 | 8109.7            | 1056.0            | 88.3   | 80.5   | 88.3                                 | 80.4   | 87.7               | 79.3   | 7863                  | 89.8   |
| 1998 | 9200.7            | 1056.0            | 100.0  | 82.3   | 100.0                                | 82.2   | 99.5               | 81.1   | 8760                  | 100.0  |
| 1999 | 7618.3            | 1056.0            | 82.8   | 82.3   | 82.8                                 | 82.3   | 82.4               | 81.2   | 7255                  | 82.8   |
| 2000 | 7706.0            | 1056.0            | 83.6   | 82.4   | 83.6                                 | 82.4   | 83.1               | 81.4   | 7340                  | 83.6   |
| 2001 | 6476.8            | 1056.0            | 70.4   | 81.6   | 70.4                                 | 81.5   | 70.0               | 80.6   | 6171                  | 70.4   |
| 2002 | 6350.9            | 1056.0            | 69.0   | 80.7   | 69.0                                 | 80.7   | 68.7               | 79.8   | 6044                  | 69.0   |
| 2003 | 1486.6            | 1056.0            | 16.1   | 76.7   | 16.1                                 | 76.6   | 16.1               | 75.8   | 1403                  | 16.0   |
| 2004 | 9342.5            | 1056.0            | 100.0  | 78.1   | 100.0                                | 78.0   | 100.7              | 77.3   | 8784                  | 100.0  |

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### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 249       |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1282                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 38                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 6         |          |
| Z. Others  |                 |           |          |  | 203       |          |
| Subtotal   | 0               | 0         | 0        | 1320                                     | 458       | 0        |
| Total  |                 | 0         |          |  | 1778      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                      | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|-----------------------------|-----------------|--|
| 11. Reactor and Accessories |                 | 216                                      |
| 35. All other I&C Systems   |                 | 0  |
| Total                       | 0               | 216                                      |

# JP-49 HAMAOKA-4

**Operator:** CHUBU (CHUBU ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1092.0 MW(e)  
**Design Net RUP:** 1092.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 7279.7 GW(e).h  
**Energy Availability Factor:** 75.8%  
**Load Factor:** 75.9%  
**Operating Factor:** 75.9%  
**Energy Unavailability Factor:** 24.2%  
**Total Off-line Time:** 2116 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 817.7 | 765.0 | 817.0 | 789.4 | 815.4 | 787.0 | 811.1 | 808.7 | 731.5 | 0.0   | 0.0   | 137.0 | 7279.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.7  | 93.2  | 0.0   | 0.0   | 17.4  | 75.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.3  | 0.0   | 0.0   | 17.4  | 75.8   |
| <b>LF (%)</b>   | 100.7 | 100.7 | 100.6 | 100.4 | 100.4 | 100.1 | 99.8  | 99.5  | 93.0  | 0.0   | 0.0   | 16.9  | 75.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 0.0   | 0.0   | 19.1  | 75.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 6.8   | 100.0 | 100.0 | 82.6  | 24.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7   | 100.0 | 100.0 | 82.3  | 24.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 13 Oct 1989  
**Date of First Criticality:** 02 Dec 1992  
**Date of Grid Connection:** 27 Jan 1993  
**Date of Commercial Operation:** 03 Sep 1993

**Lifetime Generation:** 89870.5 GW(e).h  
**Cumulative Energy Availability Factor:** 79.9%  
**Cumulative Load Factor:** 79.8%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 20.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 5877.6         | 1092.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 61.4               | 0.0    | 6326               | 72.2   |
| 1994 | 7110.4         | 1092.0         | 74.9   | 74.9   | 74.7                              | 74.7   | 74.3               | 74.3   | 6576               | 75.1   |
| 1995 | 9546.0         | 1092.0         | 100.0  | 87.5   | 100.0                             | 87.3   | 99.8               | 87.1   | 8760               | 100.0  |
| 1996 | 8301.3         | 1092.0         | 86.7   | 87.2   | 86.7                              | 87.1   | 86.5               | 86.9   | 7615               | 86.7   |
| 1997 | 7883.0         | 1092.0         | 83.1   | 86.2   | 82.6                              | 86.0   | 82.4               | 85.8   | 7302               | 83.4   |
| 1998 | 7154.1         | 1092.0         | 75.0   | 83.9   | 74.9                              | 83.8   | 74.8               | 83.6   | 6604               | 75.4   |
| 1999 | 9545.1         | 1092.0         | 100.0  | 86.6   | 99.9                              | 86.5   | 99.8               | 86.3   | 8760               | 100.0  |
| 2000 | 8233.7         | 1092.0         | 86.3   | 86.5   | 86.0                              | 86.4   | 85.8               | 86.2   | 7577               | 86.3   |
| 2001 | 8773.5         | 1092.0         | 91.8   | 87.2   | 91.8                              | 87.1   | 91.7               | 86.9   | 8046               | 91.8   |
| 2002 | 6436.4         | 1092.0         | 67.4   | 85.0   | 67.4                              | 84.9   | 67.3               | 84.7   | 5906               | 67.4   |
| 2003 | 3729.8         | 1092.0         | 39.1   | 80.4   | 39.1                              | 80.3   | 39.0               | 80.2   | 3415               | 39.0   |
| 2004 | 7279.7         | 1092.0         | 75.8   | 80.0   | 75.8                              | 79.9   | 75.9               | 79.8   | 6668               | 75.9   |



## JP-49 HAMAOKA-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 20 Jul | 1691.0 | 3.0     | XP   | N    | OUTAGE DUE TO SEASONAL VARIATIONS IN COOLING SEA WATER TEMPERATURE. |
| 28 Sep | 2116.0 | 2322.0  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.                               |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1994 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 476       |          |
| C. Inspection, maintenance or repair combined with refuelling | 2116            |           |          | 926   |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 55  |           |          |
| Z. Others   |                 |           |          |   | 96        |          |
| Subtotal  | 2116            | 0         | 0        | 981   | 572       | 0        |
| Total   | 2116            |           |          | 1553  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                      | 2004<br>Hours Lost | 1994 to 2004<br>Average Hours Lost Per Year |
|-----------------------------|--------------------|---|
| 11. Reactor and Accessories |                    | 476   |
| Total                       | 0                  | 476   |

# JP-23 IKATA-1

**Operator:** SHIKOKU (SHIKOKU ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 538.0 MW(e)  
**Design Net RUP:** 538.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3249.6 GW(e).h  
**Energy Availability Factor:** 67.6%  
**Load Factor:** 68.8%  
**Operating Factor:** 67.7%  
**Energy Unavailability Factor:** 32.4%  
**Total Off-line Time:** 2835 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 409.5 | 383.4 | 410.0 | 396.5 | 401.8 | 393.6 | 402.3 | 401.5 | 51.0 | 0.0   | 0.0   | 0.0   | 3249.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 98.1  | 100.0 | 99.8  | 100.0 | 13.1 | 0.0   | 0.0   | 0.0   | 67.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 98.1  | 100.0 | 99.8  | 100.0 | 13.1 | 0.0   | 0.0   | 0.0   | 67.6   |
| <b>LF (%)</b>   | 102.3 | 102.4 | 102.4 | 102.4 | 100.4 | 101.6 | 100.5 | 100.3 | 13.2 | 0.0   | 0.0   | 0.0   | 68.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 12.9 | 0.0   | 0.0   | 0.0   | 67.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 1.9   | 0.0   | 0.2   | 0.0   | 86.9 | 100.0 | 100.0 | 100.0 | 32.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 86.9 | 100.0 | 100.0 | 100.0 | 32.3   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 1.9   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|                                      |             |   |                  |
|--------------------------------------|-------------|---|------------------|
| <b>Date of Construction Start:</b>   | 15 Jun 1973 | <b>Lifetime Generation:</b>                     | 100932.5 GW(e).h |
| <b>Date of First Criticality:</b>    | 29 Jan 1977 | <b>Cumulative Energy Availability Factor:</b>   | 77.5%            |
| <b>Date of Grid Connection:</b>      | 17 Feb 1977 | <b>Cumulative Load Factor:</b>                  | 77.5%            |
| <b>Date of Commercial Operation:</b> | 30 Sep 1977 | <b>Cumulative Unit Capability Factor:</b>       | 77.6%            |
|                                      |             | <b>Cumulative Energy Unavailability Factor:</b> | 22.5%            |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4667.6         | 538.0          | 99.0   | 71.6   | 99.1                              | 71.6   | 99.0               | 71.6   | 8754               | 99.9   |
| 1984 | 3318.2         | 538.0          | 70.5   | 71.5   | 70.5                              | 71.5   | 70.2               | 71.4   | 6283               | 71.5   |
| 1985 | 3674.1         | 538.0          | 78.2   | 72.3   | 78.2                              | 72.3   | 78.0               | 72.2   | 6962               | 79.5   |
| 1986 | 3719.6         | 538.0          | 79.2   | 73.1   | 79.2                              | 73.1   | 78.9               | 73.0   | 7044               | 80.4   |
| 1987 | 4696.0         | 538.0          | 100.0  | 75.8   | 100.0                             | 75.8   | 99.6               | 75.6   | 8760               | 100.0  |
| 1988 | 3533.9         | 538.0          | 75.0   | 75.7   | 75.0                              | 75.7   | 74.8               | 75.6   | 6719               | 76.5   |
| 1989 | 3563.6         | 538.0          | 76.2   | 75.7   | 76.2                              | 75.7   | 75.6               | 75.6   | 6791               | 77.5   |
| 1990 | 3632.2         | 538.0          | 76.4   | 75.8   | 76.4                              | 75.8   | 77.1               | 75.7   | 6932               | 79.1   |
| 1991 | 4382.4         | 538.0          | 93.4   | 77.0   | 93.4                              | 77.0   | 93.0               | 76.9   | 8184               | 93.4   |
| 1992 | 3675.4         | 538.0          | 78.5   | 77.1   | 78.5                              | 77.1   | 77.8               | 77.0   | 6995               | 79.6   |
| 1993 | 3494.2         | 538.0          | 74.4   | 77.0   | 74.4                              | 77.0   | 74.1               | 76.8   | 6630               | 75.7   |
| 1994 | 3601.3         | 538.0          | 76.6   | 76.9   | 76.6                              | 76.9   | 76.4               | 76.8   | 6717               | 76.7   |
| 1995 | 3598.7         | 538.0          | 76.5   | 76.9   | 76.5                              | 76.9   | 76.4               | 76.8   | 6815               | 77.8   |
| 1996 | 3579.1         | 538.0          | 75.9   | 76.9   | 75.9                              | 76.9   | 75.7               | 76.7   | 6768               | 77.0   |
| 1997 | 4688.9         | 538.0          | 99.7   | 78.0   | 99.7                              | 78.0   | 99.5               | 77.8   | 8760               | 100.0  |
| 1998 | 3239.2         | 538.0          | 68.9   | 77.6   | 68.9                              | 77.6   | 68.7               | 77.4   | 6128               | 70.0   |
| 1999 | 3783.2         | 538.0          | 80.4   | 77.7   | 80.4                              | 77.7   | 80.3               | 77.5   | 7051               | 80.5   |
| 2000 | 3194.1         | 538.0          | 67.7   | 77.3   | 67.7                              | 77.3   | 67.6               | 77.1   | 5953               | 67.8   |
| 2001 | 4477.6         | 538.0          | 95.2   | 78.0   | 95.2                              | 78.0   | 95.0               | 77.8   | 8412               | 96.0   |
| 2002 | 3527.9         | 538.0          | 74.2   | 77.9   | 74.2                              | 77.9   | 74.9               | 77.7   | 6505               | 74.3   |
| 2003 | 3734.6         | 538.0          | 77.8   | 77.9   | 77.8                              | 77.9   | 79.2               | 77.8   | 6819               | 77.8   |
| 2004 | 3249.6         | 538.0          | 67.6   | 77.5   | 67.6                              | 77.5   | 68.8               | 77.5   | 5949               | 67.7   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 19 May | 17.0   | 7.6     | UP2  | L42  | HOUSE-LOAD OPERATION   |
| 04 Sep | 2835.0 | 1524.5  | PF   | C11  | PERIODICAL INSPECTION AND REFUELLING.[REACTOR CORE INTERNAL REPLACEMENT] |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1977 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 35        |          |
| C. Inspection, maintenance or repair combined with refuelling | 2835            |           |          | 1639  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 14  |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 0        |
| Z. Others   |                 |           |          |   | 17        |          |
| Subtotal  | 2835            | 0         | 0        | 1653  | 52        | 0        |
| Total   | 2835            |           |          | 1705  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1977 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 21  |
| 31. Turbine and auxiliaries         |                    | 13  |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 0                  | 34  |

**JP-32 IKATA-2**

Operator: SHIKOKU (SHIKOKU ELECTRIC POWER CO.)

Contractor: M (MITSUBISHI HEAVY INDUSTRY LTD)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 538.0 MW(e)  
 Design Net RUP: 538.0 MW(e)  
 Design Discharge Burnup: 30000 MW.d/t

**2. Production Summary 2004**

Energy Production: 3611.9 GW(e).h  
 Energy Availability Factor: 75.8%  
 Load Factor: 76.4%  
 Operating Factor: 76.1%  
 Energy Unavailability Factor: 24.2%  
 Total Off-line Time: 2101 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 410.2 | 384.0 | 410.2 | 263.5 | 0.0   | 0.0   | 227.1 | 396.8 | 381.0 | 394.6 | 384.2 | 360.4 | 3611.9 |
| EAF (%)  | 100.0 | 99.9  | 100.0 | 66.5  | 0.0   | 0.0   | 56.8  | 99.4  | 98.6  | 98.8  | 99.4  | 90.1  | 75.8   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 66.5  | 0.0   | 0.0   | 56.9  | 100.0 | 100.0 | 100.0 | 100.0 | 90.1  | 76.1   |
| LF (%)   | 102.5 | 102.5 | 102.5 | 68.0  | 0.0   | 0.0   | 56.7  | 99.1  | 98.4  | 98.6  | 99.2  | 90.0  | 76.4   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 63.3  | 0.0   | 0.0   | 59.9  | 100.0 | 100.0 | 100.0 | 100.0 | 89.9  | 76.1   |
| EUF (%)  | 0.0   | 0.1   | 0.0   | 33.5  | 100.0 | 100.0 | 43.2  | 0.6   | 1.4   | 1.2   | 0.6   | 9.9   | 24.2   |
| PUF (%)  | 0.0   | 0.1   | 0.0   | 33.5  | 100.0 | 100.0 | 43.2  | 0.0   | 0.0   | 0.0   | 0.0   | 9.9   | 23.9   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 1.4   | 1.2   | 0.6   | 0.0   | 0.3    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 21 Feb 1978      Lifetime Generation: 90251.7 GW(e).h  
 Date of First Criticality: 31 Jul 1981      Cumulative Energy Availability Factor: 82.3%  
 Date of Grid Connection: 19 Aug 1981      Cumulative Load Factor: 82.2%  
 Date of Commercial Operation: 19 Mar 1982      Cumulative Unit Capability Factor: 77.9%  
    Cumulative Energy Unavailability Factor: 17.7%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 3575.0            | 538.0             | 75.9   | 75.9   | 75.9                                 | 75.9   | 75.9               | 75.9   | 6798                  | 77.6   |
| 1984 | 3776.6            | 538.0             | 80.3   | 78.1   | 80.1                                 | 78.0   | 79.9               | 77.9   | 7157                  | 81.5   |
| 1985 | 3694.1            | 538.0             | 78.6   | 78.3   | 78.6                                 | 78.2   | 78.4               | 78.1   | 6995                  | 79.9   |
| 1986 | 4698.6            | 538.0             | 100.0  | 83.7   | 100.0                                | 83.6   | 99.7               | 83.5   | 8760                  | 100.0  |
| 1987 | 3758.7            | 538.0             | 80.5   | 83.1   | 80.5                                 | 83.0   | 79.8               | 82.7   | 7137                  | 81.5   |
| 1988 | 3541.5            | 538.0             | 75.1   | 81.7   | 75.1                                 | 81.7   | 74.9               | 81.4   | 6743                  | 76.8   |
| 1989 | 3751.3            | 538.0             | 79.8   | 81.5   | 79.8                                 | 81.4   | 79.6               | 81.2   | 7128                  | 81.4   |
| 1990 | 4694.9            | 538.0             | 100.0  | 83.8   | 99.9                                 | 83.7   | 99.6               | 83.5   | 8760                  | 100.0  |
| 1991 | 3526.2            | 538.0             | 75.2   | 82.8   | 75.2                                 | 82.8   | 74.8               | 82.5   | 6731                  | 76.8   |
| 1992 | 3479.9            | 538.0             | 74.3   | 82.0   | 74.3                                 | 82.0   | 73.6               | 81.6   | 6639                  | 75.6   |
| 1993 | 3588.6            | 538.0             | 76.4   | 81.5   | 76.4                                 | 81.4   | 76.1               | 81.1   | 6799                  | 77.6   |
| 1994 | 4700.6            | 538.0             | 99.9   | 83.0   | 99.9                                 | 83.0   | 99.7               | 82.7   | 8760                  | 100.0  |
| 1995 | 3720.9            | 538.0             | 79.0   | 82.7   | 79.0                                 | 82.7   | 79.0               | 82.4   | 7014                  | 80.1   |
| 1996 | 3664.8            | 538.0             | 77.7   | 82.3   | 77.7                                 | 82.3   | 77.5               | 82.0   | 6935                  | 79.0   |
| 1997 | 3610.4            | 538.0             | 76.8   | 82.0   | 76.8                                 | 82.0   | 76.6               | 81.7   | 6831                  | 78.0   |
| 1998 | 4701.1            | 538.0             | 99.9   | 83.1   | 99.9                                 | 83.1   | 99.7               | 82.8   | 8760                  | 100.0  |
| 1999 | 3734.4            | 538.0             | 79.5   | 82.9   | 79.5                                 | 82.9   | 79.2               | 82.6   | 6973                  | 79.6   |
| 2000 | 3695.0            | 538.0             | 78.3   | 82.6   | 78.3                                 | 82.6   | 78.2               | 82.4   | 6888                  | 78.4   |
| 2001 | 3145.7            | 538.0             | 67.0   | 81.8   | 66.9                                 | 81.8   | 66.7               | 81.5   | 5875                  | 67.1   |
| 2002 | 4718.5            | 538.0             | 99.2   | 82.7   | 99.2                                 | 82.7   | 100.1              | 82.5   | 8698                  | 99.3   |
| 2003 | 3904.7            | 538.0             | 81.6   | 82.6   | 81.6                                 | 82.6   | 82.9               | 82.5   | 7150                  | 81.6   |
| 2004 | 3611.9            | 538.0             | 76.1   | 82.3   | 75.8                                 | 82.3   | 76.4               | 82.2   | 6683                  | 76.1   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 20 Apr | 2026.0 | 1090.3  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.                            |
| 01 Aug | 2928.0 | 14.8    | XP   | N    | RISE OF SEAWATER TEMPERATURE.                                    |
| 28 Dec | 75.0   | 39.5    | PF   | G42  | REPLACE MAIN TRANSFORMER'S CV CABLES FOR PREVENTIVE MAINTENANCE. |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1982 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| C. Inspection, maintenance or repair combined with refuelling                   | 2026            |           |          | 1349  |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling | 75              |           |          |   |           |          |
| J. Grid failure or grid unavailability  |                 |           |          |   |           | 0        |
| Subtotal  | 2101            | 0         | 0        | 1349  | 0         | 0        |
| Total   | 2101            |           |          | 1349  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System | 2004<br>Hours Lost | 1982 to 2004<br>Average Hours Lost Per Year |
|--------|--------------------|---|
|        |                    |   |

The reactor has not yet completed a full year of commercial operation.

## JP-47 IKATA-3

**Operator:** SHIKOKU (SHIKOKU ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 846.0 MW(e)  
**Design Net RUP:** 846.0 MW(e)  
**Design Discharge Burnup:** 22000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7828.9 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 105.4%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 665.3 | 622.7 | 665.2 | 643.2 | 664.8 | 642.8 | 661.7 | 659.4 | 636.9 | 659.7 | 642.2 | 665.0 | 7828.9 |
| <b>EAFF (%)</b> | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 105.7 | 105.8 | 105.7 | 105.7 | 105.6 | 105.5 | 105.1 | 104.8 | 104.6 | 104.7 | 105.4 | 105.6 | 105.4  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Nov 1986  
**Date of First Criticality:** 23 Feb 1994  
**Date of Grid Connection:** 29 Mar 1994  
**Date of Commercial Operation:** 15 Dec 1994

**Lifetime Generation:** 67110.6 GW(e).h  
**Cumulative Energy Availability Factor:** 85.6%  
**Cumulative Load Factor:** 87.5%  
**Cumulative Unit Capability Factor:** 81.5%  
**Cumulative Energy Unavailability Factor:** 14.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1994 | 2195.5         | 846.0          | 0.0  | 0.0    | 31.6                              | 100.0  | 31.6               | 0.0    | 3669               | 44.7   |
| 1995 | 7491.8         | 846.0          | 100.0  | 100.0  | 100.0                             | 100.0  | 101.1              | 101.1  | 8760               | 100.0  |
| 1996 | 5578.2         | 846.0          | 74.2   | 87.1   | 74.2                              | 87.1   | 75.1               | 88.1   | 6621               | 75.4   |
| 1997 | 6134.7         | 846.0          | 81.9   | 85.4   | 81.9                              | 85.4   | 82.8               | 86.3   | 7242               | 82.7   |
| 1998 | 6250.4         | 846.0          | 83.4   | 84.9   | 83.4                              | 84.9   | 84.3               | 85.8   | 7374               | 84.2   |
| 1999 | 6298.4         | 846.0          | 84.1   | 84.7   | 84.1                              | 84.7   | 85.0               | 85.6   | 7368               | 84.1   |
| 2000 | 6660.3         | 846.0          | 88.7   | 85.4   | 88.7                              | 85.4   | 89.6               | 86.3   | 7790               | 88.7   |
| 2001 | 6210.7         | 846.0          | 82.9   | 85.0   | 82.9                              | 85.0   | 83.8               | 86.0   | 7267               | 83.0   |
| 2002 | 6599.5         | 846.0          | 85.8   | 85.1   | 85.8                              | 85.1   | 89.1               | 86.3   | 7518               | 85.8   |
| 2003 | 5862.1         | 846.0          | 74.9   | 84.0   | 74.9                              | 84.0   | 79.1               | 85.5   | 6560               | 74.9   |
| 2004 | 7828.9         | 846.0          | 100.0  | 85.6   | 100.0                             | 85.6   | 105.4              | 87.5   | 8784               | 100.0  |

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### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1996 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair<br>combined with refuelling |                 |           |          | 1245  | 131       |          |
| Subtotal   | 0               | 0         | 0        | 1245  | 131       | 0        |
| Total  | 0               |           |          | 1376  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1996 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 41. Main Generator Systems          |                    | 26  |
| 42. Electrical Power Supply Systems |                    | 104   |
| Total                               | 0                  | 130   |

# JP-33 KASHIWAZAKI KARIWA-1

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1067.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** 33000IN. MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6496.7 GW(e).h  
**Energy Availability Factor:** 69.2%  
**Load Factor:** 69.3%  
**Operating Factor:** 70.3%  
**Energy Unavailability Factor:** 30.8%  
**Total Off-line Time:** 2613 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 543.8 | 798.9 | 703.2 | 519.2 | 789.7 | 768.4 | 798.2 | 774.5 | 800.9 | 6496.7 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 71.0  | 100.0 | 91.4  | 66.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 69.2   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 71.0  | 100.0 | 91.4  | 66.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 69.2   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 70.9  | 100.6 | 91.5  | 65.4  | 99.5  | 100.0 | 100.4 | 100.8 | 100.9 | 69.3   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 71.1  | 100.0 | 100.0 | 70.4  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 70.3   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 29.0  | 0.0   | 8.6   | 33.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.8   |
| <b>PUF (%)</b>  | 100.0 | 48.3  | 0.0   | 5.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.7   |
| <b>UCLF (%)</b> | 0.0   | 51.7  | 100.0 | 23.5  | 0.0   | 8.6   | 33.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 18.1   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 05 Jun 1980  
**Date of First Criticality:** 12 Dec 1984  
**Date of Grid Connection:** 13 Feb 1985  
**Date of Commercial Operation:** 18 Sep 1985

**Lifetime Generation:** 136645.4 GW(e).h  
**Cumulative Energy Availability Factor:** 75.1%  
**Cumulative Load Factor:** 74.1%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 24.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 4960.2         | 1067.0         | 0.0  | 0.0    | 54.9                              | 100.0  | 54.9               | 0.0    | 5793               | 68.4   |
| 1986 | 6703.7         | 1067.0         | 73.0   | 73.0   | 73.0                              | 73.0   | 71.7               | 71.7   | 6463               | 73.8   |
| 1987 | 9195.5         | 1067.0         | 100.0  | 86.5   | 100.0                             | 86.5   | 98.4               | 85.1   | 8760               | 100.0  |
| 1988 | 6959.7         | 1067.0         | 75.0   | 82.7   | 75.0                              | 82.7   | 74.3               | 81.4   | 6660               | 75.8   |
| 1989 | 6442.3         | 1067.0         | 69.7   | 79.4   | 69.7                              | 79.4   | 68.9               | 78.3   | 6236               | 71.2   |
| 1990 | 5987.4         | 1067.0         | 65.0   | 76.5   | 65.0                              | 76.5   | 64.1               | 75.5   | 5711               | 65.2   |
| 1991 | 9031.6         | 1067.0         | 97.9   | 80.1   | 97.9                              | 80.1   | 96.6               | 79.0   | 8618               | 98.4   |
| 1992 | 6958.1         | 1067.0         | 75.8   | 79.5   | 75.4                              | 79.4   | 74.2               | 78.3   | 6728               | 76.6   |
| 1993 | 6874.3         | 1067.0         | 74.7   | 78.9   | 74.7                              | 78.8   | 73.5               | 77.7   | 6575               | 75.1   |
| 1994 | 7020.2         | 1067.0         | 76.1   | 78.6   | 76.1                              | 78.5   | 75.1               | 77.4   | 6744               | 77.0   |
| 1995 | 9235.2         | 1067.0         | 100.0  | 80.7   | 100.0                             | 80.7   | 98.8               | 79.6   | 8760               | 100.0  |
| 1996 | 6814.4         | 1067.0         | 73.6   | 80.1   | 73.6                              | 80.0   | 72.7               | 78.9   | 6469               | 73.6   |
| 1997 | 7899.9         | 1067.0         | 85.7   | 80.5   | 85.7                              | 80.5   | 84.5               | 79.4   | 7525               | 85.9   |
| 1998 | 6176.2         | 1067.0         | 67.4   | 79.5   | 67.4                              | 79.5   | 66.1               | 78.4   | 5960               | 68.0   |
| 1999 | 9198.8         | 1067.0         | 99.8   | 81.0   | 99.7                              | 80.9   | 98.4               | 79.8   | 8760               | 100.0  |
| 2000 | 7714.7         | 1067.0         | 83.6   | 81.2   | 83.6                              | 81.1   | 82.3               | 80.0   | 7346               | 83.6   |
| 2001 | 7070.5         | 1067.0         | 76.9   | 80.9   | 76.9                              | 80.9   | 75.6               | 79.7   | 6743               | 77.0   |
| 2002 | 5906.2         | 1067.0         | 64.2   | 79.9   | 64.2                              | 79.9   | 63.2               | 78.7   | 5628               | 64.2   |
| 2003 | 0.0            | 1067.0         | 0.0  | 75.5   | 0.0                               | 75.4   | 0.0                | 74.4   | 0                  | 0.0    |
| 2004 | 6496.7         | 1067.0         | 69.2   | 75.1   | 69.2                              | 75.1   | 69.3               | 74.1   | 6171               | 70.3   |



**JP-33 KASHIWAZAKI KARIWA-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1080.0 | 1152.4  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 15 Feb | 1312.0 | 1400.1  | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION,ETC. |
| 21 Jun | 339.0  | 98.9    | UP2  | A34  | HYDROGEN AND OXYGEN INJECTION EQUIPMENT REPAIR.   |
| 09 Jul | 220.0  | 234.8   | UF4  | A41  | FORCED OUTAGE DUE TO THE TROUBLE OF THE GENERATOR GROUND FAULT OVERVOLTAGE RELAY.           |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 220       |          |   | 374       |          |
| C. Inspection, maintenance or repair combined with refuelling | 1080            |           |          | 1564  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 45  |           |          |
| Z. Others   |                 | 1312      |          |   | 26        |          |
| Subtotal  | 1080            | 1532      | 0        | 1609  | 400       | 0        |
| Total   |                 | 2612      |          |   | 2009      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                                   | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 64  |
| 15. Reactor Cooling Systems              |                    | 259   |
| 21. Fuel Handling and Storage Facilities |                    | 50  |
| 41. Main Generator Systems               | 220                |   |
| Total                                    | 220                | 373   |

# JP-39 KASHIWAZAKI KARIWA-2

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1067.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4660.3 GW(e).h  
**Energy Availability Factor:** 49.6%  
**Load Factor:** 49.7%  
**Operating Factor:** 49.6%  
**Energy Unavailability Factor:** 50.4%  
**Total Off-line Time:** 4423 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 731.4 | 790.4 | 768.1 | 797.2 | 773.2 | 799.9 | 4660.3 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 92.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.6   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 92.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.6   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 92.1  | 99.6  | 100.0 | 100.4 | 100.7 | 100.8 | 49.7   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 92.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.6   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 7.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 50.4   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 35.5  | 0.0   | 4.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 36.4   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 64.5  | 100.0 | 3.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.9   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 18 Nov 1985  
**Date of First Criticality:** 30 Nov 1989  
**Date of Grid Connection:** 08 Feb 1990  
**Date of Commercial Operation:** 28 Sep 1990

**Lifetime Generation:** 101984.4 GW(e).h  
**Cumulative Energy Availability Factor:** 74.8%  
**Cumulative Load Factor:** 73.8%  
**Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 25.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 5386.3         | 1067.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 57.6               | 0.0    | 6071               | 69.3   |
| 1991 | 6642.4         | 1067.0         | 72.4   | 72.4   | 72.4                              | 72.4   | 71.1               | 71.1   | 6440               | 73.5   |
| 1992 | 9046.9         | 1067.0         | 97.9   | 85.2   | 97.9                              | 85.2   | 96.5               | 83.8   | 8623               | 98.2   |
| 1993 | 7212.6         | 1067.0         | 78.5   | 83.0   | 78.3                              | 82.9   | 77.2               | 81.6   | 6911               | 78.9   |
| 1994 | 7291.1         | 1067.0         | 79.0   | 82.0   | 79.0                              | 81.9   | 78.0               | 80.7   | 6962               | 79.5   |
| 1995 | 7696.8         | 1067.0         | 83.4   | 82.3   | 83.4                              | 82.2   | 82.3               | 81.0   | 7329               | 83.7   |
| 1996 | 8811.1         | 1067.0         | 95.3   | 84.4   | 95.2                              | 84.4   | 94.0               | 83.2   | 8396               | 95.6   |
| 1997 | 7284.4         | 1067.0         | 79.1   | 83.7   | 79.1                              | 83.6   | 77.9               | 82.4   | 6913               | 78.9   |
| 1998 | 8142.1         | 1067.0         | 88.4   | 84.3   | 88.4                              | 84.2   | 87.1               | 83.0   | 7769               | 88.7   |
| 1999 | 8208.8         | 1067.0         | 89.2   | 84.8   | 89.1                              | 84.8   | 87.8               | 83.6   | 7814               | 89.2   |
| 2000 | 8140.0         | 1067.0         | 88.3   | 85.2   | 88.3                              | 85.1   | 86.8               | 83.9   | 7760               | 88.3   |
| 2001 | 7595.5         | 1067.0         | 82.5   | 84.9   | 82.4                              | 84.9   | 81.3               | 83.7   | 7223               | 82.5   |
| 2002 | 5866.2         | 1067.0         | 63.1   | 83.1   | 63.1                              | 83.1   | 62.8               | 81.9   | 5532               | 63.2   |
| 2003 | 0.0            | 1067.0         | 0.0  | 76.7   | 0.0                               | 76.7   | 0.0                | 75.6   | 0                  | 0.0    |
| 2004 | 4660.3         | 1067.0         | 49.6   | 74.8   | 49.6                              | 74.8   | 49.7               | 73.8   | 4361               | 49.6   |

**JP-39 KASHIWAZAKI KARIWA-2****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 3168.0 | 3380.3  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 12 May | 1255.0 | 1339.9  | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION,ETC. |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1991 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 466       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling | 3168            |           |          | 1385  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 17  |           |          |
| Z. Others   |                 | 1255      |          |   |           |          |
| Subtotal  | 3168            | 1255      | 0        | 1402  | 479       | 0        |
| Total   |                 | 4423      |          |   | 1881      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                        | 2004<br>Hours Lost | 1991 to 2004<br>Average Hours Lost Per Year |
|-------------------------------|--------------------|---|
| 13. Reactor Auxiliary Systems |                    | 15  |
| 15. Reactor Cooling Systems   |                    | 413   |
| 31. Turbine and auxiliaries   |                    | 37  |
| Total                         | 0                  | 465   |

# JP-52 KASHIWAZAKI KARIWA-3

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1067.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 6550.0 GW(e).h  
**Energy Availability Factor:** 69.9%  
**Load Factor:** 69.9%  
**Operating Factor:** 69.4%  
**Energy Unavailability Factor:** 30.1%  
**Total Off-line Time:** 2691 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 268.9 | 797.2 | 770.0 | 792.2 | 790.6 | 767.7 | 795.9 | 770.3 | 797.0 | 6550.0 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 36.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 69.9   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 36.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 69.9   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 35.1  | 100.4 | 100.2 | 99.8  | 99.6  | 99.9  | 100.1 | 100.3 | 100.4 | 69.9   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 29.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 69.4   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 63.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.1   |
| <b>PUF (%)</b>  | 100.0 | 93.1  | 0.0   | 4.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.2   |
| <b>UCLF (%)</b> | 0.0   | 6.9   | 100.0 | 58.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.8   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 07 Mar 1989  
**Date of First Criticality:** 19 Oct 1992  
**Date of Grid Connection:** 08 Dec 1992  
**Date of Commercial Operation:** 11 Aug 1993

**Lifetime Generation:** 81830.1 GW(e).h  
**Cumulative Energy Availability Factor:** 74.0%  
**Cumulative Load Factor:** 73.2%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 26.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1992 | 53.0           | 1067.0         | 0.0  | 0.0    | 0.6                               | 100.0  | 0.6                | 0.0    | 367                | 4.2    |
| 1993 | 6488.4         | 1067.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 69.4               | 0.0    | 6755               | 77.1   |
| 1994 | 7264.4         | 1067.0         | 78.9   | 78.9   | 78.9                              | 78.9   | 77.7               | 77.7   | 6961               | 79.5   |
| 1995 | 9253.9         | 1067.0         | 100.0  | 89.5   | 100.0                             | 89.5   | 99.0               | 88.4   | 8760               | 100.0  |
| 1996 | 7921.6         | 1067.0         | 85.5   | 88.1   | 85.5                              | 88.1   | 84.5               | 87.1   | 7508               | 85.5   |
| 1997 | 8016.2         | 1067.0         | 86.8   | 87.8   | 86.8                              | 87.8   | 85.8               | 86.8   | 7601               | 86.8   |
| 1998 | 6748.0         | 1067.0         | 73.1   | 84.8   | 73.1                              | 84.8   | 72.2               | 83.8   | 6467               | 73.8   |
| 1999 | 9028.3         | 1067.0         | 97.8   | 87.0   | 97.7                              | 87.0   | 96.6               | 86.0   | 8568               | 97.8   |
| 2000 | 7945.1         | 1067.0         | 85.8   | 86.8   | 85.8                              | 86.8   | 84.8               | 85.8   | 7539               | 85.8   |
| 2001 | 6985.7         | 1067.0         | 75.8   | 85.5   | 75.8                              | 85.4   | 74.7               | 84.4   | 6639               | 75.8   |
| 2002 | 5575.5         | 1067.0         | 60.4   | 82.7   | 60.4                              | 82.7   | 59.7               | 81.7   | 5300               | 60.5   |
| 2003 | 0.0            | 1067.0         | 0.0  | 74.4   | 0.0                               | 74.4   | 0.0                | 73.5   | 0                  | 0.0    |
| 2004 | 6550.0         | 1067.0         | 69.9   | 74.0   | 69.9                              | 74.0   | 69.9               | 73.2   | 6093               | 69.4   |

**JP-52 KASHIWAZAKI KARIWA-3****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1392.0 | 1485.3  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 28 Feb | 1299.0 | 1332.6  | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION. |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1994 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 732       |          |
| C. Inspection, maintenance or repair combined with refuelling | 1392            |           |          | 1295  |           |          |
| Z. Others   |                 | 1299      |          |   |           |          |
| Subtotal  | 1392            | 1299      | 0        | 1295  | 732       | 0        |
| Total   |                 | 2691      |          |   | 2027      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                      | 2004<br>Hours Lost | 1994 to 2004<br>Average Hours Lost Per Year |
|-----------------------------|--------------------|---|
| 11. Reactor and Accessories |                    | 711   |
| 15. Reactor Cooling Systems |                    | 21  |
| Total                       | 0                  | 732   |

**JP-53 KASHIWAZAKI KARIWA-4**

Operator: TEPCO (TOKYO ELECTRIC POWER CO.)

Contractor: HITACHI (HITACHI LTD.)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1067.0 MW(e)  
 Design Net RUP: 1067.0 MW(e)  
 Design Discharge Burnup: —

**2. Production Summary 2004**

Energy Production: 5623.7 GW(e).h  
 Energy Availability Factor: 59.9%  
 Load Factor: 60.0%  
 Operating Factor: 59.9%  
 Energy Unavailability Factor: 40.1%  
 Total Off-line Time: 3526 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 799.0 | 746.3 | 798.7 | 773.1 | 798.8 | 769.9 | 790.7 | 147.2 | 0.0   | 0.0   | 0.0   | 0.0   | 5623.7 |
| EAF (%)  | 100.0 | 99.8  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 20.0  | 0.0   | 0.0   | 0.0   | 0.0   | 59.9   |
| UCF (%)  | 100.0 | 99.8  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 20.1  | 0.0   | 0.0   | 0.0   | 0.0   | 59.9   |
| LF (%)   | 100.7 | 100.5 | 100.6 | 100.6 | 100.6 | 100.2 | 99.6  | 18.5  | 0.0   | 0.0   | 0.0   | 0.0   | 60.0   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 19.6  | 0.0   | 0.0   | 0.0   | 0.0   | 59.9   |
| EUF (%)  | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 80.0  | 100.0 | 100.0 | 100.0 | 100.0 | 40.1   |
| PUF (%)  | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 79.9  | 100.0 | 100.0 | 100.0 | 22.6  | 33.6   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 77.4  | 6.6    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 05 Mar 1990  
 Date of First Criticality: 01 Nov 1993  
 Date of Grid Connection: 21 Dec 1993  
 Date of Commercial Operation: 11 Aug 1994

Lifetime Generation: 76779.1 GW(e).h  
 Cumulative Energy Availability Factor: 76.4%  
 Cumulative Load Factor: 75.6%  
 Cumulative Unit Capability Factor: 81.5%  
 Cumulative Energy Unavailability Factor: 23.6%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1993 | 11.6              | 1067.0            | 0.0  | 0.0    | 0.1                                  | 100.0  | 0.1                | 0.0    | 74                    | 0.8    |
| 1994 | 6040.1            | 1067.0            | 0.0  | 0.0    | 99.9                                 | 100.0  | 64.6               | 0.0    | 6638                  | 75.8   |
| 1995 | 6182.5            | 1067.0            | 67.0   | 67.0   | 67.0                                 | 67.0   | 66.1               | 66.1   | 5889                  | 67.2   |
| 1996 | 8068.0            | 1067.0            | 87.0   | 77.0   | 87.1                                 | 77.0   | 86.1               | 76.1   | 7651                  | 87.1   |
| 1997 | 7516.7            | 1067.0            | 81.7   | 78.6   | 81.5                                 | 78.5   | 80.4               | 77.6   | 7207                  | 82.3   |
| 1998 | 9258.7            | 1067.0            | 100.0  | 83.9   | 100.0                                | 83.9   | 99.1               | 82.9   | 8760                  | 100.0  |
| 1999 | 8141.7            | 1067.0            | 88.1   | 84.8   | 88.1                                 | 84.7   | 87.1               | 83.8   | 7719                  | 88.1   |
| 2000 | 6918.9            | 1067.0            | 75.1   | 83.2   | 75.1                                 | 83.1   | 73.8               | 82.1   | 6602                  | 75.2   |
| 2001 | 5591.4            | 1067.0            | 60.6   | 79.9   | 60.6                                 | 79.9   | 59.8               | 78.9   | 5343                  | 61.0   |
| 2002 | 9239.9            | 1067.0            | 100.0  | 82.4   | 99.9                                 | 82.4   | 98.9               | 81.4   | 8760                  | 100.0  |
| 2003 | 4185.8            | 1067.0            | 45.0   | 78.3   | 45.0                                 | 78.3   | 44.8               | 77.3   | 3946                  | 45.0   |
| 2004 | 5623.7            | 1067.0            | 59.9   | 76.4   | 59.9                                 | 76.4   | 60.0               | 75.6   | 5258                  | 59.9   |

## JP-53 KASHIWAZAKI KARIWA-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 07 Aug | 2950.0 | 3144.3  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.  |
| 08 Dec | 576.0  | 614.6   | UF3  | A12  | EXTENSION OF PERIODICAL INSPECTION DUE TO THE REPAIR OF THE PRIMARY LOOP RECIRCULATION PIPING. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1995 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 576       |          |  | 552       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 2950            |           |          | 1085                                     |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 63        |          |
| Subtotal   | 2950            | 576       | 0        | 1085                                     | 615       | 0        |
| Total  |                 | 3526      |          |  | 1700      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1995 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 576             |  |
| 15. Reactor Cooling Systems         |                 | 228                                      |
| 31. Turbine and auxiliaries         |                 | 50                                       |
| 41. Main Generator Systems          |                 | 187                                      |
| 42. Electrical Power Supply Systems |                 | 85                                       |
| Total                               | 576             | 550                                      |

# JP-40 KASHIWAZAKI KARIWA-5

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** HITACHI (HITACHI LTD.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1067.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6134.8 GW(e).h  
**Energy Availability Factor:** 65.3%  
**Load Factor:** 65.5%  
**Operating Factor:** 65.3%  
**Energy Unavailability Factor:** 34.7%  
**Total Off-line Time:** 3046 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 643.2 | 771.8 | 792.8 | 790.7 | 768.0 | 797.1 | 771.7 | 799.4 | 6134.8 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 80.8  | 99.9  | 99.7  | 99.9  | 100.0 | 100.0 | 99.8  | 100.0 | 65.3   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 80.8  | 99.9  | 99.7  | 99.9  | 100.0 | 100.0 | 99.9  | 100.0 | 65.3   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 81.0  | 100.5 | 99.9  | 99.6  | 100.0 | 100.4 | 100.4 | 100.7 | 65.5   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 80.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 65.3   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 19.2  | 0.1   | 0.3   | 0.1   | 0.0   | 0.0   | 0.2   | 0.0   | 34.7   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 64.5  | 0.5   | 19.2  | 0.0   | 0.3   | 0.1   | 0.0   | 0.0   | 0.2   | 0.0   | 23.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 35.5  | 99.5  | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.2   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 20 Jun 1985  
**Date of First Criticality:** 20 Jul 1989  
**Date of Grid Connection:** 12 Sep 1989  
**Date of Commercial Operation:** 10 Apr 1990

**Lifetime Generation:** 110943.2 GW(e).h  
**Cumulative Energy Availability Factor:** 78.8%  
**Cumulative Load Factor:** 77.9%  
**Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 21.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 1041.5         | 1067.0         | 0.0  | 0.0    | 11.1                              | 100.0  | 11.1               | 0.0    | 1850               | 21.1   |
| 1990 | 7910.6         | 1067.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 84.6               | 0.0    | 7597               | 86.7   |
| 1991 | 7093.3         | 1067.0         | 76.7   | 76.7   | 76.7                              | 76.7   | 75.9               | 75.9   | 6789               | 77.5   |
| 1992 | 6977.5         | 1067.0         | 75.5   | 76.1   | 75.5                              | 76.1   | 74.4               | 75.2   | 6715               | 76.4   |
| 1993 | 9238.2         | 1067.0         | 99.9   | 84.0   | 99.9                              | 84.0   | 98.8               | 83.0   | 8760               | 100.0  |
| 1994 | 7154.7         | 1067.0         | 77.5   | 82.4   | 77.5                              | 82.4   | 76.5               | 81.4   | 6825               | 77.9   |
| 1995 | 7508.3         | 1067.0         | 81.5   | 82.2   | 81.5                              | 82.2   | 80.3               | 81.2   | 7183               | 82.0   |
| 1996 | 7905.8         | 1067.0         | 85.6   | 82.8   | 85.6                              | 82.8   | 84.4               | 81.7   | 7524               | 85.7   |
| 1997 | 8919.1         | 1067.0         | 96.6   | 84.8   | 96.6                              | 84.8   | 95.4               | 83.7   | 8472               | 96.7   |
| 1998 | 7352.6         | 1067.0         | 79.6   | 84.1   | 79.6                              | 84.1   | 78.7               | 83.1   | 6995               | 79.9   |
| 1999 | 7771.8         | 1067.0         | 84.3   | 84.1   | 84.3                              | 84.1   | 83.1               | 83.1   | 7383               | 84.3   |
| 2000 | 7042.7         | 1067.0         | 76.4   | 83.4   | 76.3                              | 83.3   | 75.1               | 82.3   | 6712               | 76.4   |
| 2001 | 9198.6         | 1067.0         | 99.6   | 84.8   | 99.6                              | 84.8   | 98.4               | 83.7   | 8760               | 100.0  |
| 2002 | 8191.0         | 1067.0         | 88.3   | 85.1   | 88.3                              | 85.1   | 87.6               | 84.1   | 7743               | 88.4   |
| 2003 | 1503.1         | 1067.0         | 16.1   | 79.8   | 16.1                              | 79.8   | 16.1               | 78.8   | 1392               | 15.9   |
| 2004 | 6134.8         | 1067.0         | 65.3   | 78.8   | 65.3                              | 78.8   | 65.5               | 77.9   | 5738               | 65.3   |



**JP-40 KASHIWAZAKI KARIWA-5****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1920.0 | 2048.6  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 21 Mar | 980.0  | 1045.3  | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION. |
| 30 Apr | 146.0  | 155.9   | PF   | C    | PERIODICAL INSPECTION AND STARTUP   |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1991 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 353       |          |
| C. Inspection, maintenance or repair combined with refuelling | 2066            |           |          | 1256  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 16  |           |          |
| Z. Others   |                 | 980       |          |   |           |          |
| Subtotal  | 2066            | 980       | 0        | 1272  | 353       | 0        |
| Total   |                 | 3046      |          |   | 1625      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                      | 2004<br>Hours Lost | 1991 to 2004<br>Average Hours Lost Per Year |
|-----------------------------|--------------------|---|
| 15. Reactor Cooling Systems |                    | 344   |
| 31. Turbine and auxiliaries |                    | 9   |
| Total                       | 0                  | 353   |

# JP-55 KASHIWAZAKI KARIWA-6

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** TOSHI/GE (TOSHIBA CORPORATION/GENERAL ELECTRIC CO.)

## 1. Station Details

**Type:** ABWR  
**Net Reference Unit Power at the beginning of 2004:** 1315.0 MW(e)  
**Design Net RUP:** 1315.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 8635.2 GW(e).h  
**Energy Availability Factor:** 72.7%  
**Load Factor:** 74.8%  
**Operating Factor:** 73.0%  
**Energy Unavailability Factor:** 27.3%  
**Total Off-line Time:** 2374 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb   | Mar   | Apr   | May    | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec    | Annual |
|-----------------|--------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|--------|--------|
| <b>GW(e).h</b>  | 1014.6 | 923.3 | 997.3 | 970.0 | 1011.4 | 973.3 | 272.5 | 0.0   | 0.0   | 484.5 | 976.2 | 1012.1 | 8635.2 |
| <b>EAF (%)</b>  | 100.0  | 97.4  | 99.2  | 99.7  | 100.0  | 99.9  | 28.2  | 0.0   | 0.0   | 49.8  | 100.0 | 100.0  | 72.7   |
| <b>UCF (%)</b>  | 100.0  | 97.4  | 99.2  | 99.7  | 100.0  | 99.9  | 28.2  | 0.0   | 0.0   | 49.8  | 100.0 | 100.0  | 72.7   |
| <b>LF (%)</b>   | 103.7  | 100.9 | 101.9 | 102.6 | 103.4  | 102.8 | 27.9  | 0.0   | 0.0   | 49.5  | 103.1 | 103.4  | 74.8   |
| <b>OF (%)</b>   | 100.0  | 100.0 | 100.0 | 100.1 | 100.0  | 100.0 | 26.9  | 0.0   | 0.0   | 50.7  | 100.0 | 100.0  | 73.0   |
| <b>EUF (%)</b>  | 0.0    | 2.6   | 0.8   | 0.3   | 0.0    | 0.1   | 71.8  | 100.0 | 100.0 | 50.2  | 0.0   | 0.0    | 27.3   |
| <b>PUF (%)</b>  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 0.1   | 71.8  | 100.0 | 73.3  | 2.3   | 0.0   | 0.0    | 20.8   |
| <b>UCLF (%)</b> | 0.0    | 2.6   | 0.8   | 0.3   | 0.0    | 0.0   | 0.0   | 0.0   | 26.7  | 47.9  | 0.0   | 0.0    | 6.6    |
| <b>XUF (%)</b>  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 03 Nov 1992      **Lifetime Generation:** 83459.5 GW(e).h  
**Date of First Criticality:** 18 Dec 1995      **Cumulative Energy Availability Factor:** 84.1%  
**Date of Grid Connection:** 29 Jan 1996      **Cumulative Load Factor:** 84.4%  
**Date of Commercial Operation:** 07 Nov 1996      **Cumulative Unit Capability Factor:** 82.2%  
**Cumulative Energy Unavailability Factor:** 15.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1996 | 5663.2         | 1315.0         | 0.0  | 0.0    | 49.0                              | 100.0  | 49.0               | 0.0    | 5240               | 59.7   |
| 1997 | 10161.5        | 1315.0         | 88.4   | 88.4   | 88.4                              | 88.4   | 88.2               | 88.2   | 7752               | 88.5   |
| 1998 | 10702.3        | 1315.0         | 93.3   | 90.8   | 93.3                              | 90.9   | 92.9               | 90.6   | 8217               | 93.8   |
| 1999 | 9710.4         | 1315.0         | 84.8   | 88.8   | 84.8                              | 88.8   | 84.3               | 88.5   | 7480               | 85.4   |
| 2000 | 9411.6         | 1315.0         | 81.8   | 87.0   | 81.8                              | 87.1   | 81.5               | 86.7   | 7183               | 81.8   |
| 2001 | 9270.0         | 1315.0         | 80.7   | 85.8   | 80.7                              | 85.8   | 80.5               | 85.5   | 7079               | 80.8   |
| 2002 | 11504.1        | 1315.0         | 100.0  | 88.2   | 100.0                             | 88.2   | 99.9               | 87.9   | 8760               | 100.0  |
| 2003 | 8401.2         | 1315.0         | 71.5   | 85.8   | 71.5                              | 85.8   | 72.9               | 85.7   | 6163               | 70.4   |
| 2004 | 8635.2         | 1315.0         | 72.7   | 84.1   | 72.7                              | 84.1   | 74.8               | 84.4   | 6410               | 73.0   |

**JP-55 KASHIWAZAKI KARIWA-6****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 28 Feb | 114.0  | 29.8    | UP2  | A33  | MAIN CONDENSER TUBE CLEANING EQUIPMENT REPAIR.  |
| 09 Jul | 1809.0 | 2375.2  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 23 Sep | 565.0  | 744.2   | UF3  | Z    | EXTENSION OF PERIODICAL INSPECTION DUE TO THE DELAY OF THE INSPECTION BEFORE OPERATION. |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1997 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 91        |          |
| C. Inspection, maintenance or repair combined with refuelling | 1809            |           |          | 862   |           |          |
| Z. Others   |                 | 565       |          |   | 132       |          |
| Subtotal  | 1809            | 565       | 0        | 862   | 223       | 0        |
| Total   | 2374            |           |          | 1085  |           |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                                   | 2004<br>Hours Lost | 1997 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 13. Reactor Auxiliary Systems            |                    | 10  |
| 21. Fuel Handling and Storage Facilities |                    | 42  |
| 41. Main Generator Systems               |                    | 26  |
| 42. Electrical Power Supply Systems      |                    | 12  |
| Total                                    | 0                  | 90  |

# JP-56 KASHIWAZAKI KARIWA-7

**Operator:** TEPCO (TOKYO ELECTRIC POWER CO.)  
**Contractor:** HITA/GE (HITACHI LTD./GENERAL ELECTRIC CO.)

## 1. Station Details

**Type:** ABWR  
**Net Reference Unit Power at the beginning of 2004:** 1315.0 MW(e)  
**Design Net RUP:** 1315.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 10805.2 GW(e).h  
**Energy Availability Factor:** 91.6%  
**Load Factor:** 93.5%  
**Operating Factor:** 91.7%  
**Energy Unavailability Factor:** 8.4%  
**Total Off-line Time:** 727 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar    | Apr   | May    | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec    | Annual  |
|-----------------|-------|-------|--------|-------|--------|-------|-------|-------|-------|-------|-------|--------|---------|
| <b>GW(e).h</b>  | 348.4 | 941.9 | 1003.4 | 974.4 | 1005.8 | 964.0 | 997.9 | 992.7 | 963.0 | 995.0 | 618.3 | 1000.2 | 10805.2 |
| <b>EAF (%)</b>  | 36.1  | 100.0 | 99.7   | 100.0 | 100.0  | 99.4  | 100.0 | 100.0 | 100.0 | 99.7  | 65.0  | 99.7   | 91.6    |
| <b>UCF (%)</b>  | 36.1  | 100.0 | 99.7   | 100.0 | 100.0  | 99.4  | 100.0 | 100.0 | 100.0 | 99.7  | 100.0 | 99.7   | 94.5    |
| <b>LF (%)</b>   | 35.6  | 102.9 | 102.6  | 103.1 | 102.8  | 101.8 | 102.0 | 101.5 | 101.7 | 101.6 | 65.3  | 102.2  | 93.5    |
| <b>OF (%)</b>   | 36.2  | 100.0 | 100.0  | 100.1 | 100.0  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 65.0  | 100.0  | 91.7    |
| <b>EUF (%)</b>  | 63.9  | 0.0   | 0.3    | 0.0   | 0.0    | 0.6   | 0.0   | 0.0   | 0.0   | 0.3   | 35.0  | 0.3    | 8.4     |
| <b>PUF (%)</b>  | 63.9  | 0.0   | 0.3    | 0.0   | 0.0    | 0.6   | 0.0   | 0.0   | 0.0   | 0.3   | 0.0   | 0.3    | 5.5     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0    | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0    | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 35.0  | 0.0    | 2.9     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1993  
**Date of First Criticality:** 01 Nov 1996  
**Date of Grid Connection:** 17 Dec 1996  
**Date of Commercial Operation:** 02 Jul 1997

**Lifetime Generation:** 72239.5 GW(e).h  
**Cumulative Energy Availability Factor:** 79.1%  
**Cumulative Load Factor:** 79.4%  
**Cumulative Unit Capability Factor:** 82.8%  
**Cumulative Energy Unavailability Factor:** 20.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1996 | 58.3           | 1315.0         | 0.0  | 0.0    | 0.5                               | 100.0  | 0.5                | 0.0    | 257                | 3.0    |
| 1997 | 8127.9         | 1315.0         | 0.0  | 0.0    | 70.6                              | 100.0  | 70.6               | 0.0    | 6764               | 77.2   |
| 1998 | 9715.6         | 1315.0         | 84.7   | 84.7   | 84.7                              | 84.7   | 84.3               | 84.3   | 7452               | 85.1   |
| 1999 | 8445.4         | 1315.0         | 73.7   | 79.2   | 73.7                              | 79.2   | 73.3               | 78.8   | 6458               | 73.7   |
| 2000 | 11240.2        | 1315.0         | 97.6   | 85.3   | 97.6                              | 85.3   | 97.3               | 85.0   | 8587               | 97.8   |
| 2001 | 10078.4        | 1315.0         | 87.8   | 85.9   | 87.8                              | 85.9   | 87.5               | 85.6   | 7752               | 88.5   |
| 2002 | 7990.0         | 1315.0         | 69.5   | 82.7   | 68.9                              | 82.5   | 69.4               | 82.4   | 6089               | 69.5   |
| 2003 | 5778.5         | 1315.0         | 49.2   | 77.1   | 49.2                              | 77.0   | 50.2               | 77.0   | 4302               | 49.1   |
| 2004 | 10805.2        | 1315.0         | 94.5   | 79.6   | 91.6                              | 79.1   | 93.5               | 79.4   | 8057               | 91.7   |

**JP-56 KASHIWAZAKI KARIWA-7****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                           |
|--------|-------|---------|------|------|---------------------------------------|
| 01 Jan | 475.0 | 625.0   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING. |
| 04 Nov | 251.0 | 331.2   | XF4  | N    | FORCED OUTAGE DUE TO THE EARTHQUAKE.  |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1998 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 396       |          |
| C. Inspection, maintenance or repair combined with refuelling  | 475             |           |          | 1115  |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 137   |           |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 251      |   |           |          |
| Z. Others  |                 |           |          |   | 54        |          |
| Subtotal   | 475             | 0         | 251      | 1252  | 450       | 0        |
| Total  |                 | 726       |          |   | 1702      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                      | 2004<br>Hours Lost | 1998 to 2004<br>Average Hours Lost Per Year |
|-----------------------------|--------------------|---|
| 11. Reactor and Accessories |                    | 154   |
| 12. Reactor I&C Systems     |                    | 134   |
| 15. Reactor Cooling Systems |                    | 108   |
| Total                       | 0                  | 396   |

# JP-4 MIHAMA-1

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 320.0 MW(e)  
**Design Net RUP:** 320.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1764.2 GW(e).h  
**Energy Availability Factor:** 61.3%  
**Load Factor:** 62.8%  
**Operating Factor:** 61.4%  
**Energy Unavailability Factor:** 38.7%  
**Total Off-line Time:** 3395 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 101.9 | 0.0   | 226.0 | 240.1 | 245.8 | 234.0 | 238.4 | 237.5 | 35.7 | 0.0   | 0.0   | 204.6 | 1764.2 |
| <b>EAFF (%)</b> | 41.5  | 0.0   | 90.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 15.4 | 0.0   | 0.0   | 83.4  | 61.3   |
| <b>UCF (%)</b>  | 41.5  | 0.0   | 90.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 15.4 | 0.0   | 0.0   | 83.4  | 61.3   |
| <b>LF (%)</b>   | 42.8  | 0.0   | 94.9  | 104.2 | 103.3 | 101.6 | 100.2 | 99.7  | 15.5 | 0.0   | 0.0   | 85.9  | 62.8   |
| <b>OF (%)</b>   | 38.7  | 0.0   | 88.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 16.0 | 0.0   | 0.0   | 87.9  | 61.4   |
| <b>EUF (%)</b>  | 58.5  | 100.0 | 9.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 84.6 | 100.0 | 100.0 | 16.6  | 38.7   |
| <b>PUF (%)</b>  | 58.5  | 88.0  | 4.2   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.0  | 0.0   | 0.0   | 0.0   | 12.3   |
| <b>UCLF (%)</b> | 0.0   | 12.0  | 4.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 84.6 | 100.0 | 100.0 | 16.6  | 26.4   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1967      **Lifetime Generation:** 49360.1 GW(e).h  
**Date of First Criticality:** 29 Jul 1970      **Cumulative Energy Availability Factor:** 49.7%  
**Date of Grid Connection:** 08 Aug 1970      **Cumulative Load Factor:** 51.1%  
**Date of Commercial Operation:** 28 Nov 1970      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 50.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1164.4         | 320.0          | 41.5   | 39.7   | 41.5                              | 25.2   | 41.5               | 22.5   | 3731               | 42.6   |
| 1984 | 1576.6         | 320.0          | 56.0   | 40.9   | 56.0                              | 27.4   | 56.1               | 24.9   | 5053               | 57.5   |
| 1985 | 2240.2         | 320.0          | 80.0   | 43.5   | 80.0                              | 30.9   | 79.9               | 28.5   | 7077               | 80.8   |
| 1986 | 2707.2         | 320.0          | 96.6   | 46.8   | 96.3                              | 35.0   | 96.6               | 32.8   | 8482               | 96.8   |
| 1987 | 2261.5         | 320.0          | 81.6   | 48.8   | 81.6                              | 37.7   | 80.7               | 35.6   | 7150               | 81.6   |
| 1988 | 2075.4         | 320.0          | 75.4   | 50.3   | 75.4                              | 39.8   | 73.8               | 37.7   | 6623               | 75.4   |
| 1989 | 1693.2         | 320.0          | 61.9   | 50.9   | 61.8                              | 40.9   | 60.4               | 38.9   | 5418               | 61.8   |
| 1990 | 1938.2         | 320.0          | 66.9   | 51.7   | 66.9                              | 42.2   | 69.1               | 40.4   | 6058               | 69.2   |
| 1991 | 2371.9         | 320.0          | 8.8  | 49.6   | 4.5                               | 40.4   | 84.6               | 42.5   | 7615               | 86.9   |
| 1992 | 1041.1         | 320.0          | 37.2   | 49.1   | 37.2                              | 40.3   | 37.0               | 42.2   | 3511               | 40.0   |
| 1993 | 1663.3         | 320.0          | 58.5   | 49.5   | 58.5                              | 41.1   | 59.3               | 43.0   | 5300               | 60.5   |
| 1994 | 369.9          | 320.0          | 13.4   | 48.0   | 13.4                              | 39.9   | 13.2               | 41.7   | 1160               | 13.2   |
| 1995 | 0.0            | 320.0          | 0.0  | 46.1   | 0.0                               | 38.3   | 0.0                | 40.1   | 0                  | 0.0    |
| 1996 | 2245.9         | 320.0          | 79.7   | 47.4   | 79.7                              | 39.9   | 79.9               | 41.6   | 7186               | 81.8   |
| 1997 | 2271.5         | 320.0          | 80.8   | 48.6   | 80.8                              | 41.4   | 81.0               | 43.1   | 7083               | 80.9   |
| 1998 | 2321.5         | 320.0          | 82.5   | 49.8   | 82.5                              | 42.9   | 82.8               | 44.5   | 7304               | 83.4   |
| 1999 | 2530.4         | 320.0          | 90.0   | 51.2   | 90.0                              | 44.5   | 90.3               | 46.1   | 8013               | 91.5   |
| 2000 | 2381.2         | 320.0          | 84.6   | 52.3   | 84.5                              | 45.9   | 84.7               | 47.3   | 7439               | 84.7   |
| 2001 | 2104.4         | 320.0          | 75.0   | 53.0   | 74.9                              | 46.8   | 75.1               | 48.2   | 6574               | 75.0   |
| 2002 | 2158.6         | 320.0          | 77.2   | 53.8   | 76.6                              | 47.7   | 77.0               | 49.1   | 6767               | 77.2   |
| 2003 | 2880.6         | 320.0          | 99.9   | 55.2   | 99.9                              | 49.3   | 102.8              | 50.7   | 8760               | 100.0  |
| 2004 | 1764.2         | 320.0          | 61.3   | 55.4   | 61.3                              | 49.7   | 62.8               | 51.1   | 5389               | 61.4   |

## JP-4 MIHAMA-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 13 Jan | 1079.0 | 345.3   | PF   | C    | PERIODICAL INSPECTION AND REFUELING                                    |
| 24 Feb | 120.0  | 38.4    | UF3  | E12  | EXTENSION OF PERIODICAL INSPECTION BY THE TROUBLE ETC. THE EXAMINATION |
| 05 Sep | 2196.0 | 702.9   | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING                |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   |           |          |
| C. Inspection, maintenance or repair combined with refuelling | 1079            |           |          | 1825  | 1825      |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 323   |           |          |
| E. Testing of plant systems or components                     |                 | 120       |          | 0   | 0         |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 1        |
| Z. Others   |                 | 2196      |          |   |           |          |
| Subtotal  | 1079            | 2316      | 0        | 2148  | 1825      | 1        |
| Total   |                 | 3395      |          |   | 3974      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 7   |
| 12. Reactor I&C Systems             |                    | 8   |
| 15. Reactor Cooling Systems         |                    | 20  |
| 16. Steam generation systems        |                    | 1649  |
| 31. Turbine and auxiliaries         |                    | 97  |
| 32. Feedwater and Main Steam System |                    | 34  |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 0                  | 1815  |

# JP-6 MIHAMA-2

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 470.0 MW(e)  
**Design Net RUP:** 470.0 MW(e)  
**Design Discharge Burnup:** 43000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2942.3 GW(e).h  
**Energy Availability Factor:** 70.2%  
**Load Factor:** 71.3%  
**Operating Factor:** 70.2%  
**Energy Unavailability Factor:** 29.8%  
**Total Off-line Time:** 2614 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 358.2 | 334.5 | 357.9 | 345.8 | 357.1 | 340.8 | 345.7 | 141.6 | 0.0   | 0.0   | 5.2  | 355.5 | 2942.3 |
| <b>EAF (%)</b>  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 41.1  | 0.0   | 0.0   | 1.4  | 99.5  | 70.2   |
| <b>UCF (%)</b>  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 99.9  | 41.1  | 0.0   | 0.0   | 1.5  | 99.5  | 70.2   |
| <b>LF (%)</b>   | 102.4 | 102.3 | 102.3 | 102.2 | 102.1 | 100.7 | 98.9  | 40.5  | 0.0   | 0.0   | 1.5  | 101.7 | 71.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 41.8  | 0.0   | 0.0   | 0.4  | 100.0 | 70.2   |
| <b>EUF (%)</b>  | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 58.9  | 100.0 | 100.0 | 98.6 | 0.5   | 29.8   |
| <b>PUF (%)</b>  | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.1   | 0.0   | 0.0   | 0.0  | 0.0   | 0.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 58.8  | 100.0 | 100.0 | 98.6 | 0.5   | 29.8   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 29 May 1968  
**Date of First Criticality:** 10 Apr 1972  
**Date of Grid Connection:** 21 Apr 1972  
**Date of Commercial Operation:** 25 Jul 1972

**Lifetime Generation:** 82064.5 GW(e).h  
**Cumulative Energy Availability Factor:** 60.9%  
**Cumulative Load Factor:** 61.0%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 39.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1433.8         | 470.0          | 34.7   | 51.9   | 34.7                              | 51.8   | 34.8               | 51.5   | 3262               | 37.2   |
| 1984 | 3937.3         | 470.0          | 96.3   | 55.6   | 96.3                              | 55.5   | 95.4               | 55.2   | 8458               | 96.3   |
| 1985 | 2898.3         | 470.0          | 70.2   | 56.7   | 70.2                              | 56.7   | 70.4               | 56.4   | 6219               | 71.0   |
| 1986 | 3301.5         | 470.0          | 80.2   | 58.4   | 80.0                              | 58.3   | 80.2               | 58.1   | 7100               | 81.1   |
| 1987 | 2766.2         | 470.0          | 67.7   | 59.0   | 67.7                              | 59.0   | 67.2               | 58.7   | 5927               | 67.7   |
| 1988 | 3223.1         | 470.0          | 77.8   | 60.2   | 77.8                              | 60.1   | 78.1               | 59.9   | 6850               | 78.0   |
| 1989 | 3325.2         | 470.0          | 81.2   | 61.4   | 81.2                              | 61.4   | 80.8               | 61.1   | 7112               | 81.2   |
| 1990 | 3077.1         | 470.0          | 72.7   | 62.0   | 72.7                              | 62.0   | 74.7               | 61.9   | 6594               | 75.3   |
| 1991 | 447.1          | 470.0          | 10.0   | 59.3   | 10.0                              | 59.3   | 10.9               | 59.2   | 950                | 10.8   |
| 1992 | 0.0            | 470.0          | 0.0  | 56.3   | 0.0                               | 56.3   | 0.0                | 56.2   | 0                  | 0.0    |
| 1993 | 0.0            | 470.0          | 0.0  | 53.6   | 0.0                               | 53.6   | 0.0                | 53.5   | 0                  | 0.0    |
| 1994 | 1186.3         | 470.0          | 29.9   | 52.6   | 29.9                              | 52.5   | 28.8               | 52.4   | 2522               | 28.8   |
| 1995 | 3335.0         | 470.0          | 80.7   | 53.8   | 80.5                              | 53.8   | 81.0               | 53.7   | 7138               | 81.5   |
| 1996 | 3762.4         | 470.0          | 90.6   | 55.3   | 90.5                              | 55.3   | 91.1               | 55.2   | 8024               | 91.3   |
| 1997 | 3006.0         | 470.0          | 72.6   | 56.0   | 72.6                              | 56.0   | 73.0               | 55.9   | 6417               | 73.3   |
| 1998 | 3396.3         | 470.0          | 82.0   | 57.0   | 82.0                              | 57.0   | 82.5               | 57.0   | 7228               | 82.5   |
| 1999 | 2746.4         | 470.0          | 66.3   | 57.4   | 66.3                              | 57.3   | 66.7               | 57.3   | 5821               | 66.4   |
| 2000 | 3839.7         | 470.0          | 92.5   | 58.6   | 92.5                              | 58.6   | 93.0               | 58.6   | 8137               | 92.6   |
| 2001 | 2911.3         | 470.0          | 70.4   | 59.0   | 70.3                              | 59.0   | 70.7               | 59.0   | 6177               | 70.5   |
| 2002 | 3611.3         | 470.0          | 87.2   | 60.0   | 87.2                              | 59.9   | 87.7               | 60.0   | 7648               | 87.3   |
| 2003 | 3400.2         | 470.0          | 81.5   | 60.7   | 81.5                              | 60.6   | 82.6               | 60.7   | 7182               | 82.0   |
| 2004 | 2942.3         | 470.0          | 70.2   | 61.0   | 70.2                              | 60.9   | 71.3               | 61.0   | 6170               | 70.2   |



## JP-6 MIHAMA-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 13 Aug | 2614.0 | 1228.8  | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1972 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 533       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling | 2550            |           |          | 2550  |           |          |
| D. Inspection, maintenance or repair without refuelling       | 95              |           |          | 95  |           |          |
| Z. Others   |                 | 2614      |          |   |           |          |
| Subtotal  | 0               | 2614      | 0        | 2645  | 534       | 0        |
| Total   |                 | 2614      |          |   | 3179      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1972 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 13. Reactor Auxiliary Systems       |                    | 54  |
| 15. Reactor Cooling Systems         |                    | 3   |
| 16. Steam generation systems        |                    | 416   |
| 31. Turbine and auxiliaries         |                    | 26  |
| 41. Main Generator Systems          |                    | 4   |
| 42. Electrical Power Supply Systems |                    | 28  |
| Total                               | 0                  | 531   |

**JP-14 MIHAMA-3**

Operator: KEPCO (KANSAI ELECTRIC POWER CO.)

Contractor: M (MITSUBISHI HEAVY INDUSTRY LTD)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 780.0 MW(e)  
 Design Net RUP: 780.0 MW(e)  
 Design Discharge Burnup: 43000 MW.d/t

**2. Production Summary 2004**

Energy Production: 4301.3 GW(e).h  
 Energy Availability Factor: 60.5%  
 Load Factor: 62.8%  
 Operating Factor: 60.6%  
 Energy Unavailability Factor: 39.5%  
 Total Off-line Time: 3465 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 607.4 | 568.8 | 608.3 | 588.6 | 603.4 | 576.0 | 586.1 | 162.7 | 0.0   | 0.0   | 0.0   | 0.0   | 4301.3 |
| EAF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 27.0  | 0.0   | 0.0   | 0.0   | 0.0   | 60.5   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 27.1  | 0.0   | 0.0   | 0.0   | 0.0   | 60.5   |
| LF (%)   | 104.7 | 104.8 | 104.8 | 104.8 | 104.0 | 102.6 | 101.0 | 28.0  | 0.0   | 0.0   | 0.0   | 0.0   | 62.8   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 27.8  | 0.0   | 0.0   | 0.0   | 0.0   | 60.6   |
| EUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 73.0  | 100.0 | 100.0 | 100.0 | 100.0 | 39.5   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 57.9  | 100.0 | 100.0 | 60.0  | 0.0   | 26.5   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.0  | 0.0   | 0.0   | 40.0  | 100.0 | 13.0   |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 07 Aug 1972      Lifetime Generation: 145213.7 GW(e).h  
 Date of First Criticality: 28 Jan 1976      Cumulative Energy Availability Factor: 74.2%  
 Date of Grid Connection: 19 Feb 1976      Cumulative Load Factor: 74.5%  
 Date of Commercial Operation: 01 Dec 1976      Cumulative Unit Capability Factor: 77.5%  
    Cumulative Energy Unavailability Factor: 25.8%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 4818.0            | 780.0             | 70.6   | 64.2   | 70.6                                 | 64.2   | 70.5               | 64.5   | 6330                  | 72.3   |
| 1984 | 5353.7            | 780.0             | 77.8   | 65.9   | 77.8                                 | 65.9   | 78.1               | 66.2   | 6906                  | 78.6   |
| 1985 | 4971.9            | 780.0             | 72.7   | 66.7   | 72.6                                 | 66.7   | 72.8               | 66.9   | 6426                  | 73.4   |
| 1986 | 6848.4            | 780.0             | 99.8   | 70.0   | 99.8                                 | 70.0   | 100.2              | 70.2   | 8760                  | 100.0  |
| 1987 | 4822.7            | 780.0             | 71.5   | 70.1   | 71.6                                 | 70.1   | 70.6               | 70.3   | 6268                  | 71.6   |
| 1988 | 4261.3            | 780.0             | 64.0   | 69.6   | 64.0                                 | 69.6   | 62.2               | 69.6   | 5625                  | 64.0   |
| 1989 | 5299.7            | 780.0             | 78.0   | 70.3   | 78.0                                 | 70.2   | 77.6               | 70.2   | 6834                  | 78.0   |
| 1990 | 6867.0            | 780.0             | 100.0  | 72.4   | 100.0                                | 72.4   | 100.5              | 72.4   | 8760                  | 100.0  |
| 1991 | 4246.2            | 780.0             | 59.7   | 71.5   | 59.7                                 | 71.5   | 62.1               | 71.7   | 5495                  | 62.7   |
| 1992 | 4709.9            | 780.0             | 68.5   | 71.3   | 68.5                                 | 71.3   | 68.7               | 71.5   | 6095                  | 69.4   |
| 1993 | 4526.6            | 780.0             | 66.4   | 71.0   | 66.1                                 | 71.0   | 66.2               | 71.2   | 5951                  | 67.9   |
| 1994 | 6623.0            | 780.0             | 96.8   | 72.5   | 96.8                                 | 72.5   | 96.9               | 72.6   | 8486                  | 96.9   |
| 1995 | 3389.2            | 780.0             | 49.7   | 71.3   | 49.6                                 | 71.3   | 49.6               | 71.4   | 4534                  | 51.8   |
| 1996 | 4491.4            | 780.0             | 65.5   | 71.0   | 65.3                                 | 71.0   | 65.6               | 71.1   | 5760                  | 65.6   |
| 1997 | 6262.8            | 780.0             | 91.2   | 72.0   | 91.2                                 | 71.9   | 91.7               | 72.1   | 7963                  | 90.9   |
| 1998 | 5979.9            | 780.0             | 87.1   | 72.7   | 87.1                                 | 72.6   | 87.5               | 72.8   | 7788                  | 88.9   |
| 1999 | 5795.3            | 780.0             | 84.4   | 73.2   | 84.4                                 | 73.1   | 84.8               | 73.3   | 7398                  | 84.5   |
| 2000 | 4785.0            | 780.0             | 69.6   | 73.0   | 69.6                                 | 73.0   | 69.8               | 73.2   | 6117                  | 69.6   |
| 2001 | 6853.7            | 780.0             | 100.0  | 74.1   | 100.0                                | 74.1   | 100.3              | 74.3   | 8760                  | 100.0  |
| 2002 | 5248.0            | 780.0             | 76.8   | 74.2   | 76.8                                 | 74.2   | 76.8               | 74.4   | 6732                  | 76.8   |
| 2003 | 6111.5            | 780.0             | 87.9   | 74.7   | 87.9                                 | 74.7   | 89.4               | 74.9   | 7701                  | 87.9   |
| 2004 | 4301.3            | 780.0             | 60.5   | 74.2   | 60.5                                 | 74.2   | 62.8               | 74.5   | 5319                  | 60.6   |

**JP-14 MIHAMA-3****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 09 Aug | 106.0  | 87.2    | UF4  | A32  | AUTOMATIC TRIP CAUSED BY THE FRACTURE OF SECONDARY SYSTEM PIPING   |
| 14 Aug | 2327.0 | 1815.1  | PF   | C    | PERIODICAL INSPECTION AND REFUELING  |
| 19 Nov | 1032.0 | 805.0   | UF3  | A32  | EXTENSION OF PERIODICAL INSPECTION BY THE INSPECTION OF PLANT IN RELATION TO THE FRACTURE OF SECONDARY SYSTEM PIPING |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1976 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 1138      |          |   | 111       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling | 2327            |           |          | 1862  |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 0   | 4         |          |
| Subtotal  | 2327            | 1138      | 0        | 1862  | 124       | 0        |
| Total   |                 | 3465      |          |   | 1986      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1976 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 38  |
| 15. Reactor Cooling Systems         |                    | 12  |
| 16. Steam generation systems        |                    | 33  |
| 32. Feedwater and Main Steam System | 1138               | 23  |
| Total                               | 1138               | 106   |

**JP-15 OHI-1**

Operator: KEPCO (KANSAI ELECTRIC POWER CO.)

Contractor: WEST (WESTINGHOUSE ELECTRIC CORPORATION)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 1120.0 MW(e)  
 Design Net RUP: 1120.0 MW(e)  
 Design Discharge Burnup: 44000 MW.d/t

**2. Production Summary 2004**

Energy Production: 7777.0 GW(e).h  
 Energy Availability Factor: 77.7%  
 Load Factor: 79.1%  
 Operating Factor: 77.7%  
 Energy Unavailability Factor: 22.3%  
 Total Off-line Time: 1959 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 851.8 | 797.0 | 852.2 | 824.4 | 848.6 | 76.8 | 3.6  | 820.6 | 627.2 | 399.8 | 821.5 | 853.6 | 7777.0 |
| EAF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 9.4  | 0.4  | 98.4  | 77.5  | 47.3  | 100.0 | 100.0 | 77.7   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 9.4  | 0.4  | 98.4  | 77.5  | 47.3  | 100.0 | 100.0 | 77.7   |
| LF (%)   | 102.2 | 102.2 | 102.3 | 102.2 | 101.8 | 9.5  | 0.4  | 98.5  | 77.8  | 48.0  | 101.9 | 102.4 | 79.1   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 6.7  | 1.5  | 100.0 | 76.5  | 48.3  | 100.0 | 100.0 | 77.7   |
| EUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 90.6 | 99.6 | 1.6   | 22.5  | 52.7  | 0.0   | 0.0   | 22.3   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 90.6 | 72.6 | 1.6   | 0.0   | 0.0   | 0.0   | 0.0   | 13.7   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 27.0 | 0.0   | 22.5  | 52.7  | 0.0   | 0.0   | 8.6    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 26 Oct 1972      Lifetime Generation: 167230.0 GW(e).h  
 Date of First Criticality: 02 Dec 1977      Cumulative Energy Availability Factor: 65.1%  
 Date of Grid Connection: 23 Dec 1977      Cumulative Load Factor: 65.7%  
 Date of Commercial Operation: 27 Mar 1979      Cumulative Unit Capability Factor: 77.6%  
    Cumulative Energy Unavailability Factor: 34.9%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 8212.6            | 1120.0            | 83.0   | 55.1   | 82.9                                 | 55.1   | 83.7               | 55.5   | 7282                  | 83.1   |
| 1984 | 7015.1            | 1120.0            | 70.8   | 58.3   | 70.8                                 | 58.3   | 71.3               | 58.7   | 6292                  | 71.6   |
| 1985 | 5794.1            | 1120.0            | 59.0   | 58.4   | 58.7                                 | 58.3   | 59.1               | 58.7   | 5217                  | 59.6   |
| 1986 | 5138.8            | 1120.0            | 52.2   | 57.5   | 52.2                                 | 57.5   | 52.4               | 57.8   | 4664                  | 53.2   |
| 1987 | 9421.7            | 1120.0            | 95.3   | 62.2   | 95.3                                 | 62.2   | 96.0               | 62.6   | 8430                  | 96.2   |
| 1988 | 3282.4            | 1120.0            | 34.8   | 59.2   | 34.8                                 | 59.1   | 33.4               | 59.3   | 3053                  | 34.8   |
| 1989 | 2744.9            | 1120.0            | 29.5   | 56.2   | 29.5                                 | 56.2   | 28.0               | 56.2   | 2587                  | 29.5   |
| 1990 | 5446.5            | 1120.0            | 52.9   | 55.9   | 52.9                                 | 55.9   | 55.5               | 56.1   | 4919                  | 56.2   |
| 1991 | 5706.3            | 1120.0            | 55.8   | 55.9   | 55.8                                 | 55.9   | 58.2               | 56.3   | 5160                  | 58.9   |
| 1992 | 5488.2            | 1120.0            | 55.5   | 55.9   | 55.4                                 | 55.8   | 55.8               | 56.3   | 4957                  | 56.4   |
| 1993 | 5010.3            | 1120.0            | 50.7   | 55.5   | 50.7                                 | 55.5   | 51.1               | 55.9   | 4535                  | 51.8   |
| 1994 | 6929.9            | 1120.0            | 70.2   | 56.5   | 69.9                                 | 56.4   | 70.6               | 56.9   | 6202                  | 70.8   |
| 1995 | 6537.9            | 1120.0            | 66.1   | 57.1   | 66.1                                 | 57.0   | 66.6               | 57.5   | 6010                  | 68.6   |
| 1996 | 7026.3            | 1120.0            | 70.7   | 57.9   | 70.7                                 | 57.8   | 71.4               | 58.3   | 6305                  | 71.8   |
| 1997 | 7998.8            | 1120.0            | 80.8   | 59.1   | 80.7                                 | 59.1   | 81.5               | 59.6   | 7080                  | 80.8   |
| 1998 | 9406.5            | 1120.0            | 95.0   | 61.0   | 95.0                                 | 61.0   | 95.9               | 61.5   | 8359                  | 95.4   |
| 1999 | 6933.7            | 1120.0            | 70.0   | 61.5   | 70.0                                 | 61.4   | 70.7               | 62.0   | 6136                  | 70.0   |
| 2000 | 6323.6            | 1120.0            | 63.7   | 61.6   | 63.6                                 | 61.6   | 64.3               | 62.1   | 5668                  | 64.5   |
| 2001 | 9333.1            | 1120.0            | 94.5   | 63.1   | 94.2                                 | 63.0   | 95.1               | 63.6   | 8273                  | 94.4   |
| 2002 | 7935.8            | 1120.0            | 80.3   | 63.8   | 80.2                                 | 63.8   | 80.9               | 64.3   | 7038                  | 80.3   |
| 2003 | 8118.7            | 1120.0            | 81.8   | 64.6   | 81.8                                 | 64.5   | 82.7               | 65.1   | 7142                  | 81.5   |
| 2004 | 7777.0            | 1120.0            | 77.7   | 65.1   | 77.7                                 | 65.1   | 79.1               | 65.7   | 6825                  | 77.7   |

# JP-15 OHI-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 03 Jun | 1204.0 | 1349.0  | PF   | C    | PERIODICAL INSPECTION AND REFUELING   |
| 23 Jul | 201.0  | 225.1   | UF3  | A14  | EXTENSION OF PERIODICAL INSPECTION BY TRANSFORMATION OF REFUELING WATER STORAGE TANK AND WALL THINNING AT FEED WATER PIPE |
| 24 Sep | 554.0  | 621.2   | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1979 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 201       |          |  | 346       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1204            |           |          | 2526                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          | 55                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 0        |
| Z. Others  |                 | 554       |          |  |           |          |
| Subtotal   | 1204            | 755       | 0        | 2581                                     | 349       | 0        |
| Total  |                 | 1959      |          |  | 2930      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1979 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             |                 | 8  |
| 14. Safety Systems                  | 201             |  |
| 15. Reactor Cooling Systems         |                 | 29                                       |
| 16. Steam generation systems        |                 | 253                                      |
| 31. Turbine and auxiliaries         |                 | 10                                       |
| 32. Feedwater and Main Steam System |                 | 14                                       |
| 42. Electrical Power Supply Systems |                 | 2  |
| Total                               | 201             | 317                                      |

# JP-19 OHI-2

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1120.0 MW(e)  
**Design Net RUP:** 1120.0 MW(e)  
**Design Discharge Burnup:** 44000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8408.3 GW(e).h  
**Energy Availability Factor:** 83.4%  
**Load Factor:** 85.5%  
**Operating Factor:** 83.4%  
**Energy Unavailability Factor:** 16.6%  
**Total Off-line Time:** 1460 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 862.3 | 217.9 | 181.8 | 835.4 | 861.4 | 826.3 | 844.6 | 841.8 | 399.6 | 849.7 | 828.1 | 859.5 | 8408.3 |
| <b>EAF (%)</b>  | 100.0 | 27.0  | 21.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.1  | 100.0 | 100.0 | 100.0 | 83.4   |
| <b>UCF (%)</b>  | 100.0 | 27.0  | 21.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.1  | 100.0 | 100.0 | 100.0 | 83.4   |
| <b>LF (%)</b>   | 103.5 | 27.9  | 21.8  | 103.7 | 103.4 | 102.5 | 101.4 | 101.0 | 49.6  | 101.8 | 102.7 | 103.1 | 85.5   |
| <b>OF (%)</b>   | 100.0 | 24.1  | 24.3  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 48.8  | 99.9  | 100.0 | 100.0 | 83.4   |
| <b>EUF (%)</b>  | 0.0   | 73.0  | 78.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 50.9  | 0.0   | 0.0   | 0.0   | 16.6   |
| <b>PUF (%)</b>  | 0.0   | 73.0  | 78.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 50.9  | 0.0   | 0.0   | 0.0   | 4.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 08 Dec 1972  
**Date of First Criticality:** 14 Sep 1978  
**Date of Grid Connection:** 11 Oct 1978  
**Date of Commercial Operation:** 05 Dec 1979

**Lifetime Generation:** 182330.0 GW(e).h  
**Cumulative Energy Availability Factor:** 72.0%  
**Cumulative Load Factor:** 72.5%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 28.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 7443.8         | 1120.0         | 75.2   | 67.3   | 75.2                              | 67.3   | 75.9               | 67.7   | 6670               | 76.1   |
| 1984 | 5793.5         | 1120.0         | 58.5   | 65.5   | 58.5                              | 65.5   | 58.9               | 65.9   | 5208               | 59.3   |
| 1985 | 6843.0         | 1120.0         | 69.2   | 66.1   | 69.2                              | 66.1   | 69.7               | 66.6   | 6260               | 71.5   |
| 1986 | 9858.9         | 1120.0         | 99.5   | 70.9   | 99.5                              | 70.9   | 100.5              | 71.4   | 8760               | 100.0  |
| 1987 | 6238.1         | 1120.0         | 66.8   | 70.4   | 65.3                              | 70.2   | 63.6               | 70.4   | 5789               | 66.1   |
| 1988 | 6112.3         | 1120.0         | 62.9   | 69.5   | 62.9                              | 69.4   | 62.1               | 69.5   | 5525               | 62.9   |
| 1989 | 9828.0         | 1120.0         | 99.4   | 72.5   | 99.4                              | 72.4   | 100.2              | 72.6   | 8707               | 99.4   |
| 1990 | 6685.7         | 1120.0         | 66.1   | 71.9   | 66.1                              | 71.8   | 68.1               | 72.2   | 6069               | 69.3   |
| 1991 | 6409.5         | 1120.0         | 71.3   | 71.9   | 69.4                              | 71.6   | 65.3               | 71.6   | 5903               | 67.4   |
| 1992 | 6973.3         | 1120.0         | 70.2   | 71.8   | 70.2                              | 71.5   | 70.9               | 71.5   | 6178               | 70.3   |
| 1993 | 8863.9         | 1120.0         | 89.5   | 73.0   | 89.5                              | 72.8   | 90.3               | 72.9   | 7903               | 90.2   |
| 1994 | 6680.0         | 1120.0         | 68.0   | 72.7   | 67.9                              | 72.5   | 68.1               | 72.6   | 5929               | 67.7   |
| 1995 | 3273.5         | 1120.0         | 33.4   | 70.2   | 33.3                              | 70.0   | 33.4               | 70.1   | 3060               | 34.9   |
| 1996 | 9738.2         | 1120.0         | 98.3   | 71.9   | 98.0                              | 71.7   | 99.0               | 71.8   | 8662               | 98.6   |
| 1997 | 5316.5         | 1120.0         | 53.7   | 70.9   | 53.7                              | 70.7   | 54.2               | 70.8   | 4753               | 54.3   |
| 1998 | 6501.3         | 1120.0         | 65.7   | 70.6   | 65.6                              | 70.4   | 66.3               | 70.6   | 5760               | 65.8   |
| 1999 | 4511.1         | 1120.0         | 45.6   | 69.3   | 45.6                              | 69.2   | 46.0               | 69.4   | 3994               | 45.6   |
| 2000 | 7796.8         | 1120.0         | 78.6   | 69.8   | 78.6                              | 69.6   | 79.3               | 69.8   | 6987               | 79.5   |
| 2001 | 7163.5         | 1120.0         | 71.3   | 69.9   | 71.3                              | 69.7   | 73.0               | 70.0   | 6302               | 71.9   |
| 2002 | 8265.6         | 1120.0         | 83.6   | 70.5   | 83.6                              | 70.3   | 84.2               | 70.6   | 7326               | 83.6   |
| 2003 | 10075.6        | 1120.0         | 100.0  | 71.7   | 100.0                             | 71.5   | 102.7              | 71.9   | 8760               | 100.0  |
| 2004 | 8408.3         | 1120.0         | 83.3   | 72.2   | 83.4                              | 72.0   | 85.5               | 72.5   | 7324               | 83.4   |

## JP-19 OHI-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 08 Feb | 1094.0 | 1226.1  | PF   | C    | PERIODICAL INSPECTION AND REFUELING                     |
| 07 Sep | 366.0  | 410.7   | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 347       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1094            |           |          | 1968  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 17  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 5        |
| Z. Others  |                 | 366       |          |   |           |          |
| Subtotal   | 1094            | 366       | 0        | 1985  | 356       | 5        |
| Total  |                 | 1460      |          |   | 2346      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                        | 2004<br>Hours Lost | 1980 to 2004<br>Average Hours Lost Per Year |
|-------------------------------|--------------------|---|
| 12. Reactor I&C Systems       |                    | 163   |
| 13. Reactor Auxiliary Systems |                    | 33  |
| 14. Safety Systems            |                    | 0   |
| 15. Reactor Cooling Systems   |                    | 11  |
| 16. Steam generation systems  |                    | 132   |
| 31. Turbine and auxiliaries   |                    | 4   |
| 41. Main Generator Systems    |                    | 2   |
| Total                         | 0                  | 345   |

# JP-50 OHI-3

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1127.0 MW(e)  
**Design Net RUP:** 1127.0 MW(e)  
**Design Discharge Burnup:** 24000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3040.2 GW(e).h  
**Energy Availability Factor:** 30.0%  
**Load Factor:** 30.7%  
**Operating Factor:** 30.0%  
**Energy Unavailability Factor:** 70.0%  
**Total Off-line Time:** 6150 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 858.6 | 802.5 | 857.6 | 521.5 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3040.2 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 62.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 62.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.0   |
| <b>LF (%)</b>   | 102.4 | 102.3 | 102.3 | 64.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 62.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 37.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 70.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 37.2  | 83.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 16.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 59.8   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 03 Oct 1987      **Lifetime Generation:** 111224.7 GW(e).h  
**Date of First Criticality:** 17 May 1991      **Cumulative Energy Availability Factor:** 84.1%  
**Date of Grid Connection:** 07 Jun 1991      **Cumulative Load Factor:** 84.6%  
**Date of Commercial Operation:** 18 Dec 1991      **Cumulative Unit Capability Factor:** 80.2%  
**Cumulative Energy Unavailability Factor:** 15.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1991 | 2524.4         | 1127.0         | 0.0  | 0.0    | 25.6                              | 100.0  | 25.6               | 0.0    | 3228               | 36.9   |
| 1992 | 9954.7         | 1127.0         | 100.0  | 100.0  | 100.0                             | 100.0  | 100.6              | 100.6  | 8784               | 100.0  |
| 1993 | 7863.7         | 1127.0         | 79.4   | 89.7   | 79.4                              | 89.7   | 79.7               | 90.1   | 7025               | 80.2   |
| 1994 | 8139.1         | 1127.0         | 82.5   | 87.3   | 82.5                              | 87.3   | 82.4               | 87.6   | 7265               | 82.9   |
| 1995 | 7701.7         | 1127.0         | 77.8   | 85.0   | 77.8                              | 85.0   | 78.0               | 85.2   | 6887               | 78.6   |
| 1996 | 9957.4         | 1127.0         | 100.0  | 88.0   | 100.0                             | 88.0   | 100.6              | 88.3   | 8784               | 100.0  |
| 1997 | 8333.0         | 1127.0         | 83.9   | 87.3   | 83.9                              | 87.3   | 84.4               | 87.6   | 7385               | 84.3   |
| 1998 | 8872.7         | 1127.0         | 89.3   | 87.6   | 89.3                              | 87.6   | 89.9               | 87.9   | 7867               | 89.8   |
| 1999 | 8892.3         | 1127.0         | 89.9   | 87.9   | 89.5                              | 87.8   | 90.1               | 88.2   | 7875               | 89.9   |
| 2000 | 8868.9         | 1127.0         | 89.1   | 88.0   | 89.1                              | 88.0   | 89.6               | 88.4   | 7824               | 89.1   |
| 2001 | 8474.7         | 1127.0         | 85.4   | 87.7   | 85.4                              | 87.7   | 85.8               | 88.1   | 7481               | 85.4   |
| 2002 | 9918.7         | 1127.0         | 100.0  | 88.8   | 100.0                             | 88.8   | 100.5              | 89.2   | 8760               | 100.0  |
| 2003 | 8683.2         | 1127.0         | 85.9   | 88.6   | 85.9                              | 88.6   | 88.0               | 89.1   | 7525               | 85.9   |
| 2004 | 3040.2         | 1127.0         | 30.0   | 84.1   | 30.0                              | 84.1   | 30.7               | 84.6   | 2634               | 30.0   |



## JP-50 OHI-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 19 Apr | 894.0  | 1005.0  | PF   | C    | PERIODICAL INSPECTION AND REFUELING  |
| 27 May | 5256.0 | 5923.5  | UF3  | A11  | EXTENSION OF PERIODICAL INSPECTION BY SLIGHT WATER LEAK FROM REACTOR VESSEL HEAD PENETRATION |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1993 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 5256      |          |   |           |          |
| C. Inspection, maintenance or repair combined with refuelling | 894             |           |          | 978   |           |          |
| Subtotal  | 894             | 5256      | 0        | 978   | 0         | 0        |
| Total   |                 | 6150      |          |   | 978       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                      | 2004<br>Hours Lost | 1993 to 2004<br>Average Hours Lost Per Year |
|-----------------------------|--------------------|---|
| 11. Reactor and Accessories | 5256               |   |
| Total                       | 5256               | 0   |

# JP-51 OHI-4

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1127.0 MW(e)  
**Design Net RUP:** 1125.0 MW(e)  
**Design Discharge Burnup:** 24000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8318.2 GW(e).h  
**Energy Availability Factor:** 81.8%  
**Load Factor:** 84.0%  
**Operating Factor:** 81.8%  
**Energy Unavailability Factor:** 18.2%  
**Total Off-line Time:** 1598 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 865.8 | 810.1 | 865.5 | 836.4 | 863.0 | 835.0 | 858.2 | 353.4 | 495.6 | 0.0   | 679.0 | 856.2 | 8318.2 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 41.2  | 60.1  | 0.0   | 81.8  | 100.0 | 81.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 41.2  | 60.1  | 0.0   | 81.8  | 100.0 | 81.8   |
| <b>LF (%)</b>   | 103.3 | 103.3 | 103.2 | 103.1 | 102.9 | 102.9 | 102.4 | 42.2  | 61.1  | 0.0   | 83.7  | 102.1 | 84.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 38.7  | 59.9  | 0.0   | 84.9  | 100.0 | 81.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 58.8  | 39.9  | 100.0 | 18.2  | 0.0   | 18.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 20.5  | 100.0 | 18.2  | 0.0   | 11.7   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 58.8  | 19.4  | 0.0   | 0.0   | 0.0   | 6.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 13 Jun 1988  
**Date of First Criticality:** 28 May 1992  
**Date of Grid Connection:** 19 Jun 1992  
**Date of Commercial Operation:** 02 Feb 1993

**Lifetime Generation:** 103954.8 GW(e).h  
**Cumulative Energy Availability Factor:** 83.8%  
**Cumulative Load Factor:** 84.7%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 16.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1992 | 1999.3         | 1127.0         | 0.0  | 0.0    | 20.3                              | 100.0  | 20.3               | 0.0    | 2742               | 31.3   |
| 1993 | 9923.5         | 1127.0         | 0.0  | 0.0    | 100.0                             | 100.0  | 100.5              | 0.0    | 8760               | 100.0  |
| 1994 | 7851.5         | 1127.0         | 79.7   | 79.7   | 79.7                              | 79.7   | 79.5               | 79.5   | 7063               | 80.6   |
| 1995 | 7495.1         | 1127.0         | 75.6   | 77.7   | 75.6                              | 77.7   | 75.9               | 77.7   | 6695               | 76.4   |
| 1996 | 7051.1         | 1127.0         | 70.8   | 75.4   | 70.8                              | 75.4   | 71.2               | 75.6   | 6221               | 70.8   |
| 1997 | 7660.2         | 1127.0         | 77.1   | 75.8   | 77.1                              | 75.8   | 77.6               | 76.1   | 6756               | 77.1   |
| 1998 | 8839.4         | 1127.0         | 89.0   | 78.4   | 89.0                              | 78.4   | 89.5               | 78.8   | 7835               | 89.4   |
| 1999 | 8903.4         | 1127.0         | 89.8   | 80.3   | 89.5                              | 80.3   | 90.2               | 80.7   | 7872               | 89.9   |
| 2000 | 8649.8         | 1127.0         | 86.8   | 81.3   | 86.8                              | 81.2   | 87.4               | 81.6   | 7629               | 86.9   |
| 2001 | 9283.6         | 1127.0         | 93.4   | 82.8   | 93.4                              | 82.7   | 94.0               | 83.2   | 8179               | 93.4   |
| 2002 | 9217.1         | 1127.0         | 91.5   | 83.7   | 91.5                              | 83.7   | 93.4               | 84.3   | 8017               | 91.5   |
| 2003 | 8762.6         | 1127.0         | 86.3   | 84.0   | 86.3                              | 84.0   | 88.8               | 84.7   | 7557               | 86.3   |
| 2004 | 8318.2         | 1127.0         | 81.8   | 83.8   | 81.8                              | 83.8   | 84.0               | 84.7   | 7186               | 81.8   |

## JP-51 OHI-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 13 Aug | 577.0  | 650.5   | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING |
| 24 Sep | 1021.0 | 1152.6  | PF   | C    | PERIODICAL INSPECTION AND REFUELING                     |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1994 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                       |                 |           |          |   | 290       |          |
| C. Inspection, maintenance or repair<br>combined with refuelling | 1021            |           |          | 967   |           |          |
| Z. Others  |                 | 577       |          |   |           |          |
| Subtotal   | 1021            | 577       | 0        | 967   | 290       | 0        |
| Total  | 1598            |           |          | 1257  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                     | 2004<br>Hours Lost | 1994 to 2004<br>Average Hours Lost Per Year |
|----------------------------|--------------------|---|
| 41. Main Generator Systems |                    | 290   |
| Total                      | 0                  | 290   |

# JP-22 ONAGAWA-1

**Operator:** TOHOKU (TOHOKU ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 498.0 MW(e)  
**Design Net RUP:** 496.0 MW(e)  
**Design Discharge Burnup:** 27500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2998.9 GW(e).h  
**Energy Availability Factor:** 68.5%  
**Load Factor:** 68.6%  
**Operating Factor:** 68.5%  
**Energy Unavailability Factor:** 31.5%  
**Total Off-line Time:** 2764 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 370.2 | 346.5 | 371.4 | 359.8 | 371.5 | 358.7 | 370.8 | 369.5 | 80.6 | 0.0   | 0.0   | 0.0   | 2998.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 22.6 | 0.0   | 0.0   | 0.0   | 68.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 23.2 | 0.0   | 0.0   | 0.0   | 68.6   |
| <b>LF (%)</b>   | 99.9  | 100.0 | 100.2 | 100.3 | 100.3 | 100.0 | 100.1 | 99.7  | 22.5 | 0.0   | 0.0   | 0.0   | 68.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 22.8 | 0.0   | 0.0   | 0.0   | 68.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 77.4 | 100.0 | 100.0 | 100.0 | 31.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 76.8 | 100.0 | 100.0 | 35.5  | 26.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 64.5  | 5.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.6  | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 08 Jul 1980  
**Date of First Criticality:** 18 Oct 1983  
**Date of Grid Connection:** 18 Nov 1983  
**Date of Commercial Operation:** 01 Jun 1984

**Lifetime Generation:** 68595.6 GW(e).h  
**Cumulative Energy Availability Factor:** 74.3%  
**Cumulative Load Factor:** 74.5%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 25.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 100.6          | 498.0          | 0.0  | 0.0    | 85.6                              | 100.0  | 2.3                | 0.0    | 766                | 8.7    |
| 1984 | 3558.2         | 496.0          | 0.0  | 0.0    | 81.7                              | 100.0  | 81.7               | 0.0    | 7683               | 87.5   |
| 1985 | 3259.2         | 496.0          | 75.6   | 75.6   | 75.6                              | 75.6   | 75.0               | 75.0   | 6681               | 76.3   |
| 1986 | 3366.6         | 496.0          | 78.0   | 76.8   | 77.9                              | 76.8   | 77.5               | 76.2   | 6871               | 78.4   |
| 1987 | 3161.7         | 497.0          | 72.8   | 75.4   | 72.8                              | 75.4   | 72.6               | 75.0   | 6500               | 74.2   |
| 1988 | 3410.6         | 496.0          | 78.6   | 76.2   | 78.6                              | 76.2   | 78.3               | 75.8   | 6949               | 79.1   |
| 1989 | 3013.7         | 497.0          | 69.1   | 74.8   | 69.1                              | 74.8   | 69.2               | 74.5   | 6177               | 70.5   |
| 1990 | 2850.7         | 497.0          | 65.6   | 73.3   | 65.6                              | 73.3   | 65.5               | 73.0   | 5908               | 67.4   |
| 1991 | 3345.9         | 497.0          | 77.0   | 73.8   | 77.0                              | 73.8   | 76.9               | 73.6   | 6954               | 79.4   |
| 1992 | 4120.5         | 497.0          | 94.7   | 76.4   | 94.7                              | 76.4   | 94.4               | 76.2   | 8342               | 95.0   |
| 1993 | 2300.1         | 497.0          | 52.0   | 73.7   | 50.6                              | 73.5   | 52.8               | 73.6   | 4666               | 53.3   |
| 1994 | 3428.8         | 497.0          | 78.7   | 74.2   | 78.6                              | 74.1   | 78.8               | 74.1   | 6961               | 79.5   |
| 1995 | 2936.4         | 497.0          | 68.2   | 73.7   | 67.8                              | 73.5   | 67.4               | 73.5   | 6000               | 68.5   |
| 1996 | 3727.2         | 498.0          | 85.6   | 74.7   | 85.6                              | 74.5   | 85.2               | 74.5   | 7523               | 85.6   |
| 1997 | 3304.6         | 498.0          | 76.2   | 74.8   | 76.2                              | 74.6   | 75.8               | 74.6   | 6708               | 76.6   |
| 1998 | 3359.5         | 498.0          | 76.9   | 74.9   | 76.4                              | 74.8   | 77.0               | 74.7   | 6841               | 78.1   |
| 1999 | 4240.2         | 498.0          | 97.2   | 76.4   | 97.2                              | 76.3   | 97.2               | 76.2   | 8517               | 97.2   |
| 2000 | 3689.1         | 498.0          | 84.7   | 76.9   | 84.6                              | 76.8   | 84.3               | 76.8   | 7436               | 84.7   |
| 2001 | 3425.1         | 498.0          | 78.5   | 77.0   | 78.4                              | 76.9   | 78.5               | 76.9   | 6873               | 78.5   |
| 2002 | 3143.2         | 498.0          | 68.5   | 76.5   | 68.5                              | 76.4   | 72.1               | 76.6   | 6001               | 68.5   |
| 2003 | 1856.1         | 498.0          | 42.5   | 74.8   | 42.5                              | 74.6   | 42.5               | 74.8   | 3725               | 42.5   |
| 2004 | 2998.9         | 498.0          | 68.6   | 74.5   | 68.5                              | 74.3   | 68.6               | 74.5   | 6020               | 68.5   |

## JP-22 ONAGAWA-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 07 Sep | 2284.0 | 1134.4  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING  |
| 12 Dec | 480.0  | 239.0   | UF3  | A32  | EXTENSION OF PLANNED PERIODICAL INSPECTION. ADDITIONAL CHECKING ON MAIN FEEDWATER CHECK VALVE |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 480       |          |   | 313       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 2284            |           |          | 1422  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 318   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 5        |
| Subtotal   | 2284            | 480       | 0        | 1740  | 313       | 5        |
| Total  |                 | 2764      |          |   | 2058      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 15. Reactor Cooling Systems         |                    | 244   |
| 31. Turbine and auxiliaries         |                    | 36  |
| 32. Feedwater and Main Steam System | 480                | 26  |
| 42. Electrical Power Supply Systems |                    | 6   |
| Total                               | 480                | 312   |

# JP-54 ONAGAWA-2

**Operator:** TOHOKU (TOHOKU ELECTRIC POWER CO.)  
**Contractor:** TOSHIBA (TOSHIBA CORPORATION)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 796.0 MW(e)  
**Design Net RUP:** 796.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 7040.4 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 100.7%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 597.0 | 558.6 | 597.2 | 578.4 | 598.0 | 578.3 | 597.0 | 595.6 | 575.3 | 594.4 | 574.5 | 596.0 | 7040.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 100.8 | 100.8 | 100.8 | 101.1 | 101.0 | 100.9 | 100.8 | 100.6 | 100.4 | 100.2 | 100.2 | 100.6 | 100.7  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 12 Apr 1991      **Lifetime Generation:** 56027.8 GW(e).h  
**Date of First Criticality:** 02 Nov 1994      **Cumulative Energy Availability Factor:** 81.9%  
**Date of Grid Connection:** 23 Dec 1994      **Cumulative Load Factor:** 82.0%  
**Date of Commercial Operation:** 28 Jul 1995      **Cumulative Unit Capability Factor:** 81.9%  
**Cumulative Energy Unavailability Factor:** 18.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1995 | 4496.6         | 796.0          | 0.0  | 0.0    | 64.8                              | 100.0  | 64.5               | 0.0    | 6510               | 74.3   |
| 1996 | 5175.3         | 796.0          | 74.4   | 74.4   | 74.4                              | 74.4   | 74.0               | 74.0   | 6545               | 74.5   |
| 1997 | 6931.6         | 796.0          | 99.9   | 87.2   | 99.9                              | 87.2   | 99.4               | 86.7   | 8760               | 100.0  |
| 1998 | 5647.7         | 796.0          | 81.1   | 85.2   | 80.8                              | 85.1   | 81.0               | 84.8   | 7185               | 82.0   |
| 1999 | 5841.2         | 796.0          | 84.2   | 84.9   | 84.2                              | 84.8   | 83.8               | 84.5   | 7383               | 84.3   |
| 2000 | 5858.6         | 796.0          | 84.3   | 84.8   | 84.2                              | 84.7   | 83.8               | 84.4   | 7402               | 84.3   |
| 2001 | 6521.2         | 796.0          | 94.0   | 86.3   | 94.0                              | 86.3   | 93.5               | 85.9   | 8238               | 94.0   |
| 2002 | 5242.9         | 796.0          | 72.4   | 84.3   | 72.4                              | 84.3   | 75.2               | 84.4   | 6368               | 72.7   |
| 2003 | 3272.4         | 796.0          | 47.3   | 79.7   | 47.2                              | 79.7   | 46.9               | 79.7   | 4139               | 47.2   |
| 2004 | 7040.4         | 796.0          | 100.0  | 82.0   | 100.0                             | 81.9   | 100.7              | 82.0   | 8784               | 100.0  |

## JP-54 ONAGAWA-2

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1995 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 486       |          |
| C. Inspection, maintenance or repair combined with refuelling | 878             |           |          |   |           |          |
| D. Inspection, maintenance or repair without refuelling       | 62              |           |          |   |           |          |
| Subtotal  | 0               | 0         | 0        | 940   | 486       | 0        |
| Total   | 0               |           |          | 1426  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1995 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 15. Reactor Cooling Systems         |                    | 375   |
| 31. Turbine and auxiliaries         |                    | 34  |
| 32. Feedwater and Main Steam System |                    | 76  |
| Total                               | 0                  | 485   |

**JP-57 ONAGAWA-3**

Operator: TOHOKU (TOHOKU ELECTRIC POWER CO.)

Contractor: TOSHIBA (TOSHIBA CORPORATION)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 796.0 MW(e)  
 Design Net RUP: 0.0 MW(e)  
 Design Discharge Burnup: —

**2. Production Summary 2004**

Energy Production: 5348.7 GW(e).h  
 Energy Availability Factor: 74.4%  
 Load Factor: 76.5%  
 Operating Factor: 74.5%  
 Energy Unavailability Factor: 25.6%  
 Total Off-line Time: 2236 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| GW(e).h  | 612.7 | 572.4 | 611.6 | 592.4 | 600.6 | 159.0 | 0.0   | 0.8  | 387.1 | 609.8 | 590.6 | 611.8 | 5348.7 |
| EAF (%)  | 100.0 | 100.0 | 99.9  | 100.0 | 99.6  | 27.9  | 0.0   | 1.1  | 65.9  | 100.0 | 100.0 | 100.0 | 74.4   |
| UCF (%)  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 29.4  | 0.0   | 1.1  | 65.9  | 100.0 | 100.0 | 100.0 | 74.6   |
| LF (%)   | 103.5 | 103.3 | 103.3 | 103.5 | 101.4 | 27.7  | 0.0   | 0.1  | 67.5  | 102.8 | 103.1 | 103.3 | 76.5   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 26.5  | 0.0   | 1.1  | 68.5  | 99.9  | 100.0 | 100.0 | 74.5   |
| EUF (%)  | 0.0   | 0.0   | 0.1   | 0.0   | 0.4   | 72.1  | 100.0 | 98.9 | 34.1  | 0.0   | 0.0   | 0.0   | 25.6   |
| PUF (%)  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 70.6  | 100.0 | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 14.3   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 98.9 | 34.1  | 0.0   | 0.0   | 0.0   | 11.2   |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 1.5   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 23 Jan 1998      Lifetime Generation: 17979.5 GW(e).h  
 Date of First Criticality: 26 Apr 2001      Cumulative Energy Availability Factor: 86.0%  
 Date of Grid Connection: 30 May 2001      Cumulative Load Factor: 85.9%  
 Date of Commercial Operation: 30 Jan 2002      Cumulative Unit Capability Factor: 83.5%  
    Cumulative Energy Unavailability Factor: 14.0%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 2002 | 6652.5            | 796.0             | 100.0  | 100.0  | 100.0                                | 100.0  | 95.4               | 95.4   | 8064                  | 92.1   |
| 2003 | 5978.2            | 796.0             | 84.7   | 92.3   | 83.7                                 | 91.9   | 85.7               | 90.6   | 7332                  | 83.7   |
| 2004 | 5348.7            | 796.0             | 74.6   | 86.4   | 74.4                                 | 86.0   | 76.5               | 85.9   | 6548                  | 74.5   |



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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 17 May | 528.0  | 10.7    | XP   | S    | COAST-DOWN  |
| 09 Jun | 1255.0 | 997.2   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING.   |
| 01 Aug | 981.0  | 781.5   | UF3  | A32  | EXTENSION OF PLANNED PERIODICAL INSPECTION. [ADDITIONAL CHECKING ON THE MAIN STEAM SAFETY RELIEF VALVE] |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 2003 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 981       |          |  |           |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1255            |           |          | 671                                      |           |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 42       |
| Subtotal   | 1255            | 981       | 0        | 671                                      | 0         | 42       |
| Total  |                 | 2236      |          |  | 713       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2003 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 32. Feedwater and Main Steam System | 981             |  |
| Total                               | 981             | 0  |

# JP-28 SENDAI-1

**Operator:** KYUSHU (KYUSHU ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 846.0 MW(e)  
**Design Net RUP:** 846.0 MW(e)  
**Design Discharge Burnup:** 31000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6080.8 GW(e).h  
**Energy Availability Factor:** 80.1%  
**Load Factor:** 81.8%  
**Operating Factor:** 80.2%  
**Energy Unavailability Factor:** 19.9%  
**Total Off-line Time:** 1741 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 643.8 | 602.2 | 643.8 | 622.6 | 643.4 | 620.8 | 639.1 | 245.5 | 0.0   | 154.7 | 622.0 | 642.9 | 6080.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 38.4  | 0.0   | 24.3  | 100.0 | 100.0 | 80.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 38.4  | 0.0   | 24.3  | 100.0 | 100.0 | 80.2   |
| <b>LF (%)</b>   | 102.3 | 102.3 | 102.3 | 102.4 | 102.2 | 101.9 | 101.5 | 39.0  | 0.0   | 24.5  | 102.1 | 102.1 | 81.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 35.5  | 0.0   | 27.2  | 100.0 | 100.0 | 80.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 61.6  | 100.0 | 75.7  | 0.0   | 0.0   | 19.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 61.6  | 100.0 | 75.7  | 0.0   | 0.0   | 19.9   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 15 Dec 1979  
**Date of First Criticality:** 25 Aug 1983  
**Date of Grid Connection:** 16 Sep 1983  
**Date of Commercial Operation:** 04 Jul 1984

**Lifetime Generation:** 128983.0 GW(e).h  
**Cumulative Energy Availability Factor:** 81.5%  
**Cumulative Load Factor:** 82.4%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 18.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 666.3          | 846.0          | 0.0  | 0.0    | 78.8                              | 100.0  | 9.4                | 0.0    | 1760               | 21.0   |
| 1984 | 6069.8         | 846.0          | 0.0  | 0.0    | 81.1                              | 100.0  | 81.7               | 0.0    | 7487               | 85.2   |
| 1985 | 5890.3         | 846.0          | 78.7   | 78.7   | 78.7                              | 78.7   | 79.5               | 79.5   | 6964               | 79.5   |
| 1986 | 6084.0         | 846.0          | 81.4   | 80.0   | 81.4                              | 80.0   | 82.1               | 80.8   | 7224               | 82.5   |
| 1987 | 6113.4         | 846.0          | 81.7   | 80.6   | 81.7                              | 80.6   | 82.5               | 81.4   | 7261               | 82.9   |
| 1988 | 5683.1         | 846.0          | 75.8   | 79.4   | 75.8                              | 79.4   | 76.5               | 80.1   | 6756               | 76.9   |
| 1989 | 7381.3         | 846.0          | 98.7   | 83.3   | 98.7                              | 83.3   | 99.6               | 84.0   | 8641               | 98.6   |
| 1990 | 6155.0         | 846.0          | 82.3   | 83.1   | 82.3                              | 83.1   | 83.1               | 83.9   | 7307               | 83.4   |
| 1991 | 5590.7         | 846.0          | 74.8   | 81.9   | 74.8                              | 81.9   | 75.4               | 82.7   | 6684               | 76.3   |
| 1992 | 5713.9         | 846.0          | 76.1   | 81.2   | 76.1                              | 81.2   | 76.9               | 81.9   | 6780               | 77.2   |
| 1993 | 6619.2         | 846.0          | 88.4   | 82.0   | 88.4                              | 82.0   | 89.3               | 82.8   | 7753               | 88.5   |
| 1994 | 5778.3         | 846.0          | 77.2   | 81.5   | 77.2                              | 81.5   | 78.0               | 82.3   | 6762               | 77.2   |
| 1995 | 5780.3         | 846.0          | 77.3   | 81.1   | 77.3                              | 81.1   | 78.0               | 81.9   | 6863               | 78.3   |
| 1996 | 5185.4         | 846.0          | 69.1   | 80.1   | 69.1                              | 80.1   | 69.8               | 80.9   | 6157               | 70.1   |
| 1997 | 7216.7         | 846.0          | 96.4   | 81.4   | 96.4                              | 81.4   | 97.4               | 82.1   | 8449               | 96.4   |
| 1998 | 5291.2         | 846.0          | 70.6   | 80.6   | 70.6                              | 80.6   | 71.4               | 81.4   | 6311               | 72.0   |
| 1999 | 6057.6         | 846.0          | 80.8   | 80.6   | 80.8                              | 80.6   | 81.7               | 81.4   | 7082               | 80.8   |
| 2000 | 5654.0         | 846.0          | 75.2   | 80.3   | 75.2                              | 80.3   | 76.1               | 81.1   | 6609               | 75.2   |
| 2001 | 7367.0         | 846.0          | 98.3   | 81.3   | 98.3                              | 81.3   | 99.4               | 82.1   | 8614               | 98.3   |
| 2002 | 6323.0         | 846.0          | 83.7   | 81.5   | 83.7                              | 81.5   | 85.3               | 82.3   | 7333               | 83.7   |
| 2003 | 6282.1         | 846.0          | 83.1   | 81.5   | 83.1                              | 81.6   | 84.8               | 82.5   | 7278               | 83.1   |
| 2004 | 6080.8         | 846.0          | 80.2   | 81.5   | 80.1                              | 81.5   | 81.8               | 82.4   | 7043               | 80.2   |

## JP-28 SENDAI-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                           |
|--------|--------|---------|------|------|---------------------------------------|
| 12 Aug | 1741.0 | 1474.2  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair<br>combined with refuelling | 1741            |           |          | 1455  | 60        |          |
| Subtotal   | 1741            | 0         | 0        | 1455  | 60        | 0        |
| Total  | 1741            |           |          | 1515  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                        | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|-------------------------------|--------------------|---|
| 12. Reactor I&C Systems       |                    | 2   |
| 13. Reactor Auxiliary Systems |                    | 13  |
| 16. Steam generation systems  |                    | 33  |
| 31. Turbine and auxiliaries   |                    | 11  |
| Total                         | 0                  | 59  |

# JP-37 SENDAI-2

**Operator:** KYUSHU (KYUSHU ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 846.0 MW(e)  
**Design Net RUP:** 846.0 MW(e)  
**Design Discharge Burnup:** 31000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6762.5 GW(e).h  
**Energy Availability Factor:** 88.5%  
**Load Factor:** 91.0%  
**Operating Factor:** 88.5%  
**Energy Unavailability Factor:** 11.5%  
**Total Off-line Time:** 1010 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 649.4 | 606.9 | 649.2 | 628.0 | 649.3 | 626.5 | 644.8 | 643.5 | 624.1 | 646.1 | 394.8 | 0.0   | 6762.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 63.0  | 0.0   | 88.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 63.0  | 0.0   | 88.5   |
| <b>LF (%)</b>   | 103.2 | 103.1 | 103.1 | 103.2 | 103.2 | 102.9 | 102.4 | 102.2 | 102.5 | 102.5 | 64.8  | 0.0   | 91.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 63.1  | 0.0   | 88.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 37.0  | 100.0 | 11.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 37.0  | 100.0 | 11.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|                                      |             |   |                  |
|--------------------------------------|-------------|---|------------------|
| <b>Date of Construction Start:</b>   | 12 Oct 1981 | <b>Lifetime Generation:</b>                     | 121376.2 GW(e).h |
| <b>Date of First Criticality:</b>    | 18 Mar 1985 | <b>Cumulative Energy Availability Factor:</b>   | 83.1%            |
| <b>Date of Grid Connection:</b>      | 05 Apr 1985 | <b>Cumulative Load Factor:</b>                  | 84.1%            |
| <b>Date of Commercial Operation:</b> | 28 Nov 1985 | <b>Cumulative Unit Capability Factor:</b>       | 78.2%            |
|                                      |             | <b>Cumulative Energy Unavailability Factor:</b> | 16.9%            |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 2816.1         | 846.0          | 0.0  | 0.0    | 38.4                              | 100.0  | 38.4               | 0.0    | 4327               | 49.9   |
| 1986 | 5996.4         | 846.0          | 80.1   | 80.1   | 80.1                              | 80.1   | 80.9               | 80.9   | 7112               | 81.2   |
| 1987 | 6080.6         | 846.0          | 81.2   | 80.7   | 81.2                              | 80.7   | 82.0               | 81.5   | 7211               | 82.3   |
| 1988 | 7409.8         | 846.0          | 98.7   | 86.7   | 98.7                              | 86.7   | 99.7               | 87.6   | 8665               | 98.6   |
| 1989 | 4999.4         | 846.0          | 66.8   | 81.7   | 66.8                              | 81.7   | 67.5               | 82.5   | 5950               | 67.9   |
| 1990 | 6160.1         | 846.0          | 82.4   | 81.9   | 82.4                              | 81.9   | 83.1               | 82.7   | 7309               | 83.4   |
| 1991 | 5665.3         | 846.0          | 75.7   | 80.8   | 75.7                              | 80.8   | 76.4               | 81.6   | 6732               | 76.8   |
| 1992 | 7385.3         | 846.0          | 98.3   | 83.3   | 98.3                              | 83.3   | 99.4               | 84.2   | 8639               | 98.3   |
| 1993 | 5822.0         | 846.0          | 77.7   | 82.6   | 77.7                              | 82.6   | 78.6               | 83.5   | 6632               | 75.7   |
| 1994 | 5568.8         | 846.0          | 74.3   | 81.7   | 74.3                              | 81.7   | 75.1               | 82.5   | 6557               | 74.9   |
| 1995 | 5658.4         | 846.0          | 75.5   | 81.1   | 75.5                              | 81.1   | 76.4               | 81.9   | 6709               | 76.6   |
| 1996 | 7359.3         | 846.0          | 98.0   | 82.6   | 98.0                              | 82.6   | 99.0               | 83.5   | 8617               | 98.1   |
| 1997 | 5950.3         | 846.0          | 79.4   | 82.4   | 79.4                              | 82.4   | 80.3               | 83.2   | 7034               | 80.3   |
| 1998 | 5899.1         | 846.0          | 78.7   | 82.1   | 78.7                              | 82.1   | 79.6               | 82.9   | 6973               | 79.6   |
| 1999 | 5658.3         | 846.0          | 75.5   | 81.6   | 75.5                              | 81.6   | 76.4               | 82.5   | 6612               | 75.5   |
| 2000 | 7370.2         | 846.0          | 98.0   | 82.7   | 98.0                              | 82.7   | 99.2               | 83.6   | 8614               | 98.1   |
| 2001 | 6210.2         | 846.0          | 82.9   | 82.7   | 82.9                              | 82.7   | 83.8               | 83.6   | 7260               | 82.9   |
| 2002 | 6255.5         | 846.0          | 82.8   | 82.7   | 82.8                              | 82.7   | 84.4               | 83.6   | 7257               | 82.8   |
| 2003 | 6348.8         | 846.0          | 83.4   | 82.8   | 83.4                              | 82.8   | 85.7               | 83.8   | 7315               | 83.5   |
| 2004 | 6762.5         | 846.0          | 88.5   | 83.1   | 88.5                              | 83.1   | 91.0               | 84.1   | 7774               | 88.5   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                           |
|--------|--------|---------|------|------|---------------------------------------|
| 19 Nov | 1010.0 | 854.9   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING. |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| C. Inspection, maintenance or repair combined with refuelling | 1010            |           |          | 1430  |           |          |
| Subtotal  | 1010            | 0         | 0        | 1430  | 0         | 0        |
| Total   |                 | 1010      |          |   | 1430      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|--------|--------------------|---|
|        |                    |   |

The reactor has not yet completed a full year of commercial operation.

# JP-48 SHIKA-1

**Operator:** HOKURIKU (HOKURIKU ELECTRIC POWER CO.)  
**Contractor:** HITACHI (HITACHI LTD.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 505.0 MW(e)  
**Design Net RUP:** 505.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 3534.9 GW(e).h  
**Energy Availability Factor:** 78.8%  
**Load Factor:** 79.7%  
**Operating Factor:** 79.2%  
**Energy Unavailability Factor:** 21.2%  
**Total Off-line Time:** 1826 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 384.9 | 360.6 | 385.3 | 372.6 | 384.1 | 339.0 | 379.2 | 377.1 | 115.8 | 0.0   | 52.3 | 384.1 | 3534.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.4  | 100.0 | 99.9  | 36.1  | 0.0   | 16.7 | 100.0 | 78.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.4  | 100.0 | 99.9  | 36.1  | 0.0   | 16.7 | 100.0 | 78.8   |
| <b>LF (%)</b>   | 102.5 | 102.6 | 102.6 | 102.5 | 102.2 | 93.2  | 100.9 | 100.4 | 31.9  | 0.0   | 14.4 | 102.2 | 79.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 28.3  | 0.0   | 21.4 | 100.0 | 79.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.6   | 0.0   | 0.1   | 63.9  | 100.0 | 83.3 | 0.0   | 21.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 63.9  | 100.0 | 83.3 | 0.0   | 20.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1989  
**Date of First Criticality:** 20 Nov 1992  
**Date of Grid Connection:** 12 Jan 1993  
**Date of Commercial Operation:** 30 Jul 1993

**Lifetime Generation:** 41173.1 GW(e).h  
**Cumulative Energy Availability Factor:** 78.7%  
**Cumulative Load Factor:** 78.7%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 21.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 2834.3         | 505.0          | 0.0  | 0.0    | 99.9                              | 100.0  | 64.1               | 0.0    | 6576               | 75.1   |
| 1994 | 3312.4         | 505.0          | 75.0   | 75.0   | 75.0                              | 75.0   | 74.9               | 74.9   | 6584               | 75.2   |
| 1995 | 3497.2         | 505.0          | 79.0   | 77.0   | 79.0                              | 77.0   | 79.1               | 77.0   | 6974               | 79.6   |
| 1996 | 3454.7         | 505.0          | 77.9   | 77.3   | 77.9                              | 77.3   | 77.9               | 77.3   | 6848               | 78.0   |
| 1997 | 4431.8         | 505.0          | 100.0  | 83.0   | 100.0                             | 83.0   | 100.2              | 83.0   | 8760               | 100.0  |
| 1998 | 3530.6         | 505.0          | 80.0   | 82.4   | 80.0                              | 82.4   | 79.8               | 82.4   | 7047               | 80.4   |
| 1999 | 3325.7         | 505.0          | 75.4   | 81.2   | 75.4                              | 81.2   | 75.2               | 81.2   | 6607               | 75.4   |
| 2000 | 3763.1         | 505.0          | 84.9   | 81.8   | 84.9                              | 81.8   | 84.8               | 81.7   | 7462               | 84.9   |
| 2001 | 4427.4         | 505.0          | 100.0  | 84.0   | 100.0                             | 84.0   | 100.1              | 84.0   | 8760               | 100.0  |
| 2002 | 3537.1         | 505.0          | 80.0   | 83.6   | 80.0                              | 83.6   | 80.0               | 83.5   | 7010               | 80.0   |
| 2003 | 1523.8         | 505.0          | 34.6   | 78.7   | 34.6                              | 78.7   | 34.4               | 78.6   | 3029               | 34.6   |
| 2004 | 3534.9         | 505.0          | 78.8   | 78.7   | 78.8                              | 78.7   | 79.7               | 78.7   | 6958               | 79.2   |

**JP-48 SHIKA-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 25 Jun | 138.0  | 31.1    | UP1  | A31  | PARTIAL OUTAGE DUE TO INSPECTION AND REPAIR OF THE MAIN CONDENSER WHICH LEAKED A TUBE |
| 11 Sep | 1809.0 | 911.0   | PF   | C    | PERIODICAL INSPECTION AND REFUELLING  |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1994 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 128       |          |
| C. Inspection, maintenance or repair combined with refuelling | 1809            |           |          | 1560  |           |          |
| Subtotal  | 1809            | 0         | 0        | 1560  | 128       | 0        |
| Total   |                 | 1809      |          |   | 1688      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1994 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 15. Reactor Cooling Systems         |                    | 86  |
| 31. Turbine and auxiliaries         |                    | 14  |
| 42. Electrical Power Supply Systems |                    | 27  |
| Total                               | 0                  | 127   |

# JP-7 SHIMANE-1

**Operator:** CHUGOKU (CHUGOKU ELECTRIC POWER CO.)  
**Contractor:** HITACHI (HITACHI LTD.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 439.0 MW(e)  
**Design Net RUP:** 439.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3937.9 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 102.1%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 334.9 | 314.8 | 336.1 | 324.8 | 334.1 | 322.5 | 330.3 | 329.9 | 320.4 | 332.9 | 322.9 | 334.2 | 3937.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 102.5 | 103.0 | 102.9 | 102.9 | 102.3 | 102.0 | 101.1 | 101.0 | 101.4 | 101.8 | 102.2 | 102.3 | 102.1  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 02 Jul 1970  
**Date of First Criticality:** 01 Jun 1973  
**Date of Grid Connection:** 02 Dec 1973  
**Date of Commercial Operation:** 29 Mar 1974

**Lifetime Generation:** 87677.2 GW(e).h  
**Cumulative Energy Availability Factor:** 73.4%  
**Cumulative Load Factor:** 73.3%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 26.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2696.1         | 439.0          | 70.1   | 67.0   | 70.1                              | 67.0   | 70.1               | 66.5   | 6268               | 71.6   |
| 1984 | 2990.7         | 439.0          | 78.2   | 68.1   | 78.2                              | 68.1   | 77.6               | 67.6   | 6912               | 78.7   |
| 1985 | 3790.4         | 439.0          | 100.0  | 71.0   | 99.1                              | 70.9   | 98.6               | 70.5   | 8705               | 99.4   |
| 1986 | 2130.5         | 439.0          | 55.5   | 69.7   | 55.5                              | 69.6   | 55.4               | 69.2   | 4903               | 56.0   |
| 1987 | 3011.2         | 439.0          | 79.4   | 70.5   | 78.6                              | 70.3   | 78.3               | 69.9   | 6937               | 79.2   |
| 1988 | 2355.1         | 439.0          | 61.1   | 69.8   | 61.1                              | 69.7   | 61.1               | 69.3   | 5398               | 61.5   |
| 1989 | 2616.3         | 439.0          | 68.1   | 69.7   | 68.1                              | 69.6   | 68.0               | 69.2   | 5965               | 68.1   |
| 1990 | 3745.5         | 439.0          | 97.3   | 71.4   | 97.4                              | 71.3   | 97.4               | 70.9   | 8565               | 97.8   |
| 1991 | 3111.3         | 439.0          | 80.9   | 72.0   | 80.9                              | 71.9   | 80.9               | 71.5   | 7123               | 81.3   |
| 1992 | 2671.3         | 439.0          | 73.4   | 72.0   | 69.4                              | 71.7   | 69.3               | 71.4   | 6134               | 69.8   |
| 1993 | 2549.1         | 439.0          | 66.5   | 71.7   | 66.5                              | 71.4   | 66.3               | 71.1   | 5849               | 66.8   |
| 1994 | 2948.0         | 439.0          | 76.7   | 72.0   | 76.7                              | 71.7   | 76.7               | 71.4   | 6733               | 76.9   |
| 1995 | 2984.6         | 439.0          | 78.0   | 72.3   | 78.1                              | 72.0   | 77.6               | 71.7   | 6862               | 78.3   |
| 1996 | 2245.5         | 439.0          | 58.4   | 71.7   | 58.4                              | 71.4   | 58.2               | 71.1   | 5154               | 58.7   |
| 1997 | 2923.6         | 439.0          | 76.2   | 71.8   | 76.2                              | 71.6   | 76.0               | 71.3   | 6712               | 76.6   |
| 1998 | 3845.4         | 439.0          | 100.0  | 73.0   | 100.0                             | 72.8   | 100.0              | 72.5   | 8760               | 100.0  |
| 1999 | 3359.3         | 439.0          | 87.4   | 73.6   | 87.4                              | 73.4   | 87.4               | 73.1   | 7657               | 87.4   |
| 2000 | 1381.2         | 439.0          | 35.8   | 72.1   | 35.8                              | 71.9   | 35.8               | 71.7   | 3149               | 35.8   |
| 2001 | 2844.6         | 439.0          | 74.0   | 72.2   | 74.1                              | 72.0   | 74.0               | 71.7   | 6488               | 74.1   |
| 2002 | 3393.2         | 439.0          | 88.2   | 72.8   | 88.2                              | 72.6   | 88.2               | 72.3   | 7730               | 88.2   |
| 2003 | 2749.0         | 439.0          | 71.4   | 72.7   | 71.4                              | 72.5   | 71.5               | 72.3   | 6253               | 71.4   |
| 2004 | 3937.9         | 439.0          | 100.0  | 73.6   | 100.0                             | 73.4   | 102.1              | 73.3   | 8784               | 100.0  |



## JP-7 SHIMANE-1

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 15        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 2084  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 79  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 10        |          |
| Z. Others  |                 |           |          |   | 12        |          |
| Subtotal   | 0               | 0         | 0        | 2163  | 37        | 3        |
| Total  | 0               |           |          | 2203  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                      | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|-----------------------------|--------------------|---|
| 15. Reactor Cooling Systems |                    | 13  |
| 31. Turbine and auxiliaries |                    | 2   |
| Total                       | 0                  | 15  |

# JP-41 SHIMANE-2

**Operator:** CHUGOKU (CHUGOKU ELECTRIC POWER CO.)  
**Contractor:** HITACHI (HITACHI LTD.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 789.0 MW(e)  
**Design Net RUP:** 789.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4097.6 GW(e).h  
**Energy Availability Factor:** 59.0%  
**Load Factor:** 59.1%  
**Operating Factor:** 59.2%  
**Energy Unavailability Factor:** 41.0%  
**Total Off-line Time:** 3582 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 590.9 | 555.8 | 323.9 | 193.9 | 590.5 | 567.6 | 583.3 | 581.7 | 110.0 | 0.0   | 0.0   | 0.0   | 4097.6 |
| <b>EAF (%)</b>  | 99.7  | 100.0 | 54.6  | 33.9  | 100.0 | 100.0 | 100.0 | 100.0 | 19.5  | 0.0   | 0.0   | 0.0   | 59.0   |
| <b>UCF (%)</b>  | 99.7  | 100.0 | 54.6  | 33.9  | 100.0 | 100.0 | 100.0 | 100.0 | 19.5  | 0.0   | 0.0   | 0.0   | 59.0   |
| <b>LF (%)</b>   | 100.7 | 101.2 | 55.2  | 34.1  | 100.6 | 99.9  | 99.4  | 99.1  | 19.4  | 0.0   | 0.0   | 0.0   | 59.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 55.1  | 35.4  | 100.0 | 100.0 | 100.0 | 100.0 | 20.1  | 0.0   | 0.0   | 0.0   | 59.2   |
| <b>EUF (%)</b>  | 0.3   | 0.0   | 45.4  | 66.1  | 0.0   | 0.0   | 0.0   | 0.0   | 80.5  | 100.0 | 100.0 | 100.0 | 41.0   |
| <b>PUF (%)</b>  | 0.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 80.5  | 100.0 | 100.0 | 83.9  | 30.4   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 45.4  | 66.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.1  | 10.6   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 02 Feb 1985  
**Date of First Criticality:** 25 May 1988  
**Date of Grid Connection:** 11 Jul 1988  
**Date of Commercial Operation:** 10 Feb 1989

**Lifetime Generation:** 93202.8 GW(e).h  
**Cumulative Energy Availability Factor:** 83.0%  
**Cumulative Load Factor:** 82.9%  
**Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 17.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 1317.1         | 890.0          | 0.0  | 0.0    | 17.3                              | 100.0  | 17.3               | 0.0    | 2474               | 29.0   |
| 1989 | 5852.1         | 791.0          | 0.0  | 0.0    | 90.1                              | 100.0  | 84.5               | 0.0    | 7485               | 85.4   |
| 1990 | 5123.5         | 790.0          | 74.0   | 74.0   | 74.0                              | 74.0   | 74.0               | 74.0   | 6592               | 75.3   |
| 1991 | 5544.5         | 790.0          | 80.1   | 77.1   | 80.1                              | 77.1   | 80.1               | 77.1   | 7121               | 81.3   |
| 1992 | 5516.1         | 790.0          | 79.7   | 78.0   | 79.7                              | 77.9   | 79.5               | 77.9   | 7072               | 80.5   |
| 1993 | 6756.9         | 790.0          | 97.8   | 82.9   | 97.8                              | 82.9   | 97.6               | 82.8   | 8592               | 98.1   |
| 1994 | 5547.3         | 790.0          | 80.6   | 82.5   | 80.6                              | 82.4   | 80.2               | 82.3   | 7071               | 80.7   |
| 1995 | 5363.6         | 790.0          | 77.9   | 81.7   | 77.9                              | 81.7   | 77.5               | 81.5   | 6888               | 78.6   |
| 1996 | 5583.7         | 790.0          | 80.8   | 81.6   | 80.8                              | 81.6   | 80.5               | 81.3   | 7166               | 81.6   |
| 1997 | 6903.2         | 789.0          | 100.0  | 83.9   | 100.0                             | 83.8   | 99.9               | 83.7   | 8760               | 100.0  |
| 1998 | 5962.5         | 789.0          | 86.5   | 84.2   | 86.5                              | 84.1   | 86.3               | 83.9   | 7600               | 86.8   |
| 1999 | 5758.7         | 789.0          | 83.5   | 84.1   | 83.5                              | 84.1   | 83.3               | 83.9   | 7319               | 83.6   |
| 2000 | 6084.0         | 789.0          | 88.2   | 84.5   | 88.1                              | 84.4   | 87.8               | 84.2   | 7747               | 88.2   |
| 2001 | 6901.0         | 789.0          | 100.0  | 85.8   | 100.0                             | 85.7   | 99.8               | 85.5   | 8760               | 100.0  |
| 2002 | 6055.1         | 789.0          | 87.6   | 85.9   | 87.6                              | 85.9   | 87.6               | 85.7   | 7678               | 87.6   |
| 2003 | 4836.2         | 789.0          | 70.1   | 84.8   | 70.0                              | 84.7   | 70.0               | 84.6   | 6133               | 70.0   |
| 2004 | 4097.6         | 789.0          | 59.0   | 83.0   | 59.0                              | 83.0   | 59.1               | 82.9   | 5202               | 59.2   |

**JP-41 SHIMANE-2****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 17 Mar | 814.0  | 642.5   | UF1  | A15  | UNPLANNED SHUTDOWN DUE TO THE INCREASE IN THE FLOW RATE OF CONDENSATE WATER FOR THE DRYWELL COOLER AND FLOOR DRAIN INSIDE THE PRIMARY CONTAINMENT VESSEL |
| 06 Sep | 2645.0 | 2104.6  | PF   | C    | PERIODICAL INSPECTION AND REFUELLING   |
| 26 Dec | 120.0  | 94.7    | UF3  | A15  | EXTENSION OF PERIODICAL INSPECTION   |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 934       |          |   | 91        |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 7         |          |
| C. Inspection, maintenance or repair combined with refuelling | 2645            |           |          | 1048  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 7   |           |          |
| Z. Others   |                 |           |          |   | 37        |          |
| Subtotal  | 2645            | 934       | 0        | 1055  | 135       | 0        |
| Total   |                 | 3579      |          |   | 1190      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                        | 2004<br>Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|-------------------------------|--------------------|---|
| 12. Reactor I&C Systems       |                    | 6   |
| 13. Reactor Auxiliary Systems |                    | 22  |
| 15. Reactor Cooling Systems   | 934                | 10  |
| Total                         | 934                | 38  |

# JP-8 TAKAHAMA-1

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 780.0 MW(e)  
**Design Net RUP:** 780.0 MW(e)  
**Design Discharge Burnup:** 43000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5539.9 GW(e).h  
**Energy Availability Factor:** 77.2%  
**Load Factor:** 80.9%  
**Operating Factor:** 77.2%  
**Energy Unavailability Factor:** 22.8%  
**Total Off-line Time:** 1999 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 610.4 | 571.1 | 611.4 | 194.3 | 0.0   | 240.6 | 603.7 | 601.9 | 300.8 | 607.0 | 589.5 | 609.3 | 5539.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 32.8  | 0.0   | 41.0  | 100.0 | 100.0 | 51.5  | 100.0 | 100.0 | 100.0 | 77.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 32.8  | 0.0   | 41.0  | 100.0 | 100.0 | 51.5  | 100.0 | 100.0 | 100.0 | 77.2   |
| <b>LF (%)</b>   | 105.2 | 105.2 | 105.4 | 34.6  | 0.0   | 42.8  | 104.0 | 103.7 | 53.6  | 104.5 | 105.0 | 105.0 | 80.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 29.3  | 0.0   | 41.3  | 100.0 | 100.0 | 55.1  | 99.9  | 100.0 | 100.0 | 77.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 67.2  | 100.0 | 59.0  | 0.0   | 0.0   | 48.5  | 0.0   | 0.0   | 0.0   | 22.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 67.2  | 100.0 | 59.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 18.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 48.5  | 0.0   | 0.0   | 0.0   | 4.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 25 Apr 1970  
**Date of First Criticality:** 14 Mar 1974  
**Date of Grid Connection:** 27 Mar 1974  
**Date of Commercial Operation:** 14 Nov 1974

**Lifetime Generation:** 139289.9 GW(e).h  
**Cumulative Energy Availability Factor:** 66.2%  
**Cumulative Load Factor:** 66.6%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 33.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5716.2         | 780.0          | 83.7   | 47.5   | 83.8                              | 47.5   | 83.7               | 47.5   | 7403               | 84.5   |
| 1984 | 3537.4         | 780.0          | 51.4   | 47.9   | 51.4                              | 47.9   | 51.6               | 47.9   | 4586               | 52.2   |
| 1985 | 5000.8         | 780.0          | 72.8   | 50.1   | 72.8                              | 50.1   | 73.2               | 50.2   | 6473               | 73.9   |
| 1986 | 5070.3         | 780.0          | 73.9   | 52.1   | 73.9                              | 52.1   | 74.2               | 52.2   | 6507               | 74.3   |
| 1987 | 4701.4         | 780.0          | 70.2   | 53.5   | 70.2                              | 53.5   | 68.8               | 53.5   | 6148               | 70.2   |
| 1988 | 4147.1         | 780.0          | 60.9   | 54.0   | 60.9                              | 54.0   | 60.5               | 54.0   | 5351               | 60.9   |
| 1989 | 4877.3         | 780.0          | 72.0   | 55.2   | 72.0                              | 55.2   | 71.4               | 55.1   | 6311               | 72.0   |
| 1990 | 6265.5         | 780.0          | 90.8   | 57.4   | 90.8                              | 57.4   | 91.7               | 57.4   | 8002               | 91.3   |
| 1991 | 4795.0         | 780.0          | 68.3   | 58.1   | 68.2                              | 58.1   | 70.2               | 58.2   | 6202               | 70.8   |
| 1992 | 4645.0         | 780.0          | 67.6   | 58.6   | 67.6                              | 58.6   | 67.8               | 58.7   | 6051               | 68.9   |
| 1993 | 3299.7         | 780.0          | 48.4   | 58.1   | 48.4                              | 58.1   | 48.3               | 58.2   | 4458               | 50.9   |
| 1994 | 4024.0         | 780.0          | 58.8   | 58.1   | 58.8                              | 58.1   | 58.9               | 58.2   | 5146               | 58.7   |
| 1995 | 6585.1         | 780.0          | 96.0   | 59.9   | 96.0                              | 59.9   | 96.4               | 60.0   | 8485               | 96.9   |
| 1996 | 3358.8         | 780.0          | 48.8   | 59.4   | 48.8                              | 59.4   | 49.0               | 59.5   | 4331               | 49.3   |
| 1997 | 4674.4         | 780.0          | 68.1   | 59.8   | 68.1                              | 59.8   | 68.4               | 59.9   | 6000               | 68.5   |
| 1998 | 6856.8         | 780.0          | 100.0  | 61.5   | 100.0                             | 61.5   | 100.4              | 61.6   | 8760               | 100.0  |
| 1999 | 5704.2         | 780.0          | 84.3   | 62.4   | 83.2                              | 62.3   | 83.5               | 62.5   | 7291               | 83.2   |
| 2000 | 6008.1         | 780.0          | 87.4   | 63.3   | 87.4                              | 63.3   | 87.7               | 63.4   | 7716               | 87.8   |
| 2001 | 6005.8         | 780.0          | 87.6   | 64.2   | 87.6                              | 64.2   | 87.9               | 64.3   | 7731               | 88.3   |
| 2002 | 6056.3         | 780.0          | 88.4   | 65.1   | 88.4                              | 65.1   | 88.6               | 65.2   | 7749               | 88.5   |
| 2003 | 6247.2         | 780.0          | 87.2   | 65.9   | 87.2                              | 65.8   | 91.4               | 66.1   | 7637               | 87.2   |
| 2004 | 5539.9         | 780.0          | 77.2   | 66.2   | 77.2                              | 66.2   | 80.9               | 66.6   | 6785               | 77.2   |

**JP-8 TAKAHAMA-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 10 Apr | 1651.0 | 1288.5  | PF   | C    | PERIODICAL INSPECTION AND REFUELING                     |
| 07 Sep | 348.0  | 272.2   | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 426       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1651            |           |          | 2037  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 229   |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 0   |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 3        |
| Z. Others   |                 | 348       |          |   |           |          |
| Subtotal  | 1651            | 348       | 0        | 2266  | 427       | 3        |
| Total   |                 | 1999      |          |   | 2696      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 8   |
| 15. Reactor Cooling Systems         |                    | 106   |
| 16. Steam generation systems        |                    | 264   |
| 31. Turbine and auxiliaries         |                    | 18  |
| 32. Feedwater and Main Steam System |                    | 28  |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 0                  | 424   |

# JP-13 TAKAHAMA-2

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 780.0 MW(e)  
**Design Net RUP:** 780.0 MW(e)  
**Design Discharge Burnup:** 43000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6346.6 GW(e).h  
**Energy Availability Factor:** 88.9%  
**Load Factor:** 92.6%  
**Operating Factor:** 89.2%  
**Energy Unavailability Factor:** 11.1%  
**Total Off-line Time:** 945 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 609.4 | 570.1 | 608.7 | 589.0 | 608.0 | 585.4 | 574.2 | 246.4 | 468.6 | 569.8 | 586.8 | 330.4 | 6346.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.8  | 41.3  | 82.2  | 94.6  | 100.0 | 54.4  | 88.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.8  | 41.3  | 82.2  | 100.0 | 100.0 | 54.4  | 89.3   |
| <b>LF (%)</b>   | 105.0 | 105.0 | 104.9 | 105.0 | 104.8 | 104.2 | 98.9  | 42.5  | 83.4  | 98.0  | 104.5 | 56.9  | 92.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 98.7  | 36.0  | 82.8  | 99.9  | 100.0 | 55.0  | 89.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.2   | 58.7  | 17.8  | 5.4   | 0.0   | 45.6  | 11.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 45.6  | 3.9    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.2   | 58.7  | 17.8  | 0.0   | 0.0   | 0.0   | 6.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.4   | 0.0   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 09 Mar 1971  
**Date of First Criticality:** 20 Dec 1974  
**Date of Grid Connection:** 17 Jan 1975  
**Date of Commercial Operation:** 14 Nov 1975

**Lifetime Generation:** 137200.5 GW(e).h  
**Cumulative Energy Availability Factor:** 66.9%  
**Cumulative Load Factor:** 67.6%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 33.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3549.4         | 780.0          | 51.7   | 58.6   | 51.8                              | 58.6   | 51.9               | 58.7   | 4645               | 53.0   |
| 1984 | 4503.1         | 780.0          | 65.4   | 59.3   | 65.4                              | 59.3   | 65.7               | 59.5   | 5746               | 65.4   |
| 1985 | 4967.4         | 780.0          | 72.4   | 60.6   | 72.4                              | 60.6   | 72.7               | 60.8   | 6466               | 73.8   |
| 1986 | 3997.8         | 780.0          | 58.4   | 60.4   | 58.4                              | 60.4   | 58.5               | 60.6   | 5183               | 59.2   |
| 1987 | 4621.8         | 780.0          | 70.3   | 61.3   | 67.3                              | 61.0   | 67.6               | 61.2   | 6154               | 70.3   |
| 1988 | 3071.3         | 780.0          | 45.5   | 60.0   | 45.5                              | 59.8   | 44.8               | 59.9   | 4001               | 45.5   |
| 1989 | 3991.5         | 780.0          | 59.5   | 60.0   | 59.5                              | 59.8   | 58.4               | 59.8   | 5213               | 59.5   |
| 1990 | 1727.9         | 780.0          | 20.9   | 57.4   | 20.8                              | 57.2   | 25.3               | 57.5   | 2218               | 25.3   |
| 1991 | 2265.8         | 780.0          | 32.3   | 55.8   | 32.2                              | 55.6   | 33.2               | 56.0   | 3054               | 34.9   |
| 1992 | 4873.8         | 780.0          | 70.8   | 56.7   | 70.8                              | 56.5   | 71.1               | 56.9   | 6226               | 70.9   |
| 1993 | 5757.0         | 780.0          | 84.0   | 58.2   | 84.0                              | 58.1   | 84.3               | 58.4   | 7426               | 84.8   |
| 1994 | 3357.3         | 780.0          | 49.3   | 57.8   | 49.3                              | 57.6   | 49.1               | 57.9   | 4299               | 49.1   |
| 1995 | 4458.7         | 780.0          | 65.1   | 58.1   | 65.1                              | 58.0   | 65.3               | 58.3   | 5906               | 67.4   |
| 1996 | 6709.1         | 780.0          | 97.7   | 60.0   | 97.3                              | 59.9   | 97.9               | 60.2   | 8629               | 98.2   |
| 1997 | 4981.2         | 780.0          | 72.5   | 60.6   | 72.5                              | 60.4   | 72.9               | 60.8   | 6306               | 72.0   |
| 1998 | 5972.9         | 780.0          | 87.0   | 61.7   | 87.0                              | 61.6   | 87.4               | 61.9   | 7657               | 87.4   |
| 1999 | 5989.8         | 780.0          | 87.2   | 62.8   | 87.2                              | 62.6   | 87.7               | 63.0   | 7717               | 88.1   |
| 2000 | 6849.9         | 780.0          | 99.5   | 64.3   | 99.5                              | 64.1   | 100.0              | 64.5   | 8784               | 100.0  |
| 2001 | 5901.0         | 780.0          | 86.0   | 65.1   | 86.0                              | 65.0   | 86.4               | 65.3   | 7572               | 86.4   |
| 2002 | 6097.7         | 780.0          | 87.0   | 65.9   | 87.0                              | 65.8   | 89.2               | 66.2   | 7626               | 87.1   |
| 2003 | 5470.8         | 780.0          | 76.4   | 66.3   | 76.4                              | 66.2   | 80.1               | 66.7   | 6717               | 76.7   |
| 2004 | 6346.6         | 780.0          | 89.3   | 67.1   | 88.9                              | 66.9   | 92.6               | 67.6   | 7839               | 89.2   |

## JP-13 TAKAHAMA-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 24 Jul | 31.0  | 24.5    | UF1  | A42  | MANUAL TRIP CAUSED BY RISE OF TEMPERATURE OF INSULATION OIL BY ENERGIZING PART HEATING OF MAIN TRANSFORMER TAP CHANGER |
| 13 Aug | 572.0 | 465.6   | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING  |
| 17 Dec | 342.0 | 264.6   | PF   | C    | PERIODICAL INSPECTION AND REFUELING  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1976 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 31        |          |  | 148       |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling | 342             |           |          | 2531                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 11                                       |           |          |
| Z. Others   |                 | 572       |          |  |           |          |
| Subtotal  | 342             | 603       | 0        | 2542                                     | 154       | 0        |
| Total   |                 | 945       |          |  | 2696      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1976 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 43                                       |
| 16. Steam generation systems        |                 | 91                                       |
| 31. Turbine and auxiliaries         |                 | 3  |
| 32. Feedwater and Main Steam System |                 | 9  |
| 42. Electrical Power Supply Systems | 31              | 0  |
| Total                               | 31              | 146                                      |

# JP-29 TAKAHAMA-3

**Operator:** KEPCO (KANSAI ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 830.0 MW(e)  
**Design Net RUP:** 830.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5625.1 GW(e).h  
**Energy Availability Factor:** 74.1%  
**Load Factor:** 77.2%  
**Operating Factor:** 74.1%  
**Energy Unavailability Factor:** 25.9%  
**Total Off-line Time:** 2272 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 469.8 | 625.2 | 644.3 | 621.8 | 640.9 | 370.8 | 344.9 | 640.5 | 622.4 | 644.5 | 5625.1 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 72.9  | 100.0 | 100.0 | 100.0 | 100.0 | 57.9  | 55.8  | 100.0 | 100.0 | 100.0 | 74.1   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 72.9  | 100.0 | 100.0 | 100.0 | 100.0 | 57.9  | 55.8  | 100.0 | 100.0 | 100.0 | 74.1   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 76.1  | 104.8 | 104.3 | 104.0 | 103.8 | 60.0  | 57.7  | 103.6 | 104.1 | 104.4 | 77.2   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 73.3  | 100.1 | 100.0 | 100.0 | 100.0 | 55.1  | 58.5  | 99.9  | 100.0 | 100.0 | 74.1   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 27.1  | 0.0   | 0.0   | 0.0   | 0.0   | 42.1  | 44.2  | 0.0   | 0.0   | 0.0   | 25.9   |
| <b>PUF (%)</b>  | 100.0 | 69.0  | 3.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 14.2   |
| <b>UCLF (%)</b> | 0.0   | 31.0  | 24.0  | 0.0   | 0.0   | 0.0   | 0.0   | 42.0  | 44.2  | 0.0   | 0.0   | 0.0   | 11.7   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 12 Dec 1980  
**Date of First Criticality:** 17 Apr 1984  
**Date of Grid Connection:** 09 May 1984  
**Date of Commercial Operation:** 17 Jan 1985

**Lifetime Generation:** 126133.5 GW(e).h  
**Cumulative Energy Availability Factor:** 84.4%  
**Cumulative Load Factor:** 85.7%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 15.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 1456.8         | 830.0          | 0.0  | 0.0    | 54.3                              | 100.0  | 20.5               | 0.0    | 2959               | 34.5   |
| 1985 | 6199.5         | 830.0          | 84.7   | 84.7   | 84.7                              | 84.7   | 85.3               | 85.3   | 7426               | 84.8   |
| 1986 | 6833.6         | 830.0          | 93.1   | 88.9   | 93.1                              | 88.9   | 94.0               | 89.6   | 8215               | 93.8   |
| 1987 | 6030.4         | 830.0          | 82.9   | 86.9   | 82.9                              | 86.9   | 82.9               | 87.4   | 7265               | 82.9   |
| 1988 | 5743.2         | 830.0          | 79.1   | 85.0   | 79.1                              | 85.0   | 78.8               | 85.2   | 6948               | 79.1   |
| 1989 | 5987.2         | 830.0          | 81.5   | 84.3   | 81.5                              | 84.3   | 82.3               | 84.7   | 7138               | 81.5   |
| 1990 | 6775.0         | 830.0          | 91.9   | 85.5   | 91.9                              | 85.5   | 93.2               | 86.1   | 8143               | 93.0   |
| 1991 | 5513.6         | 830.0          | 73.9   | 83.9   | 73.9                              | 83.9   | 75.8               | 84.6   | 6641               | 75.8   |
| 1992 | 6059.9         | 830.0          | 82.2   | 83.7   | 82.2                              | 83.7   | 83.1               | 84.4   | 7292               | 83.0   |
| 1993 | 5804.8         | 830.0          | 77.6   | 83.0   | 77.6                              | 83.0   | 79.8               | 83.9   | 6983               | 79.7   |
| 1994 | 7361.1         | 830.0          | 100.0  | 84.7   | 100.0                             | 84.7   | 101.2              | 85.6   | 8760               | 100.0  |
| 1995 | 5662.9         | 830.0          | 77.0   | 84.0   | 77.0                              | 84.0   | 77.9               | 84.9   | 6809               | 77.7   |
| 1996 | 5479.3         | 830.0          | 74.2   | 83.2   | 74.2                              | 83.2   | 75.2               | 84.1   | 6576               | 74.9   |
| 1997 | 6028.9         | 830.0          | 81.9   | 83.1   | 81.9                              | 83.1   | 82.9               | 84.0   | 7206               | 82.3   |
| 1998 | 6853.7         | 830.0          | 93.1   | 83.8   | 93.1                              | 83.8   | 94.3               | 84.8   | 8161               | 93.2   |
| 1999 | 6833.4         | 830.0          | 93.8   | 84.5   | 92.8                              | 84.4   | 94.0               | 85.4   | 8131               | 92.8   |
| 2000 | 5898.9         | 830.0          | 79.9   | 84.2   | 79.9                              | 84.1   | 80.9               | 85.1   | 7023               | 80.0   |
| 2001 | 6167.2         | 830.0          | 83.8   | 84.2   | 83.8                              | 84.1   | 84.8               | 85.1   | 7340               | 83.8   |
| 2002 | 6463.3         | 830.0          | 87.3   | 84.3   | 87.3                              | 84.3   | 88.9               | 85.3   | 7654               | 87.4   |
| 2003 | 7355.7         | 830.0          | 96.1   | 85.0   | 96.1                              | 84.9   | 101.2              | 86.1   | 8421               | 96.1   |
| 2004 | 5625.1         | 830.0          | 74.1   | 84.4   | 74.1                              | 84.4   | 77.2               | 85.7   | 6512               | 74.1   |



## JP-29 TAKAHAMA-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1247.0 | 1035.2  | PF   | C    | PERIODICAL INSPECTION AND REFUELING  |
| 21 Feb | 395.0  | 327.6   | UF3  | Z16  | EXTENSION OF PERIODICAL INSPECTION BY DELAY OF PROCEDURE OF STEAM GENERATOR TUBE REPAIR CONSTRUCTION |
| 18 Aug | 630.0  | 523.7   | UF1  | Z31  | UNPLANNED INSPECTION BY THICKNESS MEASUREMENT OF PIPING  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1247            |           |          | 1235                                     |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |  |           | 4        |
| Z. Others   |                 | 1025      |          |  |           |          |
| Subtotal  | 1247            | 1025      | 0        | 1235                                     | 1         | 4        |
| Total   |                 | 2272      |          |  | 1240      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                  | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------|-----------------|--|
| 12. Reactor I&C Systems |                 | 1  |
| Total                   | 0               | 1  |

**JP-30 TAKAHAMA-4**

Operator: KEPCO (KANSAI ELECTRIC POWER CO.)

Contractor: M (MITSUBISHI HEAVY INDUSTRY LTD)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 830.0 MW(e)  
 Design Net RUP: 830.0 MW(e)  
 Design Discharge Burnup: 40000 MW.d/t

**2. Production Summary 2004**

Energy Production: 5987.8 GW(e).h  
 Energy Availability Factor: 78.2%  
 Load Factor: 82.1%  
 Operating Factor: 78.2%  
 Energy Unavailability Factor: 21.8%  
 Total Off-line Time: 1916 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| GW(e).h  | 650.8 | 607.7 | 650.6 | 630.0 | 649.9 | 627.2 | 646.1 | 204.4 | 0.0   | 47.6 | 626.0 | 647.5 | 5987.8 |
| EAF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.6  | 0.0   | 7.6  | 100.0 | 100.0 | 78.2   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.6  | 0.0   | 7.6  | 100.0 | 100.0 | 78.2   |
| LF (%)   | 105.4 | 105.2 | 105.4 | 105.6 | 105.3 | 105.0 | 104.6 | 33.1  | 0.0   | 7.7  | 104.8 | 104.8 | 82.1   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 29.6  | 0.0   | 9.7  | 100.0 | 100.0 | 78.2   |
| EUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 68.4  | 100.0 | 92.4 | 0.0   | 0.0   | 21.8   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 68.4  | 100.0 | 48.6 | 0.0   | 0.0   | 18.1   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 43.8 | 0.0   | 0.0   | 3.7    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 19 Mar 1981      Lifetime Generation: 123569.3 GW(e).h  
 Date of First Criticality: 11 Oct 1984      Cumulative Energy Availability Factor: 83.9%  
 Date of Grid Connection: 01 Nov 1984      Cumulative Load Factor: 85.2%  
 Date of Commercial Operation: 05 Jun 1985      Cumulative Unit Capability Factor: 78.2%  
    Cumulative Energy Unavailability Factor: 16.1%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1984 | 282.6             | 830.0             | 0.0  | 0.0    | 87.4                                 | 100.0  | 3.9                | 0.0    | 988                   | 11.3   |
| 1985 | 5479.3            | 830.0             | 0.0  | 0.0    | 74.7                                 | 100.0  | 75.4               | 0.0    | 6887                  | 78.6   |
| 1986 | 5864.0            | 830.0             | 79.6   | 79.6   | 79.6                                 | 79.6   | 80.7               | 80.7   | 7073                  | 80.7   |
| 1987 | 5588.5            | 830.0             | 77.0   | 78.3   | 77.0                                 | 78.3   | 76.9               | 78.8   | 6743                  | 77.0   |
| 1988 | 6437.9            | 830.0             | 87.3   | 81.3   | 87.3                                 | 81.3   | 88.3               | 81.9   | 7666                  | 87.3   |
| 1989 | 6802.7            | 830.0             | 93.2   | 84.3   | 93.2                                 | 84.3   | 93.6               | 84.8   | 8167                  | 93.2   |
| 1990 | 5174.6            | 830.0             | 69.0   | 81.2   | 69.0                                 | 81.2   | 71.2               | 82.1   | 6233                  | 71.2   |
| 1991 | 6170.1            | 830.0             | 83.0   | 81.5   | 83.1                                 | 81.5   | 84.9               | 82.6   | 7409                  | 84.6   |
| 1992 | 6048.4            | 830.0             | 81.9   | 81.6   | 81.9                                 | 81.6   | 83.0               | 82.6   | 7265                  | 82.7   |
| 1993 | 7210.9            | 830.0             | 97.9   | 83.6   | 97.9                                 | 83.6   | 99.2               | 84.7   | 8578                  | 97.9   |
| 1994 | 5767.2            | 830.0             | 78.5   | 83.0   | 78.5                                 | 83.0   | 79.3               | 84.1   | 6861                  | 78.3   |
| 1995 | 5651.8            | 830.0             | 76.7   | 82.4   | 76.7                                 | 82.4   | 77.7               | 83.5   | 6785                  | 77.5   |
| 1996 | 5666.5            | 830.0             | 76.7   | 81.9   | 76.7                                 | 81.9   | 77.7               | 82.9   | 6785                  | 77.2   |
| 1997 | 7367.3            | 830.0             | 100.0  | 83.4   | 100.0                                | 83.4   | 101.3              | 84.5   | 8760                  | 100.0  |
| 1998 | 6470.2            | 830.0             | 87.8   | 83.7   | 87.8                                 | 83.7   | 89.0               | 84.8   | 7727                  | 88.2   |
| 1999 | 5500.3            | 830.0             | 75.8   | 83.2   | 74.6                                 | 83.1   | 75.6               | 84.2   | 6542                  | 74.7   |
| 2000 | 6099.0            | 830.0             | 82.6   | 83.1   | 82.6                                 | 83.1   | 83.7               | 84.1   | 7254                  | 82.6   |
| 2001 | 7364.6            | 830.0             | 100.0  | 84.2   | 100.0                                | 84.1   | 101.3              | 85.2   | 8760                  | 100.0  |
| 2002 | 6145.5            | 830.0             | 83.5   | 84.1   | 83.5                                 | 84.1   | 84.5               | 85.2   | 7316                  | 83.5   |
| 2003 | 6490.2            | 830.0             | 86.0   | 84.3   | 86.0                                 | 84.2   | 89.3               | 85.4   | 7531                  | 86.0   |
| 2004 | 5987.8            | 830.0             | 78.2   | 83.9   | 78.2                                 | 83.9   | 82.1               | 85.2   | 6868                  | 78.2   |

## JP-30 TAKAHAMA-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 10 Aug | 1590.0 | 1320.5  | PF   | C    | PERIODICAL INSPECTION AND REFUELING  |
| 15 Oct | 326.0  | 270.7   | UF3  | Z16  | EXTENSION OF PERIODICAL INSPECTION BY DELAY OF PROCEDURE OF STEAM GENERATOR TUBE REPAIR CONSTRUCTION |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling | 1590            |           |          | 1225                                     |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |  |           | 5        |
| Z. Others   |                 | 326       |          |  |           |          |
| Subtotal  | 1590            | 326       | 0        | 1225                                     | 13        | 5        |
| Total   |                 | 1916      |          |  | 1243      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                  | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------|-----------------|--|
| 12. Reactor I&C Systems |                 | 13                                       |
| Total                   | 0               | 13                                       |

**JP-21 TOKAI-2**

**Operator:** JAPCO (JAPAN ATOMIC POWER CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1060.0 MW(e)  
**Design Net RUP:** 1060.0 MW(e)  
**Design Discharge Burnup:** 21000 IN MW.d/t

**2. Production Summary 2004**

**Energy Production:** 7195.4 GW(e).h  
**Energy Availability Factor:** 76.3%  
**Load Factor:** 77.3%  
**Operating Factor:** 76.5%  
**Energy Unavailability Factor:** 23.7%  
**Total Off-line Time:** 2061 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 769.9 | 0.0   | 0.0   | 108.0 | 798.9 | 774.1 | 797.7 | 798.0 | 772.3 | 800.3 | 775.1 | 801.1 | 7195.4 |
| <b>EAF (%)</b>  | 97.4  | 0.0   | 0.0   | 13.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 76.3   |
| <b>UCF (%)</b>  | 99.5  | 0.0   | 0.0   | 13.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 76.5   |
| <b>LF (%)</b>   | 97.6  | 0.0   | 0.0   | 14.2  | 101.3 | 101.4 | 101.2 | 101.2 | 101.2 | 101.3 | 101.6 | 101.6 | 77.3   |
| <b>OF (%)</b>   | 96.8  | 0.0   | 0.0   | 17.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 76.5   |
| <b>EUF (%)</b>  | 2.6   | 100.0 | 100.0 | 86.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 23.7   |
| <b>PUF (%)</b>  | 0.5   | 100.0 | 61.3  | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 38.7  | 86.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3   |
| <b>XUF (%)</b>  | 2.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 03 Oct 1973  
**Date of First Criticality:** 18 Jan 1978  
**Date of Grid Connection:** 13 Mar 1978  
**Date of Commercial Operation:** 28 Nov 1978

**Lifetime Generation:** 181675.5 GW(e).h  
**Cumulative Energy Availability Factor:** 73.7%  
**Cumulative Load Factor:** 73.8%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 26.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6556.6         | 1056.0         | 70.5   | 64.9   | 70.5                              | 64.9   | 70.9               | 65.1   | 6327               | 72.2   |
| 1984 | 8695.2         | 1056.0         | 93.5   | 69.6   | 93.5                              | 69.6   | 93.7               | 69.9   | 8240               | 93.8   |
| 1985 | 6957.5         | 1056.0         | 75.0   | 70.4   | 75.0                              | 70.4   | 75.2               | 70.7   | 6625               | 75.6   |
| 1986 | 5797.6         | 1056.0         | 62.5   | 69.4   | 62.5                              | 69.4   | 62.7               | 69.7   | 5508               | 62.9   |
| 1987 | 7040.5         | 1056.0         | 76.5   | 70.2   | 76.5                              | 70.2   | 76.1               | 70.4   | 6776               | 77.4   |
| 1988 | 6088.4         | 1056.0         | 66.0   | 69.8   | 66.0                              | 69.8   | 65.6               | 69.9   | 5872               | 66.8   |
| 1989 | 8435.0         | 1056.0         | 91.2   | 71.7   | 91.2                              | 71.7   | 91.2               | 71.8   | 8006               | 91.4   |
| 1990 | 7291.6         | 1056.0         | 78.9   | 72.3   | 78.9                              | 72.3   | 78.8               | 72.4   | 6948               | 79.3   |
| 1991 | 7025.3         | 1056.0         | 76.1   | 72.6   | 76.1                              | 72.6   | 75.9               | 72.7   | 6716               | 76.7   |
| 1992 | 6307.7         | 1080.0         | 68.6   | 72.3   | 68.5                              | 72.3   | 66.5               | 72.2   | 5990               | 68.2   |
| 1993 | 8707.2         | 1080.0         | 93.8   | 73.8   | 93.8                              | 73.8   | 92.0               | 73.6   | 8252               | 94.2   |
| 1994 | 7325.8         | 1056.0         | 78.9   | 74.1   | 78.9                              | 74.1   | 79.2               | 73.9   | 6938               | 79.2   |
| 1995 | 6845.0         | 1056.0         | 73.7   | 74.1   | 73.7                              | 74.1   | 74.0               | 73.9   | 6488               | 74.1   |
| 1996 | 7562.1         | 1056.0         | 80.8   | 74.5   | 80.7                              | 74.4   | 81.5               | 74.4   | 7169               | 81.6   |
| 1997 | 8884.5         | 1056.0         | 95.7   | 75.6   | 95.6                              | 75.5   | 96.0               | 75.5   | 8404               | 95.9   |
| 1998 | 6999.4         | 1056.0         | 75.1   | 75.5   | 75.0                              | 75.5   | 75.7               | 75.5   | 6642               | 75.8   |
| 1999 | 2316.1         | 1056.0         | 25.4   | 73.2   | 24.9                              | 73.1   | 25.0               | 73.1   | 2228               | 25.4   |
| 2000 | 7031.6         | 1056.0         | 76.3   | 73.3   | 75.4                              | 73.2   | 75.8               | 73.2   | 6626               | 75.4   |
| 2001 | 5833.2         | 1056.0         | 62.7   | 72.8   | 62.7                              | 72.8   | 63.1               | 72.8   | 5641               | 64.4   |
| 2002 | 6420.1         | 1056.0         | 70.0   | 72.7   | 68.9                              | 72.6   | 69.4               | 72.6   | 6061               | 69.2   |
| 2003 | 9176.5         | 1056.0         | 98.6   | 73.8   | 98.5                              | 73.6   | 99.2               | 73.7   | 8635               | 98.6   |
| 2004 | 7195.4         | 1060.0         | 76.5   | 73.8   | 76.3                              | 73.7   | 77.3               | 73.8   | 6723               | 76.5   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 31 Jan | 1155.0 | 1225.3  | PF   | C    | PERIODICAL INSPECTION AND REFUELING   |
| 21 Mar | 906.0  | 961.9   | UF3  | A14  | EXTENSION OF PERIODICAL INSPECTION DUE TO INVESTIGATION FOR LOST OF INJECTION NOZZLE PARTS FOR HPCS SPARGER |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1979 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 906       |          |  | 334       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1155            |           |          | 1740                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 36                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 24        |          |
| Subtotal   | 1155            | 906       | 0        | 1776                                     | 358       | 5        |
| Total  |                 | 2061      |          |  | 2139      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1979 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 228                                      |
| 13. Reactor Auxiliary Systems       |                 | 5  |
| 14. Safety Systems                  | 906             |  |
| 15. Reactor Cooling Systems         |                 | 46                                       |
| 31. Turbine and auxiliaries         |                 | 15                                       |
| 32. Feedwater and Main Steam System |                 | 23                                       |
| 42. Electrical Power Supply Systems |                 | 13                                       |
| Total                               | 906             | 330                                      |

# JP-43 TOMARI-1

**Operator:** HEPCO (HOKKAIDO ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 550.0 MW(e)  
**Design Net RUP:** 550.0 MW(e)  
**Design Discharge Burnup:** 31500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3788.8 GW(e).h  
**Energy Availability Factor:** 77.0%  
**Load Factor:** 78.4%  
**Operating Factor:** 77.0%  
**Energy Unavailability Factor:** 23.0%  
**Total Off-line Time:** 2022 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 417.1 | 390.5 | 417.5 | 404.5 | 418.8 | 405.0 | 415.8 | 170.9 | 0.0   | 0.0   | 333.3 | 415.5 | 3788.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 41.4  | 0.0   | 0.0   | 83.1  | 100.0 | 77.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 41.4  | 0.0   | 0.0   | 83.1  | 100.0 | 77.0   |
| <b>LF (%)</b>   | 101.9 | 102.0 | 102.0 | 102.1 | 102.3 | 102.3 | 101.6 | 41.8  | 0.0   | 0.0   | 84.2  | 101.5 | 78.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 38.6  | 0.0   | 0.0   | 86.0  | 100.0 | 77.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 58.6  | 100.0 | 100.0 | 16.9  | 0.0   | 23.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 58.6  | 100.0 | 100.0 | 16.9  | 0.0   | 23.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 12 Jul 1985  
**Date of First Criticality:** 16 Nov 1988  
**Date of Grid Connection:** 06 Dec 1988  
**Date of Commercial Operation:** 22 Jun 1989

**Lifetime Generation:** 64944.8 GW(e).h  
**Cumulative Energy Availability Factor:** 84.1%  
**Cumulative Load Factor:** 84.7%  
**Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 15.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 55.0           | 550.0          | 0.0  | 0.0    | 1.2                               | 100.0  | 1.2                | 0.0    | 375                | 4.4    |
| 1989 | 3607.0         | 550.0          | 0.0  | 0.0    | 99.8                              | 100.0  | 74.9               | 0.0    | 7095               | 81.0   |
| 1990 | 3830.7         | 550.0          | 79.5   | 79.5   | 79.5                              | 79.5   | 79.5               | 79.5   | 7092               | 81.0   |
| 1991 | 3540.4         | 550.0          | 73.5   | 76.5   | 73.5                              | 76.5   | 73.5               | 76.5   | 6588               | 75.2   |
| 1992 | 3646.4         | 550.0          | 75.9   | 76.3   | 75.9                              | 76.3   | 75.5               | 76.2   | 6780               | 77.2   |
| 1993 | 4795.2         | 550.0          | 100.0  | 82.2   | 100.0                             | 82.2   | 99.5               | 82.0   | 8760               | 100.0  |
| 1994 | 3903.9         | 550.0          | 81.4   | 82.0   | 81.4                              | 82.0   | 81.0               | 81.8   | 7208               | 82.3   |
| 1995 | 3946.3         | 550.0          | 81.8   | 82.0   | 81.9                              | 82.0   | 81.9               | 81.8   | 7175               | 81.9   |
| 1996 | 3750.4         | 550.0          | 78.1   | 81.4   | 78.1                              | 81.4   | 77.6               | 81.2   | 6920               | 78.8   |
| 1997 | 4795.6         | 550.0          | 100.0  | 83.8   | 100.0                             | 83.8   | 99.5               | 83.5   | 8760               | 100.0  |
| 1998 | 4239.1         | 550.0          | 83.1   | 83.7   | 82.7                              | 83.6   | 88.0               | 84.0   | 7373               | 84.2   |
| 1999 | 4074.6         | 550.0          | 79.7   | 83.3   | 79.7                              | 83.3   | 84.6               | 84.1   | 6986               | 79.7   |
| 2000 | 4168.5         | 550.0          | 86.5   | 83.6   | 86.5                              | 83.5   | 86.3               | 84.3   | 7598               | 86.5   |
| 2001 | 4804.0         | 550.0          | 100.0  | 85.0   | 100.0                             | 84.9   | 99.7               | 85.5   | 8760               | 100.0  |
| 2002 | 4177.3         | 550.0          | 86.9   | 85.1   | 86.9                              | 85.1   | 86.7               | 85.6   | 7614               | 86.9   |
| 2003 | 3821.7         | 550.0          | 78.7   | 84.6   | 78.7                              | 84.6   | 79.3               | 85.2   | 6893               | 78.7   |
| 2004 | 3788.8         | 550.0          | 77.0   | 84.1   | 77.0                              | 84.1   | 78.4               | 84.7   | 6762               | 77.0   |

## JP-43 TOMARI-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                         |
|--------|--------|---------|------|------|-------------------------------------|
| 13 Aug | 2022.0 | 1112.2  | PF   | C    | PERIODICAL INSPECTION AND REFUELING |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                       |                 |           |          |   | 32        |          |
| C. Inspection, maintenance or repair<br>combined with refuelling | 2022            |           |          | 1144  |           |          |
| Z. Others  |                 |           |          |   | 36        |          |
| Subtotal   | 2022            | 0         | 0        | 1144  | 68        | 0        |
| Total  | 2022            |           |          | 1212  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1990 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 32. Feedwater and Main Steam System |                    | 32  |
| Total                               | 0                  | 32  |

# JP-44 TOMARI-2

**Operator:** HEPCO (HOKKAIDO ELECTRIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 550.0 MW(e)  
**Design Net RUP:** 550.0 MW(e)  
**Design Discharge Burnup:** 31500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3864.7 GW(e).h  
**Energy Availability Factor:** 78.1%  
**Load Factor:** 80.0%  
**Operating Factor:** 78.1%  
**Energy Unavailability Factor:** 21.9%  
**Total Off-line Time:** 1922 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 421.0 | 394.0 | 310.2 | 0.0   | 0.0   | 256.1 | 418.1 | 415.1 | 403.0 | 418.7 | 407.2 | 421.3 | 3864.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 73.7  | 0.0   | 0.0   | 63.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 73.7  | 0.0   | 0.0   | 63.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.1   |
| <b>LF (%)</b>   | 102.9 | 102.9 | 75.8  | 0.0   | 0.0   | 64.7  | 102.2 | 101.4 | 101.8 | 102.3 | 102.8 | 103.0 | 80.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 71.0  | 0.0   | 0.0   | 66.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.1   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 26.3  | 100.0 | 100.0 | 36.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 26.3  | 100.0 | 100.0 | 36.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.9   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 08 May 1986  
**Date of First Criticality:** 25 Jul 1990  
**Date of Grid Connection:** 27 Aug 1990  
**Date of Commercial Operation:** 12 Apr 1991

**Lifetime Generation:** 57168.8 GW(e).h  
**Cumulative Energy Availability Factor:** 83.9%  
**Cumulative Load Factor:** 84.9%  
**Cumulative Unit Capability Factor:** 80.2%  
**Cumulative Energy Unavailability Factor:** 16.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 675.2          | 550.0          | 0.0  | 0.0    | 100.0                             | 100.0  | 14.0               | 0.0    | 2001               | 22.8   |
| 1991 | 3277.8         | 550.0          | 0.0  | 0.0    | 81.9                              | 100.0  | 68.0               | 0.0    | 6061               | 69.2   |
| 1992 | 3639.6         | 550.0          | 75.5   | 75.5   | 75.5                              | 75.5   | 75.3               | 75.3   | 6756               | 76.9   |
| 1993 | 3847.5         | 550.0          | 80.0   | 77.8   | 80.0                              | 77.8   | 79.9               | 77.6   | 7092               | 81.0   |
| 1994 | 4511.6         | 550.0          | 93.9   | 83.1   | 93.9                              | 83.1   | 93.6               | 82.9   | 8232               | 94.0   |
| 1995 | 4161.9         | 550.0          | 85.5   | 83.7   | 85.5                              | 83.7   | 86.4               | 83.8   | 7567               | 86.4   |
| 1996 | 3933.6         | 550.0          | 81.5   | 83.3   | 81.5                              | 83.3   | 81.4               | 83.3   | 7232               | 82.3   |
| 1997 | 3775.2         | 550.0          | 78.5   | 82.5   | 78.5                              | 82.5   | 78.4               | 82.5   | 6943               | 79.3   |
| 1998 | 5071.6         | 550.0          | 100.0  | 85.0   | 100.0                             | 85.0   | 105.3              | 85.7   | 8760               | 100.0  |
| 1999 | 4273.2         | 550.0          | 83.8   | 84.8   | 83.8                              | 84.8   | 88.7               | 86.1   | 7344               | 83.8   |
| 2000 | 4107.5         | 550.0          | 85.1   | 84.9   | 85.1                              | 84.9   | 85.0               | 86.0   | 7477               | 85.1   |
| 2001 | 3971.3         | 550.0          | 82.6   | 84.7   | 82.6                              | 84.6   | 82.4               | 85.6   | 7235               | 82.6   |
| 2002 | 4516.1         | 550.0          | 93.9   | 85.5   | 93.9                              | 85.5   | 93.7               | 86.4   | 8228               | 93.9   |
| 2003 | 3542.0         | 550.0          | 71.9   | 84.4   | 71.9                              | 84.4   | 73.5               | 85.3   | 6300               | 71.9   |
| 2004 | 3864.7         | 550.0          | 78.1   | 83.9   | 78.1                              | 83.9   | 80.0               | 84.9   | 6862               | 78.1   |



## JP-44 TOMARI-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                         |
|--------|--------|---------|------|------|-------------------------------------|
| 23 Mar | 1922.0 | 1057.5  | PF   | C    | PERIODICAL INSPECTION AND REFUELING |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1991 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 122       |          |
| C. Inspection, maintenance or repair combined with refuelling | 1922            |           |          | 1021  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 108   |           |          |
| Subtotal  | 1922            | 0         | 0        | 1129  | 122       | 0        |
| Total   | 1922            |           |          | 1251  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                        | 2004<br>Hours Lost | 1991 to 2004<br>Average Hours Lost Per Year |
|-------------------------------|--------------------|---|
| 13. Reactor Auxiliary Systems |                    | 122   |
| Total                         | 0                  | 122   |

# JP-3 TSURUGA-1

**Operator:** JAPCO (JAPAN ATOMIC POWER CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 341.0 MW(e)  
**Design Net RUP:** 341.0 MW(e)  
**Design Discharge Burnup:** 16500 IN MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2535.9 GW(e).h  
**Energy Availability Factor:** 84.1%  
**Load Factor:** 84.7%  
**Operating Factor:** 84.2%  
**Energy Unavailability Factor:** 15.9%  
**Total Off-line Time:** 1389 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 233.4 | 239.9 | 256.4 | 247.8 | 256.0 | 122.1 | 253.0 | 251.9 | 137.5 | 34.6 | 246.9 | 256.2 | 2535.9 |
| <b>EAF (%)</b>  | 91.2  | 100.0 | 100.0 | 100.0 | 100.0 | 49.4  | 99.7  | 99.6  | 56.6  | 13.0 | 100.0 | 100.0 | 84.1   |
| <b>UCF (%)</b>  | 91.2  | 100.0 | 100.0 | 100.0 | 100.0 | 49.4  | 99.8  | 99.9  | 56.7  | 13.0 | 100.0 | 100.0 | 84.2   |
| <b>LF (%)</b>   | 92.0  | 101.1 | 101.1 | 101.1 | 100.9 | 49.7  | 99.7  | 99.3  | 56.0  | 13.6 | 100.6 | 101.0 | 84.7   |
| <b>OF (%)</b>   | 90.9  | 100.0 | 100.0 | 100.1 | 100.0 | 47.2  | 100.0 | 100.0 | 56.3  | 15.8 | 100.0 | 100.0 | 84.2   |
| <b>EUF (%)</b>  | 8.8   | 0.0   | 0.0   | 0.0   | 0.0   | 50.6  | 0.3   | 0.4   | 43.4  | 87.0 | 0.0   | 0.0   | 15.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.2   | 0.1   | 43.3  | 84.4 | 0.0   | 0.0   | 10.8   |
| <b>UCLF (%)</b> | 8.8   | 0.0   | 0.0   | 0.0   | 0.0   | 50.4  | 0.0   | 0.0   | 0.0   | 2.6  | 0.0   | 0.0   | 5.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.3   | 0.1   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 24 Nov 1966  
**Date of First Criticality:** 03 Oct 1969  
**Date of Grid Connection:** 16 Nov 1969  
**Date of Commercial Operation:** 14 Mar 1970

**Lifetime Generation:** 69367.1 GW(e).h  
**Cumulative Energy Availability Factor:** 67.5%  
**Cumulative Load Factor:** 66.8%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 32.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1972.1         | 340.0          | 71.3   | 70.7   | 69.8                              | 61.4   | 66.2               | 59.7   | 6464               | 73.8   |
| 1984 | 2643.1         | 325.0          | 92.2   | 72.2   | 92.1                              | 63.5   | 92.6               | 62.0   | 8129               | 92.5   |
| 1985 | 1703.6         | 340.0          | 57.3   | 71.2   | 57.3                              | 63.1   | 57.2               | 61.6   | 5088               | 58.1   |
| 1986 | 2286.3         | 340.0          | 77.5   | 71.5   | 77.1                              | 64.0   | 76.8               | 62.6   | 6863               | 78.3   |
| 1987 | 2349.2         | 340.0          | 80.2   | 72.1   | 80.2                              | 64.9   | 78.9               | 63.6   | 7052               | 80.5   |
| 1988 | 2222.9         | 341.0          | 74.8   | 72.2   | 74.8                              | 65.5   | 74.2               | 64.2   | 6611               | 75.3   |
| 1989 | 2457.7         | 341.0          | 82.8   | 72.8   | 82.8                              | 66.4   | 82.3               | 65.1   | 7298               | 83.3   |
| 1990 | 1959.8         | 341.0          | 65.6   | 72.4   | 65.6                              | 66.4   | 65.6               | 65.1   | 5822               | 66.5   |
| 1991 | 2255.9         | 341.0          | 76.6   | 72.6   | 76.1                              | 66.8   | 75.5               | 65.6   | 6742               | 77.0   |
| 1992 | 1994.1         | 341.0          | 66.9   | 72.4   | 66.7                              | 66.8   | 66.6               | 65.7   | 5914               | 67.3   |
| 1993 | 2623.7         | 341.0          | 87.5   | 73.0   | 87.5                              | 67.7   | 87.8               | 66.7   | 7745               | 88.4   |
| 1994 | 1507.5         | 341.0          | 50.5   | 72.1   | 50.5                              | 67.0   | 50.5               | 66.0   | 4477               | 51.1   |
| 1995 | 2328.7         | 341.0          | 79.8   | 72.4   | 77.3                              | 67.4   | 78.0               | 66.5   | 7027               | 80.2   |
| 1996 | 2514.2         | 341.0          | 84.0   | 72.8   | 84.0                              | 68.1   | 83.9               | 67.1   | 7411               | 84.4   |
| 1997 | 1936.1         | 341.0          | 64.8   | 72.5   | 64.8                              | 68.0   | 64.8               | 67.1   | 5728               | 65.4   |
| 1998 | 1870.5         | 341.0          | 62.6   | 72.2   | 62.7                              | 67.8   | 62.6               | 66.9   | 5528               | 63.1   |
| 1999 | 1845.0         | 341.0          | 63.2   | 71.9   | 62.5                              | 67.6   | 61.8               | 66.7   | 5542               | 63.3   |
| 2000 | 0.0            | 341.0          | 0.0  | 69.5   | 0.0                               | 65.3   | 0.0                | 64.5   | 0                  | 0.0    |
| 2001 | 2584.5         | 341.0          | 86.6   | 70.0   | 86.6                              | 66.0   | 86.5               | 65.2   | 7594               | 86.7   |
| 2002 | 2546.6         | 341.0          | 85.5   | 70.5   | 85.3                              | 66.6   | 85.3               | 65.8   | 7495               | 85.6   |
| 2003 | 2426.3         | 341.0          | 81.0   | 70.8   | 80.7                              | 67.0   | 81.2               | 66.3   | 7135               | 81.4   |
| 2004 | 2535.9         | 341.0          | 84.2   | 71.2   | 84.1                              | 67.5   | 84.7               | 66.8   | 7395               | 84.2   |

## JP-3 TSURUGA-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 65.0  | 22.3    | UF2  | A15  | PLANT MANUAL SHUTDOWN DUE TO THE PREVENTIVE MAINTENANCE FOR THE MECHANICAL SEALS OF PRIMARY LOOP RECIRCULATION PUMP         |
| 08 Jun | 363.0 | 123.8   | UF4  | A31  | AUTOMATIC SCRAM DUE TO TURBINE GENERATOR LOAD REJECTION SIGNAL DURING MONTHLY SURVEILLANCE TEST FOR TURBINE BYPASS VALVES   |
| 17 Sep | 942.0 | 320.7   | PF   | C    | PERIODICAL INSPECTION AND REFUELING   |
| 27 Oct | 19.0  | 6.6     | UF3  | A14  | EXTENSION OF PERIODICAL INSPECTION DUE TO REPAIR WORK FOR LEAKAGE FROM THE FLANGE BETWEEN ISOLATION CONDENSER BODY AND PIPE |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 447       |          |  | 341       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 942             |           |          | 2215                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 106                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 11        |          |
| Subtotal   | 942             | 447       | 0        | 2321                                     | 352       | 3        |
| Total  |                 | 1389      |          |  | 2676      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 77                                       |
| 12. Reactor I&C Systems             |                 | 111                                      |
| 14. Safety Systems                  | 19              | 23                                       |
| 15. Reactor Cooling Systems         | 65              | 98                                       |
| 31. Turbine and auxiliaries         | 363             | 7  |
| 32. Feedwater and Main Steam System |                 | 6  |
| 42. Electrical Power Supply Systems |                 | 11                                       |
| Total                               | 447             | 333                                      |

# JP-34 TSURUGA-2

**Operator:** JAPCO (JAPAN ATOMIC POWER CO.)  
**Contractor:** M (MITSUBISHI HEAVY INDUSTRY LTD)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1115.0 MW(e)  
**Design Net RUP:** 1115.0 MW(e)  
**Design Discharge Burnup:** 24000 IN MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9447.0 GW(e).h  
**Energy Availability Factor:** 95.2%  
**Load Factor:** 96.5%  
**Operating Factor:** 95.3%  
**Energy Unavailability Factor:** 4.8%  
**Total Off-line Time:** 417 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 840.5 | 786.1 | 840.6 | 817.0 | 844.2 | 815.0 | 838.6 | 836.5 | 811.4 | 839.0 | 810.8 | 367.4 | 9447.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 43.9  | 95.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 43.9  | 95.2   |
| <b>LF (%)</b>   | 101.3 | 101.3 | 101.3 | 101.9 | 101.8 | 101.5 | 101.1 | 100.8 | 101.1 | 101.0 | 101.0 | 44.3  | 96.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 44.0  | 95.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 56.1  | 4.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 56.1  | 4.8    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 06 Nov 1982  
**Date of First Criticality:** 28 May 1986  
**Date of Grid Connection:** 19 Jun 1986  
**Date of Commercial Operation:** 17 Feb 1987

**Lifetime Generation:** 147161.0 GW(e).h  
**Cumulative Energy Availability Factor:** 82.4%  
**Cumulative Load Factor:** 82.4%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 17.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 1553.6         | 1115.0         | 0.0  | 0.0    | 16.7                              | 100.0  | 16.7               | 0.0    | 2506               | 30.0   |
| 1987 | 8751.3         | 1115.0         | 0.0  | 0.0    | 95.8                              | 100.0  | 89.6               | 0.0    | 8028               | 91.6   |
| 1988 | 7939.7         | 1115.0         | 81.3   | 81.3   | 81.3                              | 81.3   | 81.1               | 81.1   | 7243               | 82.5   |
| 1989 | 7507.7         | 1115.0         | 77.0   | 79.2   | 77.0                              | 79.1   | 76.9               | 79.0   | 6814               | 77.8   |
| 1990 | 7201.0         | 1115.0         | 72.9   | 77.1   | 72.9                              | 77.1   | 73.7               | 77.2   | 6462               | 73.8   |
| 1991 | 9259.2         | 1115.0         | 95.1   | 81.6   | 95.1                              | 81.6   | 94.8               | 81.6   | 8338               | 95.2   |
| 1992 | 8118.7         | 1115.0         | 82.5   | 81.8   | 82.5                              | 81.7   | 82.9               | 81.9   | 7310               | 83.2   |
| 1993 | 7844.1         | 1115.0         | 80.2   | 81.5   | 80.2                              | 81.5   | 80.3               | 81.6   | 7086               | 80.9   |
| 1994 | 7814.6         | 1115.0         | 80.2   | 81.3   | 80.2                              | 81.3   | 80.0               | 81.4   | 7080               | 80.8   |
| 1995 | 9220.5         | 1115.0         | 94.5   | 83.0   | 94.5                              | 83.0   | 94.4               | 83.0   | 8290               | 94.6   |
| 1996 | 8092.3         | 1115.0         | 83.0   | 83.0   | 83.0                              | 83.0   | 82.6               | 83.0   | 7325               | 83.4   |
| 1997 | 6522.2         | 1115.0         | 67.0   | 81.4   | 67.0                              | 81.4   | 66.8               | 81.3   | 5946               | 67.9   |
| 1998 | 8534.6         | 1115.0         | 92.0   | 82.3   | 92.0                              | 82.3   | 87.4               | 81.9   | 7724               | 88.2   |
| 1999 | 5131.7         | 1115.0         | 52.7   | 79.9   | 52.7                              | 79.9   | 52.5               | 79.4   | 4615               | 52.7   |
| 2000 | 8993.8         | 1115.0         | 92.1   | 80.8   | 92.1                              | 80.8   | 91.8               | 80.4   | 8087               | 92.1   |
| 2001 | 8072.7         | 1115.0         | 83.0   | 81.0   | 82.9                              | 81.0   | 82.6               | 80.6   | 7267               | 83.0   |
| 2002 | 8695.5         | 1115.0         | 88.4   | 81.4   | 88.4                              | 81.4   | 89.0               | 81.1   | 7742               | 88.4   |
| 2003 | 8460.9         | 1115.0         | 84.7   | 81.7   | 84.7                              | 81.6   | 86.6               | 81.5   | 7418               | 84.7   |
| 2004 | 9447.0         | 1115.0         | 95.2   | 82.5   | 95.2                              | 82.4   | 96.5               | 82.4   | 8367               | 95.3   |

**JP-34 TSURUGA-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                         |
|--------|-------|---------|------|------|-------------------------------------|
| 14 Dec | 417.0 | 465.5   | PF   | C    | PERIODICAL INSPECTION AND REFUELING |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                       |                 |           |          |   | 253       |          |
| B. Refuelling without a maintenance                              |                 |           |          |   | 7         |          |
| C. Inspection, maintenance or repair<br>combined with refuelling | 417             |           |          | 1161  |           |          |
| P. Fire  |                 |           |          |   | 16        |          |
| Subtotal   | 417             | 0         | 0        | 1161  | 276       | 0        |
| Total  |                 | 417       |          |   | 1437      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                        | 2004<br>Hours Lost | 1987 to 2004<br>Average Hours Lost Per Year |
|-------------------------------|--------------------|---|
| 13. Reactor Auxiliary Systems |                    | 229   |
| 15. Reactor Cooling Systems   |                    | 23  |
| Total                         | 0                  | 252   |

# KR-1 KORI-1

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 556.0 MW(e)  
**Design Net RUP:** 564.0 MW(e)  
**Design Discharge Burnup:** 31500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4637.7 GW(e).h  
**Energy Availability Factor:** 92.0%  
**Load Factor:** 95.0%  
**Operating Factor:** 92.6%  
**Energy Unavailability Factor:** 8.0%  
**Total Off-line Time:** 653 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 429.5 | 349.4 | 133.4 | 415.7 | 428.8 | 413.6 | 428.1 | 424.1 | 346.3 | 427.3 | 414.1 | 427.2 | 4637.7 |
| <b>EAF (%)</b>  | 100.0 | 87.9  | 31.8  | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 84.6  | 100.0 | 100.0 | 100.0 | 92.0   |
| <b>UCF (%)</b>  | 100.0 | 88.0  | 31.8  | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 84.6  | 100.0 | 100.0 | 100.0 | 92.0   |
| <b>LF (%)</b>   | 103.8 | 90.3  | 32.3  | 104.0 | 103.7 | 103.3 | 103.5 | 102.5 | 86.5  | 103.2 | 103.4 | 103.3 | 95.0   |
| <b>OF (%)</b>   | 100.0 | 89.4  | 35.3  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 86.4  | 99.9  | 100.0 | 100.0 | 92.6   |
| <b>EUF (%)</b>  | 0.0   | 12.1  | 68.2  | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 15.4  | 0.0   | 0.0   | 0.0   | 8.0    |
| <b>PUF (%)</b>  | 0.0   | 12.1  | 68.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 15.4  | 0.0   | 0.0   | 0.0   | 1.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1972      **Lifetime Generation:** 97480.4 GW(e).h  
**Date of First Criticality:** 19 Jun 1977      **Cumulative Energy Availability Factor:** 77.1%  
**Date of Grid Connection:** 26 Jun 1977      **Cumulative Load Factor:** 75.0%  
**Date of Commercial Operation:** 29 Apr 1978      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 22.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3065.6         | 556.0          | 70.2   | 75.8   | 70.1                              | 70.5   | 62.9               | 63.2   | 6142               | 70.1   |
| 1984 | 3236.3         | 556.0          | 67.3   | 74.4   | 67.3                              | 70.0   | 66.3               | 63.7   | 6321               | 72.0   |
| 1985 | 3158.9         | 556.0          | 66.0   | 73.2   | 64.6                              | 69.2   | 64.9               | 63.9   | 6364               | 72.6   |
| 1986 | 3279.5         | 556.0          | 72.8   | 73.2   | 72.8                              | 69.7   | 67.3               | 64.3   | 6404               | 73.1   |
| 1987 | 4557.0         | 556.0          | 99.8   | 76.1   | 98.9                              | 72.9   | 93.6               | 67.6   | 8653               | 98.8   |
| 1988 | 2221.0         | 556.0          | 50.6   | 73.6   | 50.6                              | 70.7   | 45.5               | 65.4   | 4449               | 50.6   |
| 1989 | 2735.9         | 556.0          | 59.2   | 72.3   | 59.2                              | 69.6   | 56.2               | 64.5   | 5256               | 60.0   |
| 1990 | 3500.1         | 556.0          | 74.6   | 72.5   | 74.6                              | 70.0   | 71.9               | 65.1   | 6536               | 74.6   |
| 1991 | 4365.5         | 556.0          | 93.6   | 74.1   | 93.3                              | 71.8   | 89.6               | 67.0   | 8172               | 93.3   |
| 1992 | 3640.3         | 556.0          | 77.0   | 74.3   | 76.9                              | 72.2   | 74.5               | 67.5   | 6759               | 76.9   |
| 1993 | 3824.9         | 556.0          | 81.6   | 74.8   | 81.4                              | 72.8   | 78.5               | 68.3   | 7131               | 81.4   |
| 1994 | 3223.4         | 564.0          | 66.2   | 74.2   | 65.8                              | 72.4   | 65.2               | 68.1   | 5973               | 68.2   |
| 1995 | 3969.1         | 556.0          | 99.1   | 75.7   | 81.2                              | 72.9   | 81.5               | 68.9   | 8704               | 99.4   |
| 1996 | 3748.4         | 556.0          | 78.6   | 75.8   | 76.6                              | 73.1   | 76.7               | 69.3   | 6936               | 79.0   |
| 1997 | 3844.2         | 556.0          | 79.0   | 76.0   | 78.9                              | 73.4   | 78.9               | 69.8   | 7080               | 80.8   |
| 1998 | 3783.7         | 556.0          | 78.7   | 76.2   | 78.7                              | 73.6   | 77.7               | 70.2   | 6698               | 76.5   |
| 1999 | 4153.2         | 556.0          | 83.3   | 76.5   | 83.3                              | 74.1   | 85.3               | 70.9   | 7418               | 84.7   |
| 2000 | 4514.3         | 556.0          | 89.2   | 77.1   | 89.2                              | 74.8   | 92.4               | 71.9   | 7932               | 90.3   |
| 2001 | 4636.5         | 556.0          | 92.5   | 77.7   | 92.5                              | 75.6   | 95.2               | 72.9   | 8144               | 93.0   |
| 2002 | 4147.0         | 556.0          | 84.0   | 78.0   | 84.0                              | 75.9   | 85.1               | 73.4   | 8000               | 91.3   |
| 2003 | 4550.2         | 556.0          | 90.9   | 78.5   | 90.1                              | 76.5   | 93.4               | 74.2   | 7978               | 91.1   |
| 2004 | 4637.7         | 556.0          | 92.0   | 79.0   | 92.0                              | 77.1   | 95.0               | 75.0   | 8131               | 92.6   |

# KR-1 KORI-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 26 Feb | 555.0 | 328.7   | PF   | C    | REFUELING AND MAINTENANCE                               |
| 10 Sep | 98.0  | 65.1    | UF2  | A32  | FAILURE OF CONTROLLER IN MAIN-FEED WATER CONTROL SYSTEM |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 98        |          | 1   | 357       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 555             |           |          | 1278  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 153   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 19  | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 8        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 4        |
| Subtotal   | 555             | 98        | 0        | 1451  | 362       | 12       |
| Total  |                 | 653       |          |   | 1825      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1977 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 9   |
| 15. Reactor Cooling Systems         |                    | 30  |
| 16. Steam generation systems        |                    | 85  |
| 31. Turbine and auxiliaries         |                    | 28  |
| 32. Feedwater and Main Steam System | 98                 | 45  |
| 35. All other I&C Systems           |                    | 0   |
| 41. Main Generator Systems          |                    | 117   |
| 42. Electrical Power Supply Systems |                    | 38  |
| XX. Miscellaneous Systems           |                    | 3   |
| Total                               | 98                 | 355   |

# KR-2 KORI-2

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 605.0 MW(e)  
**Design Net RUP:** 605.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5501.5 GW(e).h  
**Energy Availability Factor:** 97.8%  
**Load Factor:** 103.5%  
**Operating Factor:** 97.9%  
**Energy Unavailability Factor:** 2.2%  
**Total Off-line Time:** 182 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 475.6 | 445.0 | 476.2 | 461.3 | 476.7 | 461.7 | 477.8 | 474.0 | 458.6 | 475.7 | 462.6 | 356.5 | 5501.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 74.6  | 97.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 74.6  | 97.8   |
| <b>LF (%)</b>   | 105.7 | 105.7 | 105.8 | 105.9 | 105.9 | 106.0 | 106.1 | 105.3 | 105.3 | 105.7 | 106.2 | 79.2  | 103.5  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 75.5  | 97.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 25.4  | 2.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 25.4  | 2.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 23 Dec 1977  
**Date of First Criticality:** 09 Apr 1983  
**Date of Grid Connection:** 22 Apr 1983  
**Date of Commercial Operation:** 25 Jul 1983

**Lifetime Generation:** 99098.3 GW(e).h  
**Cumulative Energy Availability Factor:** 85.2%  
**Cumulative Load Factor:** 86.9%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 14.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 4086.4         | 605.0          | 76.1   | 76.1   | 76.1                              | 76.1   | 76.9               | 76.9   | 6876               | 78.3   |
| 1985 | 3731.4         | 605.0          | 69.8   | 73.0   | 69.8                              | 73.0   | 70.4               | 73.7   | 6641               | 75.8   |
| 1986 | 3945.2         | 605.0          | 75.2   | 73.7   | 74.8                              | 73.6   | 74.4               | 73.9   | 6555               | 74.8   |
| 1987 | 4265.4         | 605.0          | 82.1   | 75.8   | 81.6                              | 75.6   | 80.5               | 75.6   | 7251               | 82.8   |
| 1988 | 4504.7         | 605.0          | 82.8   | 77.2   | 82.8                              | 77.0   | 84.8               | 77.4   | 7275               | 82.8   |
| 1989 | 5062.8         | 605.0          | 95.7   | 80.3   | 95.7                              | 80.2   | 95.5               | 80.4   | 8387               | 95.7   |
| 1990 | 4349.9         | 605.0          | 84.3   | 80.9   | 84.3                              | 80.7   | 82.1               | 80.7   | 7381               | 84.3   |
| 1991 | 4554.0         | 605.0          | 85.8   | 81.5   | 85.8                              | 81.4   | 85.9               | 81.3   | 7512               | 85.8   |
| 1992 | 4517.2         | 605.0          | 85.0   | 81.9   | 85.0                              | 81.8   | 85.0               | 81.7   | 7469               | 85.0   |
| 1993 | 4187.0         | 605.0          | 80.5   | 81.7   | 80.5                              | 81.6   | 79.0               | 81.5   | 7048               | 80.5   |
| 1994 | 4693.9         | 605.0          | 86.5   | 82.2   | 86.5                              | 82.1   | 88.6               | 82.1   | 7685               | 87.7   |
| 1995 | 5106.6         | 605.0          | 94.8   | 83.2   | 94.7                              | 83.1   | 96.4               | 83.3   | 8370               | 95.5   |
| 1996 | 4673.9         | 605.0          | 86.1   | 83.4   | 86.0                              | 83.4   | 87.9               | 83.6   | 7668               | 87.3   |
| 1997 | 4620.3         | 605.0          | 86.8   | 83.7   | 86.6                              | 83.6   | 87.2               | 83.9   | 7639               | 87.2   |
| 1998 | 4697.6         | 605.0          | 84.9   | 83.8   | 84.9                              | 83.7   | 88.6               | 84.2   | 7541               | 86.1   |
| 1999 | 4672.2         | 605.0          | 83.6   | 83.7   | 83.6                              | 83.7   | 88.2               | 84.5   | 7472               | 85.3   |
| 2000 | 4914.7         | 605.0          | 90.1   | 84.1   | 90.1                              | 84.1   | 92.5               | 84.9   | 7812               | 88.9   |
| 2001 | 4807.8         | 605.0          | 87.3   | 84.3   | 87.3                              | 84.2   | 90.7               | 85.3   | 7650               | 87.3   |
| 2002 | 5051.2         | 605.0          | 90.6   | 84.6   | 90.6                              | 84.6   | 95.3               | 85.8   | 7982               | 91.1   |
| 2003 | 4844.2         | 605.0          | 86.5   | 84.7   | 85.4                              | 84.6   | 91.4               | 86.1   | 7709               | 88.0   |
| 2004 | 5501.5         | 605.0          | 97.8   | 85.3   | 97.8                              | 85.2   | 103.5              | 86.9   | 8602               | 97.9   |



**KR-2 KORI-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description               |
|--------|-------|---------|------|------|---------------------------|
| 24 Dec | 182.0 | 114.5   | PF   | C    | REFUELING AND MAINTENANCE |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 132       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling | 182             |           |          | 941   |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 43  |           |          |
| E. Testing of plant systems or components                     |                 |           |          |   | 0         |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 6        |
| Subtotal  | 182             | 0         | 0        | 984   | 136       | 6        |
| Total   |                 | 182       |          |   | 1126      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1983 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 27  |
| 15. Reactor Cooling Systems         |                    | 6   |
| 16. Steam generation systems        |                    | 3   |
| 31. Turbine and auxiliaries         |                    | 31  |
| 32. Feedwater and Main Steam System |                    | 10  |
| 35. All other I&C Systems           |                    | 0   |
| 41. Main Generator Systems          |                    | 51  |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 0                  | 128   |

# KR-5 KORI-3

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 895.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7312.5 GW(e).h  
**Energy Availability Factor:** 86.5%  
**Load Factor:** 93.0%  
**Operating Factor:** 86.9%  
**Energy Unavailability Factor:** 13.5%  
**Total Off-line Time:** 1154 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb  | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 346.2 | 28.9 | 589.3 | 697.9 | 721.4 | 697.7 | 721.2 | 688.5 | 688.5 | 717.0 | 696.2 | 719.8 | 7312.5 |
| <b>EAF (%)</b>  | 48.9  | 4.1  | 82.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.5   |
| <b>UCF (%)</b>  | 48.9  | 4.1  | 82.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.6   |
| <b>LF (%)</b>   | 52.0  | 4.6  | 88.5  | 108.3 | 108.3 | 108.3 | 108.3 | 103.4 | 106.8 | 107.7 | 108.0 | 108.1 | 93.0   |
| <b>OF (%)</b>   | 52.7  | 4.0  | 82.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.9   |
| <b>EUF (%)</b>  | 51.1  | 95.9 | 18.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.5   |
| <b>PUF (%)</b>  | 51.1  | 95.9 | 18.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1979  
**Date of First Criticality:** 01 Jan 1985  
**Date of Grid Connection:** 22 Jan 1985  
**Date of Commercial Operation:** 30 Sep 1985

**Lifetime Generation:** 132231.6 GW(e).h  
**Cumulative Energy Availability Factor:** 84.4%  
**Cumulative Load Factor:** 87.5%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 15.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 5611.7         | 895.0          | 73.3   | 73.3   | 73.3                              | 73.3   | 71.6               | 71.6   | 6529               | 74.5   |
| 1987 | 5804.8         | 895.0          | 79.1   | 76.2   | 78.8                              | 76.0   | 74.0               | 72.8   | 6665               | 76.1   |
| 1988 | 6119.7         | 895.0          | 79.8   | 77.4   | 79.7                              | 77.3   | 77.8               | 74.5   | 7005               | 79.7   |
| 1989 | 6592.0         | 895.0          | 82.3   | 78.6   | 82.3                              | 78.5   | 84.1               | 76.9   | 7206               | 82.3   |
| 1990 | 6838.1         | 895.0          | 90.5   | 81.0   | 90.4                              | 80.9   | 87.2               | 79.0   | 7923               | 90.4   |
| 1991 | 5902.5         | 895.0          | 75.1   | 80.0   | 75.1                              | 79.9   | 75.3               | 78.3   | 6578               | 75.1   |
| 1992 | 6746.2         | 895.0          | 83.7   | 80.5   | 83.7                              | 80.5   | 85.8               | 79.4   | 7349               | 83.7   |
| 1993 | 7121.8         | 895.0          | 88.1   | 81.5   | 88.1                              | 81.4   | 90.8               | 80.8   | 7721               | 88.1   |
| 1994 | 6545.3         | 890.0          | 79.3   | 81.2   | 79.2                              | 81.2   | 84.0               | 81.2   | 7128               | 81.4   |
| 1995 | 6015.5         | 895.0          | 73.8   | 80.5   | 73.7                              | 80.4   | 76.7               | 80.7   | 6863               | 78.3   |
| 1996 | 7939.7         | 895.0          | 95.4   | 81.8   | 95.4                              | 81.8   | 101.0              | 82.6   | 8431               | 96.0   |
| 1997 | 6051.9         | 895.0          | 73.8   | 81.2   | 73.8                              | 81.1   | 77.2               | 82.1   | 6503               | 74.2   |
| 1998 | 6902.5         | 895.0          | 82.9   | 81.3   | 82.8                              | 81.3   | 88.0               | 82.6   | 7325               | 83.6   |
| 1999 | 7231.8         | 895.0          | 86.3   | 81.7   | 86.3                              | 81.6   | 92.2               | 83.3   | 7615               | 86.9   |
| 2000 | 8094.3         | 895.0          | 95.6   | 82.6   | 95.6                              | 82.6   | 103.0              | 84.6   | 8399               | 95.6   |
| 2001 | 7570.3         | 895.0          | 89.4   | 83.0   | 89.4                              | 83.0   | 96.6               | 85.3   | 7881               | 90.0   |
| 2002 | 7684.8         | 895.0          | 90.9   | 83.5   | 90.9                              | 83.5   | 98.0               | 86.1   | 8062               | 92.0   |
| 2003 | 8387.4         | 895.0          | 100.0  | 84.4   | 99.1                              | 84.3   | 107.0              | 87.2   | 8689               | 99.2   |
| 2004 | 7312.5         | 895.0          | 86.5   | 84.5   | 86.5                              | 84.4   | 93.0               | 87.5   | 7630               | 86.9   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description               |
|--------|--------|---------|------|------|---------------------------|
| 17 Jan | 1154.0 | 1057.5  | PF   | C    | REFUELING AND MAINTENANCE |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 108       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1154            |           |          | 1053  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 18  |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 5        |
| Subtotal  | 1154            | 0         | 0        | 1071  | 116       | 5        |
| Total   |                 | 1154      |          |   | 1192      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 20  |
| 15. Reactor Cooling Systems         |                    | 3   |
| 31. Turbine and auxiliaries         |                    | 19  |
| 32. Feedwater and Main Steam System |                    | 10  |
| 35. All other I&C Systems           |                    | 8   |
| 41. Main Generator Systems          |                    | 45  |
| 42. Electrical Power Supply Systems |                    | 1   |
| Total                               | 0                  | 106   |

# KR-6 KORI-4

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 895.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7378.6 GW(e).h  
**Energy Availability Factor:** 86.8%  
**Load Factor:** 93.9%  
**Operating Factor:** 87.3%  
**Energy Unavailability Factor:** 13.2%  
**Total Off-line Time:** 1115 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 722.1 | 675.1 | 722.0 | 698.8 | 722.1 | 698.1 | 722.1 | 707.9 | 0.0   | 363.8 | 625.3 | 721.3 | 7378.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0   | 51.1  | 89.9  | 100.0 | 86.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0   | 51.1  | 89.9  | 100.0 | 86.8   |
| <b>LF (%)</b>   | 108.4 | 108.4 | 108.4 | 108.4 | 108.4 | 108.3 | 108.4 | 106.3 | 0.0   | 54.6  | 97.0  | 108.3 | 93.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0   | 55.0  | 91.7  | 100.0 | 87.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 100.0 | 48.9  | 10.1  | 0.0   | 13.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 100.0 | 48.9  | 0.0   | 0.0   | 12.3   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.1  | 0.0   | 0.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1980  
**Date of First Criticality:** 26 Oct 1985  
**Date of Grid Connection:** 15 Nov 1985  
**Date of Commercial Operation:** 29 Apr 1986

**Lifetime Generation:** 131154.7 GW(e).h  
**Cumulative Energy Availability Factor:** 85.8%  
**Cumulative Load Factor:** 89.3%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 14.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 5860.8         | 895.0          | 78.3   | 78.3   | 78.0                              | 78.0   | 74.8               | 74.8   | 6707               | 76.6   |
| 1988 | 5909.1         | 895.0          | 80.7   | 79.5   | 79.8                              | 78.9   | 75.2               | 75.0   | 7006               | 79.8   |
| 1989 | 6177.4         | 895.0          | 77.2   | 78.7   | 77.2                              | 78.3   | 78.8               | 76.2   | 6763               | 77.2   |
| 1990 | 6230.0         | 895.0          | 81.5   | 79.4   | 81.5                              | 79.1   | 79.5               | 77.0   | 7140               | 81.5   |
| 1991 | 6353.0         | 895.0          | 80.4   | 79.6   | 80.0                              | 79.3   | 81.0               | 77.8   | 7011               | 80.0   |
| 1992 | 6652.3         | 895.0          | 82.7   | 80.1   | 82.7                              | 79.9   | 84.6               | 79.0   | 7266               | 82.7   |
| 1993 | 6835.9         | 895.0          | 85.1   | 80.8   | 85.1                              | 80.6   | 87.2               | 80.1   | 7456               | 85.1   |
| 1994 | 7455.1         | 890.0          | 90.0   | 82.0   | 90.0                              | 81.8   | 95.6               | 82.1   | 8160               | 93.2   |
| 1995 | 6950.6         | 890.0          | 89.3   | 82.8   | 89.3                              | 82.6   | 89.2               | 82.9   | 7824               | 89.3   |
| 1996 | 6678.4         | 895.0          | 80.0   | 82.5   | 80.0                              | 82.4   | 84.9               | 83.1   | 7147               | 81.4   |
| 1997 | 7014.2         | 895.0          | 84.4   | 82.7   | 84.4                              | 82.5   | 89.5               | 83.6   | 7450               | 85.0   |
| 1998 | 8433.7         | 895.0          | 100.0  | 84.1   | 100.0                             | 84.0   | 107.6              | 85.6   | 8760               | 100.0  |
| 1999 | 7129.0         | 895.0          | 84.6   | 84.2   | 84.6                              | 84.0   | 90.9               | 86.0   | 7451               | 85.1   |
| 2000 | 7334.4         | 895.0          | 86.2   | 84.3   | 86.2                              | 84.2   | 93.3               | 86.6   | 7578               | 86.3   |
| 2001 | 7615.1         | 895.0          | 90.0   | 84.7   | 90.0                              | 84.6   | 97.1               | 87.3   | 7929               | 90.5   |
| 2002 | 8495.5         | 895.0          | 100.0  | 85.7   | 100.0                             | 85.5   | 108.4              | 88.6   | 8760               | 100.0  |
| 2003 | 7597.0         | 895.0          | 90.5   | 85.9   | 89.6                              | 85.8   | 96.9               | 89.1   | 7913               | 90.3   |
| 2004 | 7378.6         | 895.0          | 86.8   | 86.0   | 86.8                              | 85.8   | 93.9               | 89.3   | 7669               | 87.3   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                        |
|--------|--------|---------|------|------|------------------------------------|
| 01 Sep | 1045.0 | 970.3   | PF   | C    | REFUELING AND MAINTENANCE          |
| 22 Nov | 60.0   | 65.3    | UF2  | A15  | RCP 'A' PROTECTION RELAY ACTUATION |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 60        |          |   | 33        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1045            |           |          | 1021  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 30  |           |          |
| E. Testing of plant systems or components  |                 |           |          |   | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 6        |
| Subtotal   | 1045            | 60        | 0        | 1051  | 35        | 11       |
| Total  |                 | 1105      |          |   | 1097      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 0   |
| 15. Reactor Cooling Systems                    | 60                 | 1   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 0   |
| 31. Turbine and auxiliaries                    |                    | 12  |
| 32. Feedwater and Main Steam System            |                    | 8   |
| 41. Main Generator Systems                     |                    | 0   |
| 42. Electrical Power Supply Systems            |                    | 9   |
| Total  | 60                 | 30  |

# KR-9 ULCHIN-1

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 920.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33906 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7420.1 GW(e).h  
**Energy Availability Factor:** 89.3%  
**Load Factor:** 91.8%  
**Operating Factor:** 90.7%  
**Energy Unavailability Factor:** 10.7%  
**Total Off-line Time:** 814 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 710.3 | 664.3 | 710.5 | 682.9 | 661.5 | 679.4 | 685.2 | 697.4 | 678.2 | 367.1 | 180.0 | 703.4 | 7420.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 94.3  | 100.0 | 97.7  | 99.9  | 100.0 | 51.7  | 27.5  | 100.0 | 89.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 94.3  | 100.0 | 100.0 | 99.9  | 100.0 | 51.7  | 27.8  | 100.0 | 89.5   |
| <b>LF (%)</b>   | 103.8 | 103.7 | 103.8 | 103.1 | 96.6  | 102.6 | 100.1 | 101.9 | 102.4 | 53.6  | 27.2  | 102.8 | 91.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 54.8  | 33.6  | 100.0 | 90.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 5.7   | 0.0   | 2.3   | 0.1   | 0.0   | 48.3  | 72.5  | 0.0   | 10.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 48.3  | 72.2  | 0.0   | 10.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 5.7   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.3   | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 26 Jan 1983  
**Date of First Criticality:** 25 Feb 1988  
**Date of Grid Connection:** 07 Apr 1988  
**Date of Commercial Operation:** 10 Sep 1988

**Lifetime Generation:** 104413.5 GW(e).h  
**Cumulative Energy Availability Factor:** 84.3%  
**Cumulative Load Factor:** 84.5%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 15.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 5205.4         | 920.0          | 66.5   | 66.5   | 66.4                              | 66.4   | 64.6               | 64.6   | 5821               | 66.4   |
| 1990 | 6166.2         | 920.0          | 81.7   | 74.1   | 81.7                              | 74.1   | 76.5               | 70.6   | 7156               | 81.7   |
| 1991 | 7244.3         | 920.0          | 91.0   | 79.7   | 91.0                              | 79.7   | 89.9               | 77.0   | 7970               | 91.0   |
| 1992 | 7020.8         | 920.0          | 87.4   | 81.6   | 87.4                              | 81.6   | 86.9               | 79.5   | 7675               | 87.4   |
| 1993 | 6977.6         | 920.0          | 87.3   | 82.8   | 87.3                              | 82.8   | 86.6               | 80.9   | 7651               | 87.3   |
| 1994 | 6878.5         | 890.0          | 82.0   | 82.7   | 82.0                              | 82.6   | 88.2               | 82.1   | 7293               | 83.3   |
| 1995 | 7153.8         | 920.0          | 85.7   | 83.1   | 85.7                              | 83.1   | 88.8               | 83.0   | 7698               | 87.9   |
| 1996 | 7113.7         | 920.0          | 85.6   | 83.4   | 85.4                              | 83.4   | 88.0               | 83.7   | 7631               | 86.9   |
| 1997 | 6801.0         | 920.0          | 83.7   | 83.4   | 82.3                              | 83.3   | 84.4               | 83.7   | 7323               | 83.6   |
| 1998 | 7643.0         | 920.0          | 94.1   | 84.5   | 91.4                              | 84.1   | 94.8               | 84.9   | 8256               | 94.2   |
| 1999 | 7161.6         | 920.0          | 86.1   | 84.7   | 86.1                              | 84.3   | 88.9               | 85.2   | 7639               | 87.2   |
| 2000 | 7230.8         | 920.0          | 86.8   | 84.8   | 86.3                              | 84.4   | 89.5               | 85.6   | 7736               | 88.1   |
| 2001 | 7022.3         | 920.0          | 85.1   | 84.9   | 84.5                              | 84.4   | 87.1               | 85.7   | 7483               | 85.4   |
| 2002 | 5462.4         | 920.0          | 76.0   | 84.2   | 76.0                              | 83.8   | 67.8               | 84.4   | 6052               | 69.1   |
| 2003 | 6371.6         | 920.0          | 85.2   | 84.3   | 85.2                              | 83.9   | 79.1               | 84.1   | 7446               | 85.0   |
| 2004 | 7420.1         | 920.0          | 89.5   | 84.6   | 89.3                              | 84.3   | 91.8               | 84.5   | 7970               | 90.7   |

**KR-9 ULCHIN-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description               |
|--------|-------|---------|------|------|---------------------------|
| 18 Oct | 814.0 | 809.2   | PF   | C    | REFUELING AND MAINTENANCE |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          | 159   | 201       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 814             |           |          | 919   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 6        |
| Subtotal   | 814             | 0         | 0        | 1078  | 214       | 7        |
| Total  |                 | 814       |          |   | 1299      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 15. Reactor Cooling Systems                    |                    | 4   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 0   |
| 31. Turbine and auxiliaries                    |                    | 4   |
| 32. Feedwater and Main Steam System            |                    | 5   |
| 41. Main Generator Systems                     |                    | 276   |
| 42. Electrical Power Supply Systems            |                    | 9   |
| Total  | 0                  | 298   |

# KR-10 ULCHIN-2

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** FRAM (FRAMATOME)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 920.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33906 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7253.7 GW(e).h  
**Energy Availability Factor:** 88.6%  
**Load Factor:** 89.8%  
**Operating Factor:** 89.8%  
**Energy Unavailability Factor:** 11.4%  
**Total Off-line Time:** 896 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 709.6 | 661.7 | 705.5 | 629.3 | 150.3 | 329.1 | 694.8 | 690.0 | 667.1 | 661.8 | 666.1 | 688.6 | 7253.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 19.5  | 48.7  | 100.0 | 100.0 | 100.0 | 96.1  | 100.0 | 100.0 | 88.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 19.5  | 48.7  | 100.0 | 100.0 | 100.0 | 96.1  | 100.0 | 100.0 | 88.6   |
| <b>LF (%)</b>   | 103.7 | 103.3 | 103.1 | 95.0  | 22.0  | 49.7  | 101.5 | 100.8 | 100.7 | 96.7  | 100.6 | 100.6 | 89.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 20.0  | 58.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 80.5  | 51.3  | 0.0   | 0.0   | 0.0   | 3.9   | 0.0   | 0.0   | 11.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 80.5  | 38.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.8  | 0.0   | 0.0   | 0.0   | 3.9   | 0.0   | 0.0   | 1.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 05 Jul 1983  
**Date of First Criticality:** 25 Feb 1989  
**Date of Grid Connection:** 14 Apr 1989  
**Date of Commercial Operation:** 30 Sep 1989

**Lifetime Generation:** 108353.4 GW(e).h  
**Cumulative Energy Availability Factor:** 86.3%  
**Cumulative Load Factor:** 88.0%  
**Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 13.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 5547.3         | 920.0          | 73.0   | 73.0   | 73.0                              | 73.0   | 68.8               | 68.8   | 6395               | 73.0   |
| 1991 | 6671.2         | 920.0          | 86.8   | 79.9   | 86.8                              | 79.9   | 82.8               | 75.8   | 7603               | 86.8   |
| 1992 | 7076.9         | 920.0          | 87.5   | 82.4   | 87.5                              | 82.4   | 87.6               | 79.7   | 7686               | 87.5   |
| 1993 | 7230.2         | 920.0          | 87.8   | 83.8   | 87.8                              | 83.8   | 89.7               | 82.2   | 7693               | 87.8   |
| 1994 | 6889.7         | 890.0          | 81.5   | 83.3   | 81.5                              | 83.3   | 88.4               | 83.4   | 7315               | 83.5   |
| 1995 | 7810.3         | 920.0          | 93.4   | 85.0   | 93.4                              | 85.0   | 96.9               | 85.7   | 8223               | 93.9   |
| 1996 | 7696.4         | 920.0          | 91.3   | 85.9   | 91.0                              | 85.9   | 95.2               | 87.1   | 8151               | 92.8   |
| 1997 | 7055.2         | 920.0          | 86.0   | 85.9   | 84.3                              | 85.7   | 87.5               | 87.1   | 7534               | 86.0   |
| 1998 | 7388.9         | 920.0          | 88.5   | 86.2   | 88.3                              | 86.0   | 91.7               | 87.6   | 7947               | 90.7   |
| 1999 | 7815.2         | 920.0          | 94.6   | 87.0   | 94.5                              | 86.8   | 97.0               | 88.6   | 8748               | 99.9   |
| 2000 | 6836.8         | 920.0          | 82.5   | 86.6   | 82.3                              | 86.4   | 84.6               | 88.2   | 7330               | 83.4   |
| 2001 | 7268.6         | 920.0          | 90.2   | 86.9   | 89.2                              | 86.7   | 90.2               | 88.4   | 7848               | 89.6   |
| 2002 | 6485.8         | 920.0          | 78.3   | 86.3   | 78.3                              | 86.0   | 80.5               | 87.8   | 6939               | 79.2   |
| 2003 | 7253.8         | 920.0          | 87.1   | 86.3   | 87.1                              | 86.1   | 90.0               | 87.9   | 7686               | 87.7   |
| 2004 | 7253.7         | 920.0          | 88.6   | 86.5   | 88.6                              | 86.3   | 89.8               | 88.0   | 7888               | 89.8   |



## KR-10 ULCHIN-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                    |
|--------|-------|---------|------|------|--|
| 08 May | 876.0 | 806.2   | PF   | C    | REFUELING AND MAINTENANCE                      |
| 18 Jun | 20.0  | 84.8    | UF2  | A41  | MALFUNCTION OF GEN. EXCITER OVER CURRENT RELAY |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 20        |          |   | 148       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 876             |           |          | 939   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 38  |           |          |
| E. Testing of plant systems or components  |                 |           |          |   | 2         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 10       |
| Subtotal   | 876             | 20        | 0        | 977   | 150       | 10       |
| Total  |                 | 896       |          |   | 1137      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 0   |
| 31. Turbine and auxiliaries                    |                    | 76  |
| 32. Feedwater and Main Steam System            |                    | 0   |
| 41. Main Generator Systems                     | 20                 | 67  |
| 42. Electrical Power Supply Systems            |                    | 2   |
| Total  | 20                 | 145   |

# KR-13 ULCHIN-3

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** DHICKOPC (DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA POWER ENGINEERING COMPAN

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 960.0 MW(e)  
**Design Net RUP:** 960.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 7187.6 GW(e).h  
**Energy Availability Factor:** 90.0%  
**Load Factor:** 85.2%  
**Operating Factor:** 90.9%  
**Energy Unavailability Factor:** 10.0%  
**Total Off-line Time:** 798 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 739.2 | 691.6 | 740.1 | 194.9 | 407.6 | 720.6 | 32.8  | 742.1 | 717.9 | 741.4 | 717.9 | 741.6 | 7187.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 25.0  | 55.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 25.0  | 55.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.1   |
| <b>LF (%)</b>   | 103.5 | 103.5 | 103.6 | 28.2  | 57.1  | 104.3 | 4.6   | 103.9 | 103.9 | 103.8 | 103.9 | 103.8 | 85.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 30.0  | 60.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 75.0  | 44.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 75.0  | 44.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 21 Jul 1993  
**Date of First Criticality:** 21 Dec 1997  
**Date of Grid Connection:** 06 Jan 1998  
**Date of Commercial Operation:** 11 Aug 1998

**Lifetime Generation:** 49354.7 GW(e).h  
**Cumulative Energy Availability Factor:** 89.4%  
**Cumulative Load Factor:** 88.2%  
**Cumulative Unit Capability Factor:** 83.3%  
**Cumulative Energy Unavailability Factor:** 10.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1998 | 4822.2         | 960.0          | 0.0  | 0.0    | 100.0                             | 100.0  | 57.3               | 0.0    | 5872               | 67.0   |
| 1999 | 6918.0         | 960.0          | 81.5   | 81.5   | 79.7                              | 79.7   | 82.3               | 82.3   | 7149               | 81.6   |
| 2000 | 7489.1         | 960.0          | 87.0   | 84.2   | 87.0                              | 83.3   | 88.8               | 85.5   | 7734               | 88.0   |
| 2001 | 7922.2         | 960.0          | 91.3   | 86.6   | 91.3                              | 86.0   | 94.2               | 88.4   | 8025               | 91.6   |
| 2002 | 7031.3         | 960.0          | 89.0   | 87.2   | 89.0                              | 86.7   | 83.6               | 87.2   | 7824               | 89.3   |
| 2003 | 7984.3         | 960.0          | 99.6   | 89.6   | 99.6                              | 89.3   | 94.9               | 88.8   | 8758               | 100.0  |
| 2004 | 7187.6         | 960.0          | 90.0   | 89.7   | 90.0                              | 89.4   | 85.2               | 88.2   | 7986               | 90.9   |

**KR-13 ULCHIN-3****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description               |
|--------|-------|---------|------|------|---------------------------|
| 10 Apr | 798.4 | 834.2   | PF   | C    | REFUELING AND MAINTENANCE |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1999 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair<br>combined with refuelling | 798             |           |          | 710   | 11        |          |
| Subtotal   | 798             | 0         | 0        | 710   | 11        | 0        |
| Total  | 798             |           |          | 721   |           |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1999 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 5   |
| 32. Feedwater and Main Steam System |                    | 5   |
| Total                               | 0                  | 10  |

# KR-14 ULCHIN-4

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** DHICKOPC (DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA POWER ENGINEERING COMPAN

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 960.0 MW(e)  
**Design Net RUP:** 960.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 8623.1 GW(e).h  
**Energy Availability Factor:** 98.7%  
**Load Factor:** 102.3%  
**Operating Factor:** 99.0%  
**Energy Unavailability Factor:** 1.3%  
**Total Off-line Time:** 84 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 740.3 | 694.0 | 740.7 | 660.4 | 740.3 | 717.8 | 676.8 | 738.4 | 714.1 | 740.5 | 718.1 | 741.7 | 8623.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 92.6  | 100.0 | 100.0 | 91.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 92.6  | 100.0 | 100.0 | 91.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.7   |
| <b>LF (%)</b>   | 103.7 | 103.9 | 103.7 | 95.5  | 103.6 | 103.8 | 94.8  | 103.4 | 103.3 | 103.7 | 103.9 | 103.8 | 102.3  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 94.0  | 100.0 | 100.0 | 94.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 7.4   | 0.0   | 0.0   | 8.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.3    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 7.4   | 0.0   | 0.0   | 8.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1993      **Lifetime Generation:** 38636.0 GW(e).h  
**Date of First Criticality:** 14 Dec 1998      **Cumulative Energy Availability Factor:** 89.1%  
**Date of Grid Connection:** 28 Dec 1998      **Cumulative Load Factor:** 91.8%  
**Date of Commercial Operation:** 31 Dec 1999      **Cumulative Unit Capability Factor:** 83.6%  
**Cumulative Energy Unavailability Factor:** 10.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1998 | 4.4            | 80.0           | 0.0  | 0.0    | 100.0                             | 100.0  | 7.4                | 0.0    | 81                 | 10.9   |
| 2000 | 7042.5         | 960.0          | 81.3   | 81.3   | 81.3                              | 81.3   | 83.5               | 83.5   | 7229               | 82.3   |
| 2001 | 7732.3         | 960.0          | 90.0   | 85.6   | 89.9                              | 85.6   | 91.9               | 87.7   | 7880               | 90.0   |
| 2002 | 7311.3         | 960.0          | 84.0   | 85.1   | 83.8                              | 85.0   | 86.9               | 87.5   | 7448               | 85.0   |
| 2003 | 7922.5         | 960.0          | 91.6   | 86.7   | 91.6                              | 86.7   | 94.2               | 89.1   | 8081               | 92.2   |
| 2004 | 8623.1         | 960.0          | 98.7   | 89.1   | 98.7                              | 89.1   | 102.3              | 91.8   | 8700               | 99.0   |

## KR-14 ULCHIN-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                       |
|--------|-------|---------|------|------|---|
| 09 Apr | 43.0  | 51.4    | UF2  | A41  | THE ACTUATION OF MAIN-GENERATOR PROTECTION SIGNAL |
| 01 Jul | 8.0   | 16.2    | UF2  | L41  | MAIN-GENERATOR PROGRAM MALFUNCTION                |
| 26 Jul | 33.0  | 44.7    | UF2  | A12  | CEA CALCULATOR INPUT ERROR                        |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 2000 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                       |                 | 76        |          |   | 27        |          |
| C. Inspection, maintenance or repair<br>combined with refuelling |                 |           |          | 858   |           |          |
| L. Human factor related  |                 | 8         |          |   |           |          |
| Subtotal   | 0               | 84        | 0        | 858   | 27        | 0        |
| Total  |                 | 84        |          |   | 885       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 2000 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             | 33                 | 11  |
| 41. Main Generator Systems          | 43                 |   |
| 42. Electrical Power Supply Systems |                    | 15  |
| Total                               | 76                 | 26  |

# KR-19 ULCHIN-5

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** DHICKOPC (DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA POWER ENGINEERING COMPAN

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** —  
**Design Net RUP:** 960.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 3648.4 GW(e).h  
**Energy Availability Factor:** 98.2%  
**Load Factor:** 86.0%  
**Operating Factor:** 83.1%  
**Energy Unavailability Factor:** 1.8%  
**Total Off-line Time:** 748 hours

## 3. 2004 Monthly Performance Data

|                 | Jan | Feb | Mar | Apr | May | Jun | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  |     |     |     |     |     |     | 72.1  | 738.1 | 720.5 | 745.0 | 698.8 | 673.8 | 3648.4 |
| <b>EAF (%)</b>  |     |     |     |     |     |     | 100.0 | 98.8  | 100.0 | 100.0 | 100.0 | 90.8  | 98.2   |
| <b>UCF (%)</b>  |     |     |     |     |     |     | 100.0 | 98.8  | 100.0 | 100.0 | 100.0 | 90.8  | 98.2   |
| <b>LF (%)</b>   |     |     |     |     |     |     | 10.1  | 103.3 | 104.2 | 104.2 | 101.1 | 94.3  | 86.0   |
| <b>OF (%)</b>   |     |     |     |     |     |     | 9.7   | 100.0 | 100.0 | 99.9  | 97.1  | 92.7  | 83.1   |
| <b>EUF (%)</b>  |     |     |     |     |     |     | 0.0   | 1.2   | 0.0   | 0.0   | 0.0   | 9.2   | 1.8    |
| <b>PUF (%)</b>  |     |     |     |     |     |     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> |     |     |     |     |     |     | 0.0   | 1.2   | 0.0   | 0.0   | 0.0   | 9.2   | 1.8    |
| <b>XUF (%)</b>  |     |     |     |     |     |     | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE UNIT WAS FIRST CONNECTED TO THE GRID IN NOVEMBER, 2003.

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1999      **Lifetime Generation:** 3648.4 GW(e).h  
**Date of First Criticality:** 28 Nov 2003      **Cumulative Energy Availability Factor:** —  
**Date of Grid Connection:** 18 Dec 2003      **Cumulative Load Factor:** —  
**Date of Commercial Operation:** 29 Jul 2004      **Cumulative Unit Capability Factor:** —  
**Cumulative Energy Unavailability Factor:** —

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 3648.4         | 960.0          | 0.0  | 0.0    | 98.2                              | 100.0  | 86.0               | 0.0    | 3669               | 83.1   |

## KR-19 ULCHIN-5

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                          |
|--------|-------|---------|------|------|--------------------------------------|
| 30 Nov | 75.0  | 87.1    | UF4  | A12  | REACTOR PROTECTION SIGNAL (DNBR LOW) |

### 7. Full Outages, Analysis by Cause

| Outage Cause | 2004 Hours Lost |           |          | 2004 to 2004<br>Average Hours Lost Per Year |           |          |
|--------------|-----------------|-----------|----------|---|-----------|----------|
|              | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
|              |                 |           |          |   |           |          |

The reactor has not yet completed a full year of commercial operation.

### 8. Equipment Related Full Outages, Analysis by System

| System | 2004<br>Hours Lost | 2004 to 2004<br>Average Hours Lost Per Year |
|--------|--------------------|---|
|        |                    |   |

The reactor has not yet completed a full year of commercial operation.

# KR-3 WOLSONG-1

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** AECL (ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 629.0 MW(e)  
**Design Net RUP:** 629.0 MW(e)  
**Design Discharge Burnup:** 6500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5027.5 GW(e).h  
**Energy Availability Factor:** 88.2%  
**Load Factor:** 91.0%  
**Operating Factor:** 89.4%  
**Energy Unavailability Factor:** 11.8%  
**Total Off-line Time:** 929 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 482.4 | 448.7 | 471.4 | 465.9 | 56.3 | 327.6 | 427.0 | 478.6 | 465.9 | 468.5 | 459.2 | 475.9 | 5027.5 |
| <b>EAF (%)</b>  | 100.0 | 99.5  | 98.0  | 99.7  | 11.9 | 71.7  | 88.6  | 99.4  | 99.6  | 96.6  | 97.3  | 97.6  | 88.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 11.9 | 74.3  | 89.0  | 100.0 | 100.0 | 98.3  | 100.0 | 100.0 | 89.4   |
| <b>LF (%)</b>   | 103.1 | 102.5 | 100.7 | 102.9 | 12.0 | 72.3  | 91.2  | 102.3 | 102.9 | 100.1 | 101.4 | 101.7 | 91.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 12.9 | 71.4  | 89.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.4   |
| <b>EUF (%)</b>  | 0.0   | 0.5   | 2.0   | 0.3   | 88.1 | 28.3  | 11.4  | 0.6   | 0.4   | 3.4   | 2.7   | 2.4   | 11.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 88.1 | 25.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.3   | 11.0  | 0.0   | 0.0   | 1.7   | 0.0   | 0.0   | 1.1    |
| <b>XUF (%)</b>  | 0.0   | 0.5   | 2.0   | 0.3   | 0.0  | 2.6   | 0.4   | 0.6   | 0.4   | 1.7   | 2.7   | 2.4   | 1.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 30 Oct 1977  
**Date of First Criticality:** 21 Nov 1982  
**Date of Grid Connection:** 31 Dec 1982  
**Date of Commercial Operation:** 22 Apr 1983

**Lifetime Generation:** 104528.3 GW(e).h  
**Cumulative Energy Availability Factor:** 84.5%  
**Cumulative Load Factor:** 87.5%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 15.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2893.2         | 628.0          | 0.0  | 0.0    | 52.5                              | 100.0  | 52.5               | 0.0    | 6255               | 71.4   |
| 1984 | 3693.2         | 629.0          | 66.8   | 66.8   | 66.8                              | 66.8   | 66.8               | 66.8   | 6202               | 70.6   |
| 1985 | 5246.5         | 629.0          | 95.7   | 81.3   | 94.0                              | 80.4   | 95.2               | 81.0   | 8277               | 94.5   |
| 1986 | 4420.4         | 629.0          | 80.9   | 81.1   | 80.8                              | 80.5   | 80.2               | 80.7   | 7079               | 80.8   |
| 1987 | 5155.8         | 629.0          | 94.4   | 84.5   | 93.9                              | 83.9   | 93.6               | 84.0   | 8185               | 93.4   |
| 1988 | 4415.3         | 629.0          | 80.1   | 83.6   | 80.1                              | 83.1   | 79.9               | 83.1   | 7033               | 80.1   |
| 1989 | 5053.2         | 629.0          | 91.7   | 84.9   | 68.8                              | 80.7   | 91.7               | 84.6   | 8036               | 91.7   |
| 1990 | 4770.3         | 629.0          | 86.0   | 85.1   | 86.0                              | 81.5   | 86.6               | 84.9   | 7532               | 86.0   |
| 1991 | 5062.0         | 629.0          | 90.5   | 85.8   | 90.5                              | 82.6   | 91.9               | 85.7   | 7927               | 90.5   |
| 1992 | 4843.3         | 629.0          | 85.5   | 85.7   | 85.5                              | 82.9   | 87.7               | 85.9   | 7510               | 85.5   |
| 1993 | 5611.3         | 629.0          | 99.0   | 87.1   | 99.0                              | 84.5   | 101.8              | 87.5   | 8671               | 99.0   |
| 1994 | 4583.1         | 629.0          | 80.5   | 86.5   | 80.4                              | 84.1   | 83.2               | 87.1   | 7150               | 81.6   |
| 1995 | 4647.1         | 629.0          | 80.9   | 86.0   | 80.9                              | 83.9   | 84.3               | 86.9   | 7266               | 82.9   |
| 1996 | 4508.2         | 629.0          | 78.5   | 85.4   | 78.0                              | 83.4   | 81.6               | 86.5   | 7029               | 80.0   |
| 1997 | 5689.6         | 629.0          | 99.7   | 86.4   | 99.6                              | 84.6   | 103.3              | 87.7   | 8732               | 99.7   |
| 1998 | 4360.4         | 629.0          | 76.5   | 85.8   | 76.5                              | 84.0   | 79.1               | 87.1   | 6730               | 76.8   |
| 1999 | 4613.0         | 629.0          | 80.7   | 85.5   | 80.7                              | 83.8   | 83.7               | 86.9   | 7087               | 80.9   |
| 2000 | 4511.6         | 629.0          | 79.0   | 85.1   | 79.0                              | 83.5   | 81.7               | 86.6   | 6993               | 79.6   |
| 2001 | 4622.0         | 629.0          | 81.3   | 84.9   | 81.3                              | 83.4   | 83.9               | 86.4   | 7153               | 81.7   |
| 2002 | 5516.2         | 629.0          | 97.2   | 85.5   | 97.1                              | 84.1   | 100.1              | 87.2   | 8543               | 97.5   |
| 2003 | 4980.0         | 629.0          | 88.1   | 85.7   | 88.1                              | 84.3   | 90.4               | 87.3   | 7715               | 88.1   |
| 2004 | 5027.5         | 629.0          | 89.3   | 85.8   | 88.2                              | 84.5   | 91.0               | 87.5   | 7855               | 89.4   |



# KR-3 WOLSONG-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                      |
|--------|-------|---------|------|------|--|
| 05 May | 839.7 | 527.6   | PF   | D    | PERIODIC INSPECTION AND MAINTENANCE              |
| 19 Jun | 14.0  | 10.9    | XF   | J    | SWYD GROUND EARTH DISCONNECT SWITCH MISOPERATION |
| 30 Jun | 76.0  | 52.5    | UF2  | L11  | MALFUNCTION OF MODERATE LEVEL SWITCH             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 100       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 726                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 839             |           |          | 307                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 4  |           |          |
| J. Grid failure or grid unavailability   |                 |           | 14       |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 7        |
| L. Human factor related  |                 | 76        |          |  |           |          |
| Subtotal   | 839             | 76        | 14       | 1037                                     | 104       | 9        |
| Total  |                 | 929       |          |  | 1150      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 45                                       |
| 13. Reactor Auxiliary Systems       |                 | 5  |
| 14. Safety Systems                  |                 | 5  |
| 15. Reactor Cooling Systems         |                 | 13                                       |
| 16. Steam generation systems        |                 | 1  |
| 31. Turbine and auxiliaries         |                 | 8  |
| 32. Feedwater and Main Steam System |                 | 11                                       |
| 41. Main Generator Systems          |                 | 1  |
| 42. Electrical Power Supply Systems |                 | 3  |
| Total                               | 0               | 92                                       |

# KR-4 WOLSONG-2

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** AECL/DHI (ATOMIC ENERGY OF CANADA LTD./DOOSAN HEAVY INDUSTRY & CONSTRUCTION)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 650.0 MW(e)  
**Design Net RUP:** 650.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 5465.5 GW(e).h  
**Energy Availability Factor:** 90.9%  
**Load Factor:** 95.7%  
**Operating Factor:** 91.2%  
**Energy Unavailability Factor:** 9.1%  
**Total Off-line Time:** 769 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 511.6 | 479.5 | 512.1 | 495.7 | 511.9 | 396.6 | 509.3 | 463.2 | 70.4 | 507.1 | 495.5 | 512.7 | 5465.5 |
| <b>EAF (%)</b>  | 99.8  | 100.0 | 100.0 | 100.0 | 100.0 | 80.9  | 100.0 | 93.0  | 15.5 | 100.0 | 100.0 | 100.0 | 90.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.9  | 100.0 | 93.0  | 15.6 | 100.0 | 100.0 | 100.0 | 90.9   |
| <b>LF (%)</b>   | 105.8 | 106.0 | 105.9 | 105.9 | 105.9 | 84.7  | 105.3 | 95.8  | 15.0 | 104.9 | 105.9 | 106.0 | 95.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 82.1  | 100.0 | 93.5  | 17.8 | 100.0 | 100.0 | 100.0 | 91.2   |
| <b>EUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 19.1  | 0.0   | 7.0   | 84.5 | 0.0   | 0.0   | 0.0   | 9.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 19.1  | 0.0   | 7.0   | 84.4 | 0.0   | 0.0   | 0.0   | 9.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 25 Sep 1992      **Lifetime Generation:** 40439.7 GW(e).h  
**Date of First Criticality:** 29 Jan 1997      **Cumulative Energy Availability Factor:** 89.0%  
**Date of Grid Connection:** 01 Apr 1997      **Cumulative Load Factor:** 93.1%  
**Date of Commercial Operation:** 01 Jul 1997      **Cumulative Unit Capability Factor:** 82.8%  
**Cumulative Energy Unavailability Factor:** 11.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1997 | 3295.0         | 650.0          | 0.0  | 0.0    | 97.3                              | 100.0  | 57.9               | 0.0    | 5296               | 60.5   |
| 1998 | 4788.7         | 650.0          | 81.0   | 81.0   | 81.0                              | 81.0   | 84.1               | 84.1   | 7144               | 81.6   |
| 1999 | 5211.8         | 650.0          | 88.1   | 84.6   | 88.1                              | 84.6   | 91.5               | 87.8   | 7754               | 88.5   |
| 2000 | 5346.8         | 650.0          | 91.5   | 86.9   | 91.5                              | 86.9   | 93.6               | 89.8   | 7843               | 89.3   |
| 2001 | 5585.4         | 650.0          | 93.0   | 88.4   | 92.8                              | 88.4   | 98.1               | 91.8   | 8188               | 93.5   |
| 2002 | 5266.0         | 650.0          | 87.7   | 88.3   | 87.7                              | 88.2   | 92.5               | 92.0   | 7717               | 88.1   |
| 2003 | 5480.6         | 650.0          | 91.2   | 88.8   | 91.2                              | 88.7   | 96.3               | 92.7   | 8015               | 91.5   |
| 2004 | 5465.5         | 650.0          | 90.9   | 89.1   | 90.9                              | 89.0   | 95.7               | 93.1   | 8015               | 91.2   |

## KR-4 WOLSONG-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                         |
|--------|-------|---------|------|------|-------------------------------------|
| 18 Jun | 129.0 | 89.5    | PF   | D13  | PLANNED REPAIR                      |
| 30 Aug | 640.0 | 429.0   | PF   | D    | PERIODIC INSPECTION AND MAINTENANCE |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1997 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 31        |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 430   |           |          |
| D. Inspection, maintenance or repair without refuelling       | 769             |           |          | 296   |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 9        |
| Subtotal  | 769             | 0         | 0        | 726   | 31        | 9        |
| Total   | 769             |           |          | 766   |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1997 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 8   |
| 31. Turbine and auxiliaries         |                    | 5   |
| 32. Feedwater and Main Steam System |                    | 11  |
| 41. Main Generator Systems          |                    | 3   |
| 42. Electrical Power Supply Systems |                    | 1   |
| Total                               | 0                  | 28  |

# KR-15 WOLSONG-3

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** AECL/DHI (ATOMIC ENERGY OF CANADA LTD./DOOSAN HEAVY INDUSTRY & CONSTRUCTION)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 650.0 MW(e)  
**Design Net RUP:** 650.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 5540.3 GW(e).h  
**Energy Availability Factor:** 92.2%  
**Load Factor:** 97.0%  
**Operating Factor:** 92.8%  
**Energy Unavailability Factor:** 7.8%  
**Total Off-line Time:** 632 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 510.7 | 477.7 | 510.6 | 494.3 | 434.6 | 483.2 | 504.2 | 498.6 | 485.1 | 504.9 | 429.8 | 206.4 | 5540.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 85.1  | 98.2  | 99.1  | 100.0 | 100.0 | 100.0 | 87.0  | 38.6  | 92.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 85.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.0  | 38.6  | 92.5   |
| <b>LF (%)</b>   | 105.6 | 105.6 | 105.6 | 105.6 | 89.9  | 103.2 | 104.3 | 103.1 | 103.7 | 104.4 | 91.8  | 42.7  | 97.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 86.8  | 98.6  | 99.3  | 100.0 | 100.0 | 100.0 | 87.6  | 42.2  | 92.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 14.9  | 1.8   | 0.9   | 0.0   | 0.0   | 0.0   | 13.0  | 61.4  | 7.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 14.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.0  | 61.4  | 7.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.8   | 0.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 17 Mar 1994      **Lifetime Generation:** 35169.2 GW(e).h  
**Date of First Criticality:** 19 Feb 1998      **Cumulative Energy Availability Factor:** 90.4%  
**Date of Grid Connection:** 25 Mar 1998      **Cumulative Load Factor:** 92.7%  
**Date of Commercial Operation:** 01 Jul 1998      **Cumulative Unit Capability Factor:** 83.3%  
**Cumulative Energy Unavailability Factor:** 9.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1998 | 3460.3         | 650.0          | 0.0  | 0.0    | 97.4                              | 100.0  | 80.7               | 0.0    | 5326               | 80.7   |
| 1999 | 4696.7         | 650.0          | 80.2   | 80.2   | 80.2                              | 80.2   | 82.5               | 82.5   | 7008               | 80.0   |
| 2000 | 5925.2         | 650.0          | 99.9   | 90.1   | 99.9                              | 90.1   | 103.8              | 93.1   | 8784               | 100.0  |
| 2001 | 4923.9         | 650.0          | 85.3   | 88.5   | 85.3                              | 88.5   | 86.5               | 90.9   | 7409               | 84.6   |
| 2002 | 5043.3         | 650.0          | 91.8   | 89.3   | 91.8                              | 89.3   | 88.6               | 90.3   | 8083               | 92.3   |
| 2003 | 5579.5         | 650.0          | 93.1   | 90.1   | 93.1                              | 90.1   | 98.0               | 91.9   | 8176               | 93.3   |
| 2004 | 5540.3         | 650.0          | 92.5   | 90.5   | 92.2                              | 90.4   | 97.0               | 92.7   | 8152               | 92.8   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                      |
|--------|-------|---------|------|------|--|
| 25 May | 98.0  | 72.0    | PF   | D    | PLANNED REPAIR                                   |
| 19 Jun | 11.0  | 8.3     | XF   | J    | SWYD GROUND EARTH DISCONNECT SWITCH MISOPERATION |
| 25 Jul | 5.0   | 4.5     | XF   | J    | SWYD POWER CIRCUIT BREAKER GROUND                |
| 27 Nov | 518.0 | 358.0   | PF   | D    | PERIODIC INSPECTION AND MAINTENANCE              |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1999 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 40        |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 465                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       | 616             |           |          | 210                                      |           |          |
| J. Grid failure or grid unavailability                        |                 |           | 16       |  |           |          |
| Subtotal  | 616             | 0         | 16       | 675                                      | 40        | 0        |
| Total   |                 | 632       |          |  | 715       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                       | 2004 Hours Lost | 1999 to 2004 Average Hours Lost Per Year |
|------------------------------|-----------------|--|
| 16. Steam generation systems |                 | 0  |
| 35. All other I&C Systems    |                 | 40                                       |
| Total                        | 0               | 40                                       |

# KR-16 WOLSONG-4

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** AECL/DHI (ATOMIC ENERGY OF CANADA LTD./DOOSAN HEAVY INDUSTRY & CONSTRUCTION)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 650.0 MW(e)  
**Design Net RUP:** 650.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 5620.9 GW(e).h  
**Energy Availability Factor:** 93.2%  
**Load Factor:** 98.4%  
**Operating Factor:** 93.5%  
**Energy Unavailability Factor:** 6.8%  
**Total Off-line Time:** 575 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 512.5 | 479.7 | 513.2 | 497.0 | 512.7 | 494.4 | 250.2 | 357.0 | 488.5 | 507.9 | 495.3 | 512.6 | 5620.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.7  | 69.7  | 100.0 | 100.0 | 100.0 | 93.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.7  | 69.7  | 100.0 | 100.0 | 100.0 | 93.2   |
| <b>LF (%)</b>   | 106.0 | 106.0 | 106.1 | 106.2 | 106.0 | 105.6 | 51.7  | 73.8  | 104.4 | 105.0 | 105.8 | 106.0 | 98.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 49.6  | 73.1  | 100.0 | 100.0 | 100.0 | 100.0 | 93.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 50.3  | 30.3  | 0.0   | 0.0   | 0.0   | 0.0   | 6.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 50.3  | 30.3  | 0.0   | 0.0   | 0.0   | 0.0   | 6.8    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

|  |  |
|--|--|
| <b>Date of Construction Start:</b> 22 Jul 1994   | <b>Lifetime Generation:</b> 29076.6 GW(e).h          |
| <b>Date of First Criticality:</b> 10 Apr 1999    | <b>Cumulative Energy Availability Factor:</b> 92.3%  |
| <b>Date of Grid Connection:</b> 21 May 1999      | <b>Cumulative Load Factor:</b> 96.8%                 |
| <b>Date of Commercial Operation:</b> 01 Oct 1999 | <b>Cumulative Unit Capability Factor:</b> 83.6%      |
|  | <b>Cumulative Energy Unavailability Factor:</b> 7.7% |

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1999 | 1489.2         | 650.0          | 0.0  | 0.0    | 99.9                              | 100.0  | 103.8              | 0.0    | 2208               | 100.0  |
| 2000 | 5423.3         | 650.0          | 91.4   | 91.4   | 91.4                              | 91.4   | 95.0               | 95.0   | 8033               | 91.5   |
| 2001 | 5493.2         | 650.0          | 92.6   | 92.0   | 92.6                              | 92.0   | 96.5               | 95.7   | 8110               | 92.6   |
| 2002 | 5448.1         | 650.0          | 90.8   | 91.6   | 90.8                              | 91.6   | 95.7               | 95.7   | 7971               | 91.0   |
| 2003 | 5601.9         | 650.0          | 93.5   | 92.0   | 93.5                              | 92.1   | 98.4               | 96.4   | 8225               | 93.9   |
| 2004 | 5620.9         | 650.0          | 93.2   | 92.3   | 93.2                              | 92.3   | 98.4               | 96.8   | 8209               | 93.5   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                         |
|--------|-------|---------|------|------|-------------------------------------|
| 16 Jul | 575.0 | 389.6   | PF   | D    | PERIODIC INSPECTION AND MAINTENANCE |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 2000 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                       |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair<br>combined with refuelling |                 |           |          | 278   |           |          |
| D. Inspection, maintenance or repair<br>without refuelling       | 575             |           |          | 256   |           |          |
| Subtotal   | 575             | 0         | 0        | 534   | 1         | 0        |
| Total  | 575             |           |          | 535   |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                      | 2004<br>Hours Lost | 2000 to 2004<br>Average Hours Lost Per Year |
|-----------------------------|--------------------|---|
| 31. Turbine and auxiliaries |                    | 1   |
| Total                       | 0                  | 1   |

# KR-7 YONGGWANG-1

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 900.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7207.2 GW(e).h  
**Energy Availability Factor:** 86.7%  
**Load Factor:** 91.2%  
**Operating Factor:** 87.5%  
**Energy Unavailability Factor:** 13.3%  
**Total Off-line Time:** 1096 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 709.1 | 660.7 | 708.3 | 686.2 | 706.3 | 676.4 | 694.4 | 688.2 | 673.3 | 69.6 | 226.2 | 708.6 | 7207.2 |
| <b>EAF (%)</b>  | 100.0 | 99.6  | 99.9  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 9.7  | 31.4  | 100.0 | 86.7   |
| <b>UCF (%)</b>  | 100.0 | 99.6  | 99.9  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 9.7  | 31.4  | 100.0 | 86.7   |
| <b>LF (%)</b>   | 105.9 | 105.5 | 105.8 | 105.9 | 105.5 | 104.4 | 103.7 | 102.8 | 103.9 | 10.4 | 34.9  | 105.8 | 91.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 12.1 | 38.6  | 100.0 | 87.5   |
| <b>EUF (%)</b>  | 0.0   | 0.4   | 0.1   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 90.3 | 68.6  | 0.0   | 13.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 90.3 | 68.6  | 0.0   | 13.3   |
| <b>UCLF (%)</b> | 0.0   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 04 Jun 1981      **Lifetime Generation:** 128770.5 GW(e).h  
**Date of First Criticality:** 31 Jan 1986      **Cumulative Energy Availability Factor:** 86.2%  
**Date of Grid Connection:** 05 Mar 1986      **Cumulative Load Factor:** 89.0%  
**Date of Commercial Operation:** 25 Aug 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 13.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 2467.9         | 900.0          | 0.0  | 0.0    | 98.1                              | 100.0  | 31.6               | 0.0    | 2928               | 33.8   |
| 1987 | 5973.9         | 900.0          | 78.8   | 78.8   | 78.8                              | 78.8   | 75.8               | 75.8   | 6870               | 78.4   |
| 1988 | 6199.6         | 900.0          | 77.9   | 78.3   | 77.9                              | 78.3   | 78.4               | 77.1   | 6844               | 77.9   |
| 1989 | 6451.8         | 900.0          | 81.5   | 79.4   | 81.5                              | 79.4   | 81.8               | 78.7   | 7136               | 81.5   |
| 1990 | 6897.5         | 900.0          | 85.7   | 81.0   | 85.7                              | 81.0   | 87.5               | 80.9   | 7507               | 85.7   |
| 1991 | 6695.6         | 900.0          | 84.3   | 81.6   | 84.3                              | 81.6   | 84.9               | 81.7   | 7383               | 84.3   |
| 1992 | 6947.3         | 900.0          | 86.5   | 82.4   | 86.5                              | 82.4   | 87.9               | 82.7   | 7600               | 86.5   |
| 1993 | 6724.0         | 900.0          | 86.8   | 83.1   | 86.8                              | 83.1   | 85.3               | 83.1   | 7603               | 86.8   |
| 1994 | 8230.1         | 890.0          | 99.5   | 85.1   | 99.4                              | 85.1   | 105.6              | 85.9   | 8751               | 99.9   |
| 1995 | 6094.6         | 900.0          | 74.9   | 84.0   | 74.9                              | 84.0   | 77.3               | 84.9   | 6781               | 77.4   |
| 1996 | 6755.5         | 900.0          | 81.4   | 83.7   | 81.3                              | 83.7   | 85.5               | 85.0   | 7255               | 82.6   |
| 1997 | 8236.1         | 900.0          | 99.4   | 85.1   | 99.4                              | 85.1   | 104.5              | 86.7   | 8741               | 99.8   |
| 1998 | 7104.5         | 900.0          | 85.5   | 85.2   | 85.5                              | 85.2   | 90.1               | 87.0   | 7599               | 86.7   |
| 1999 | 6730.0         | 900.0          | 81.1   | 84.8   | 81.1                              | 84.8   | 85.4               | 86.9   | 7242               | 82.7   |
| 2000 | 7215.1         | 900.0          | 87.5   | 85.0   | 87.5                              | 85.0   | 91.3               | 87.2   | 7696               | 87.6   |
| 2001 | 8346.4         | 900.0          | 99.9   | 86.0   | 99.9                              | 86.0   | 105.9              | 88.5   | 8760               | 100.0  |
| 2002 | 7419.0         | 900.0          | 88.8   | 86.2   | 88.8                              | 86.2   | 94.1               | 88.8   | 7867               | 89.8   |
| 2003 | 7074.4         | 900.0          | 86.3   | 86.2   | 86.3                              | 86.2   | 89.7               | 88.9   | 7593               | 86.7   |
| 2004 | 7207.2         | 900.0          | 86.7   | 86.2   | 86.7                              | 86.2   | 91.2               | 89.0   | 7688               | 87.5   |



**KR-7 YONGGWANG-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description               |
|--------|--------|---------|------|------|---------------------------|
| 04 Oct | 1096.0 | 1048.8  | PF   | C    | REFUELING AND MAINTENANCE |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 30        |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1096            |           |          | 996   |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 8   |           |          |
| H. Nuclear regulatory requirements                            |                 |           |          |   | 8         |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   | 0         |          |
| Subtotal  | 1096            | 0         | 0        | 1004  | 38        | 0        |
| Total   |                 | 1096      |          |   | 1042      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 9   |
| 15. Reactor Cooling Systems                    |                    | 2   |
| 16. Steam generation systems                   |                    | 0   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 4   |
| 31. Turbine and auxiliaries                    |                    | 4   |
| 32. Feedwater and Main Steam System            |                    | 4   |
| 41. Main Generator Systems                     |                    | 0   |
| 42. Electrical Power Supply Systems            |                    | 2   |
| XX. Miscellaneous Systems                      |                    | 0   |
| Total  | 0                  | 25  |

# KR-8 YONGGWANG-2

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 900.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7242.9 GW(e).h  
**Energy Availability Factor:** 87.5%  
**Load Factor:** 91.6%  
**Operating Factor:** 88.4%  
**Energy Unavailability Factor:** 12.5%  
**Total Off-line Time:** 1020 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 704.2 | 658.7 | 704.8 | 682.3 | 612.9 | 0.0   | 434.5 | 688.4 | 671.6 | 700.7 | 680.4 | 704.2 | 7242.9 |
| <b>EAF (%)</b>  | 99.9  | 99.9  | 100.0 | 100.0 | 87.0  | 0.0   | 62.6  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 87.5   |
| <b>UCF (%)</b>  | 99.9  | 99.9  | 100.0 | 100.0 | 87.0  | 0.0   | 62.6  | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 87.5   |
| <b>LF (%)</b>   | 105.2 | 105.2 | 105.3 | 105.3 | 91.5  | 0.0   | 64.9  | 102.8 | 103.6 | 104.6 | 105.0 | 105.2 | 91.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 90.3  | 0.0   | 69.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.4   |
| <b>EUF (%)</b>  | 0.1   | 0.1   | 0.0   | 0.0   | 13.0  | 100.0 | 37.4  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 12.5   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.0   | 0.0   | 13.0  | 100.0 | 15.9  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 10.7   |
| <b>UCLF (%)</b> | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1981      **Lifetime Generation:** 119702.0 GW(e).h  
**Date of First Criticality:** 15 Oct 1986      **Cumulative Energy Availability Factor:** 83.8%  
**Date of Grid Connection:** 11 Nov 1986      **Cumulative Load Factor:** 86.1%  
**Date of Commercial Operation:** 10 Jun 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 16.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 4297.0         | 900.0          | 0.0  | 0.0    | 98.9                              | 100.0  | 55.9               | 0.0    | 4826               | 56.5   |
| 1988 | 6280.9         | 900.0          | 80.7   | 80.7   | 80.6                              | 80.6   | 79.4               | 79.4   | 7085               | 80.7   |
| 1989 | 5703.2         | 900.0          | 73.6   | 77.1   | 73.6                              | 77.1   | 72.3               | 75.9   | 6446               | 73.6   |
| 1990 | 5964.5         | 900.0          | 77.1   | 77.1   | 77.1                              | 77.1   | 75.7               | 75.8   | 6757               | 77.1   |
| 1991 | 6715.0         | 900.0          | 84.8   | 79.1   | 84.9                              | 79.1   | 85.2               | 78.2   | 7433               | 84.9   |
| 1992 | 6434.6         | 900.0          | 82.6   | 79.8   | 82.6                              | 79.8   | 81.4               | 78.8   | 7259               | 82.6   |
| 1993 | 6930.5         | 900.0          | 85.8   | 80.8   | 85.7                              | 80.8   | 87.9               | 80.3   | 7506               | 85.7   |
| 1994 | 7132.9         | 890.0          | 85.5   | 81.5   | 85.5                              | 81.4   | 91.5               | 81.9   | 7687               | 87.8   |
| 1995 | 6036.5         | 900.0          | 74.2   | 80.5   | 74.2                              | 80.5   | 76.6               | 81.2   | 6696               | 76.4   |
| 1996 | 7656.1         | 900.0          | 91.7   | 81.8   | 91.6                              | 81.8   | 96.8               | 83.0   | 8189               | 93.2   |
| 1997 | 6657.3         | 900.0          | 81.2   | 81.7   | 81.2                              | 81.7   | 84.4               | 83.1   | 7453               | 85.1   |
| 1998 | 6010.4         | 900.0          | 74.5   | 81.1   | 74.4                              | 81.0   | 76.2               | 82.5   | 6583               | 75.1   |
| 1999 | 6718.9         | 900.0          | 82.1   | 81.2   | 82.1                              | 81.1   | 85.2               | 82.7   | 7301               | 83.3   |
| 2000 | 7144.1         | 900.0          | 87.1   | 81.6   | 87.1                              | 81.6   | 90.4               | 83.3   | 7753               | 88.3   |
| 2001 | 7169.7         | 900.0          | 87.1   | 82.0   | 87.1                              | 82.0   | 90.9               | 83.9   | 7726               | 88.2   |
| 2002 | 8194.2         | 900.0          | 99.9   | 83.2   | 99.6                              | 83.2   | 103.9              | 85.2   | 8744               | 99.8   |
| 2003 | 7413.3         | 900.0          | 89.7   | 83.6   | 89.6                              | 83.6   | 94.0               | 85.7   | 7931               | 90.5   |
| 2004 | 7242.9         | 900.0          | 87.5   | 83.8   | 87.5                              | 83.8   | 91.6               | 86.1   | 7764               | 88.4   |

## KR-8 YONGGWANG-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description               |
|--------|-------|---------|------|------|---------------------------|
| 29 May | 884.0 | 842.2   | PF   | C    | REFUELING AND MAINTENANCE |
| 11 Jul | 136.0 | 144.1   | UF2  | A16  | S/G LEVEL HUNTING         |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 136       |          |   | 43        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 884             |           |          | 1044  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 115   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 0        |
| Subtotal   | 884             | 136       | 0        | 1159  | 48        | 1        |
| Total  |                 | 1020      |          |   | 1208      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1987 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 1   |
| 15. Reactor Cooling Systems         |                    | 2   |
| 16. Steam generation systems        | 136                |   |
| 31. Turbine and auxiliaries         |                    | 1   |
| 32. Feedwater and Main Steam System |                    | 5   |
| 35. All other I&C Systems           |                    | 1   |
| 41. Main Generator Systems          |                    | 20  |
| 42. Electrical Power Supply Systems |                    | 9   |
| Total                               | 136                | 39  |

# KR-11 YONGGWANG-3

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** DHICKAEC (DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA ATOMICENERGY RESEARCH INS

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 1049.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 7654.7 GW(e).h  
**Energy Availability Factor:** 90.3%  
**Load Factor:** 91.7%  
**Operating Factor:** 88.8%  
**Energy Unavailability Factor:** 9.7%  
**Total Off-line Time:** 983 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 740.5 | 692.3 | 739.6 | 714.9 | 736.3 | 711.0 | 694.1 | 727.1 | 707.0 | 7.7  | 442.1 | 742.2 | 7654.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.9  | 100.0 | 100.0 | 22.7 | 67.5  | 100.0 | 90.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.9  | 100.0 | 100.0 | 22.7 | 67.5  | 100.0 | 90.4   |
| <b>LF (%)</b>   | 104.8 | 104.7 | 104.6 | 104.5 | 104.2 | 103.9 | 98.2  | 102.9 | 103.4 | 1.1  | 64.6  | 105.0 | 91.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.7  | 100.0 | 100.0 | 2.6  | 68.6  | 100.0 | 88.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.1   | 0.0   | 0.0   | 77.3 | 32.5  | 0.0   | 9.7    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 77.3 | 32.5  | 0.0   | 9.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.1   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 23 Dec 1989  
**Date of First Criticality:** 13 Oct 1994  
**Date of Grid Connection:** 30 Oct 1994  
**Date of Commercial Operation:** 31 Mar 1995

**Lifetime Generation:** 73844.3 GW(e).h  
**Cumulative Energy Availability Factor:** 87.2%  
**Cumulative Load Factor:** 89.9%  
**Cumulative Unit Capability Factor:** 81.9%  
**Cumulative Energy Unavailability Factor:** 12.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1995 | 6430.3         | 950.0          | 0.0  | 0.0    | 99.4                              | 100.0  | 77.3               | 0.0    | 6573               | 75.0   |
| 1996 | 6366.2         | 950.0          | 74.0   | 74.0   | 74.0                              | 74.0   | 76.3               | 76.3   | 6589               | 75.0   |
| 1997 | 7229.6         | 950.0          | 84.0   | 79.0   | 84.0                              | 79.0   | 86.9               | 81.6   | 7443               | 85.0   |
| 1998 | 7400.8         | 950.0          | 85.5   | 81.2   | 85.5                              | 81.1   | 88.9               | 84.0   | 7566               | 86.4   |
| 1999 | 7395.3         | 950.0          | 86.7   | 82.5   | 86.7                              | 82.5   | 88.9               | 85.2   | 7678               | 87.6   |
| 2000 | 7262.0         | 950.0          | 85.6   | 83.2   | 85.6                              | 83.2   | 87.0               | 85.6   | 7568               | 86.2   |
| 2001 | 8629.1         | 950.0          | 100.0  | 86.0   | 100.0                             | 86.0   | 103.7              | 88.6   | 8760               | 100.0  |
| 2002 | 7658.2         | 950.0          | 89.1   | 86.4   | 89.1                              | 86.4   | 92.0               | 89.1   | 7831               | 89.4   |
| 2003 | 7818.1         | 950.0          | 90.1   | 86.9   | 90.1                              | 86.9   | 93.9               | 89.7   | 7971               | 91.0   |
| 2004 | 7654.7         | 950.0          | 90.3   | 87.3   | 90.3                              | 87.2   | 91.7               | 89.9   | 7801               | 88.8   |

## KR-11 YONGGWANG-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                      |
|--------|-------|---------|------|------|--|
| 25 Jul | 32.0  | 36.0    | UF2  | A31  | TURBINE OVER SPEED PROTECTION SYSTEM MALFUNCTION |
| 02 Oct | 951.0 | 769.2   | PF   | C    | REFUELING AND MAINTENANCE                        |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1995 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 32        |          |  | 11        |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 951             |           |          | 860                                      |           |          |
| E. Testing of plant systems or components                     |                 |           |          |  | 0         |          |
| Subtotal  | 951             | 32        | 0        | 860                                      | 11        | 0        |
| Total   |                 | 983       |          |  | 871       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1995 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 3  |
| 31. Turbine and auxiliaries         | 32              | 1  |
| 32. Feedwater and Main Steam System |                 | 0  |
| 35. All other I&C Systems           |                 | 2  |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 3  |
| Total                               | 32              | 9  |

# KR-12 YONGGWANG-4

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** DHICKAEC (DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA ATOMICENERGY RESEARCH INS

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 1049.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 7624.9 GW(e).h  
**Energy Availability Factor:** 88.3%  
**Load Factor:** 91.4%  
**Operating Factor:** 88.6%  
**Energy Unavailability Factor:** 11.7%  
**Total Off-line Time:** 1002 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 736.6 | 688.3 | 734.4 | 37.3 | 361.6 | 712.1 | 733.9 | 730.2 | 709.2 | 734.4 | 711.2 | 735.6 | 7624.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 7.7  | 50.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 7.7  | 50.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.3   |
| <b>LF (%)</b>   | 104.2 | 104.1 | 103.9 | 5.5  | 51.2  | 104.1 | 103.8 | 103.3 | 103.7 | 103.9 | 104.0 | 104.1 | 91.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 6.7  | 55.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 92.3 | 49.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 92.3 | 49.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.7   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 26 May 1990  
**Date of First Criticality:** 07 Jul 1995  
**Date of Grid Connection:** 18 Jul 1995  
**Date of Commercial Operation:** 01 Jan 1996

**Lifetime Generation:** 68365.0 GW(e).h  
**Cumulative Energy Availability Factor:** 88.2%  
**Cumulative Load Factor:** 91.2%  
**Cumulative Unit Capability Factor:** 81.9%  
**Cumulative Energy Unavailability Factor:** 11.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1996 | 7197.5         | 950.0          | 83.5   | 83.5   | 83.5                              | 83.5   | 86.3               | 86.3   | 7565               | 86.1   |
| 1997 | 6767.7         | 950.0          | 78.8   | 81.2   | 78.8                              | 81.1   | 81.3               | 83.8   | 7125               | 81.3   |
| 1998 | 8427.3         | 950.0          | 97.1   | 86.5   | 97.1                              | 86.5   | 101.3              | 89.6   | 8591               | 98.1   |
| 1999 | 7627.9         | 950.0          | 89.0   | 87.1   | 89.0                              | 87.1   | 91.7               | 90.1   | 7883               | 90.0   |
| 2000 | 7252.3         | 950.0          | 84.7   | 86.6   | 84.6                              | 86.6   | 86.9               | 89.5   | 7441               | 84.7   |
| 2001 | 7237.2         | 950.0          | 84.8   | 86.3   | 84.8                              | 86.3   | 87.0               | 89.1   | 7424               | 84.7   |
| 2002 | 7653.5         | 950.0          | 88.7   | 86.6   | 88.7                              | 86.6   | 92.0               | 89.5   | 7808               | 89.1   |
| 2003 | 8576.8         | 950.0          | 98.7   | 88.2   | 98.7                              | 88.1   | 103.1              | 91.2   | 8652               | 98.8   |
| 2004 | 7624.9         | 950.0          | 88.3   | 88.2   | 88.3                              | 88.2   | 91.4               | 91.2   | 7782               | 88.6   |

## KR-12 YONGGWANG-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description               |
|--------|--------|---------|------|------|---------------------------|
| 03 Apr | 1002.0 | 962.9   | PF   | C    | REFUELING AND MAINTENANCE |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1996 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 41        |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1002            |           |          | 805   |           |          |
| Subtotal  | 1002            | 0         | 0        | 805   | 42        | 0        |
| Total   |                 | 1002      |          |   | 847       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1996 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 8   |
| 31. Turbine and auxiliaries         |                    | 4   |
| 32. Feedwater and Main Steam System |                    | 3   |
| 41. Main Generator Systems          |                    | 12  |
| 42. Electrical Power Supply Systems |                    | 11  |
| Total                               | 0                  | 38  |

# KR-17 YONGGWANG-5

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** DHICKOPC (DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA POWER ENGINEERING COMPAN

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 0.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 5524.5 GW(e).h  
**Energy Availability Factor:** 63.3%  
**Load Factor:** 66.2%  
**Operating Factor:** 63.9%  
**Energy Unavailability Factor:** 36.7%  
**Total Off-line Time:** 3173 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 738.3 | 714.3 | 530.7 | 733.5 | 712.8 | 740.4 | 716.8 | 637.7 | 5524.5 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 99.7  | 99.8  | 71.8  | 100.0 | 100.0 | 100.0 | 100.0 | 86.3  | 63.3   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 99.7  | 99.8  | 71.8  | 100.0 | 100.0 | 100.0 | 100.0 | 86.3  | 63.3   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 104.5 | 104.4 | 75.1  | 103.8 | 104.2 | 104.8 | 104.8 | 90.2  | 66.2   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 100.0 | 100.0 | 74.7  | 100.0 | 100.0 | 100.0 | 100.0 | 89.1  | 63.9   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 0.3   | 0.2   | 28.2  | 0.0   | 0.0   | 0.0   | 0.0   | 13.7  | 36.7   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 0.3   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.7  | 34.3   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 28.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 29 Jun 1997  
**Date of First Criticality:** 24 Nov 2001  
**Date of Grid Connection:** 19 Dec 2001  
**Date of Commercial Operation:** 21 May 2002

**Lifetime Generation:** 17225.6 GW(e).h  
**Cumulative Energy Availability Factor:** 70.2%  
**Cumulative Load Factor:** 73.3%  
**Cumulative Unit Capability Factor:** 82.9%  
**Cumulative Energy Unavailability Factor:** 29.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2002 | 5006.8         | 950.0          | 0.0  | 0.0    | 98.7                              | 100.0  | 102.6              | 0.0    | 5095               | 99.2   |
| 2003 | 6694.4         | 950.0          | 77.1   | 77.1   | 77.1                              | 77.1   | 80.4               | 80.4   | 6856               | 78.3   |
| 2004 | 5524.5         | 950.0          | 63.3   | 70.2   | 63.3                              | 70.2   | 66.2               | 73.3   | 5611               | 63.9   |



## KR-17 YONGGWANG-5

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description               |
|--------|--------|---------|------|------|---------------------------|
| 01 Jan | 2904.0 | 2758.8  | PF   | C    | REFUELING AND MAINTENANCE |
| 13 Jul | 188.0  | 199.1   | UF2  | A16  | S/G LEVEL HIGH            |
| 18 Dec | 81.0   | 97.1    | PF   | D    | PLANNED REPAIR            |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2002 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 188       |          |  | 34        |          |
| C. Inspection, maintenance or repair combined with refuelling | 2904            |           |          | 587                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       | 81              |           |          | 26                                       |           |          |
| Subtotal  | 2985            | 188       | 0        | 613                                      | 34        | 0        |
| Total   | 3173            |           |          | 647                                      |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                       | 2004 Hours Lost | 2002 to 2004 Average Hours Lost Per Year |
|------------------------------|-----------------|--|
| 12. Reactor I&C Systems      |                 | 20                                       |
| 16. Steam generation systems | 188             |  |
| Total                        | 188             | 20                                       |

# KR-18 YONGGWANG-6

**Operator:** KHNP (Korea Hydro and Nuclear Power Co.)

**Contractor:** DHICKOPC (DOOSAN HEAVY INDUSTRIES & CONSTRUCTION CO.LTD./KOREA POWER ENGINEERING COMPAN

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 0.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 6354.5 GW(e).h  
**Energy Availability Factor:** 72.8%  
**Load Factor:** 76.1%  
**Operating Factor:** 73.4%  
**Energy Unavailability Factor:** 27.2%  
**Total Off-line Time:** 2335 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 568.1 | 742.0 | 663.5 | 737.1 | 734.0 | 712.4 | 738.8 | 716.9 | 741.7 | 6354.5 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 78.7  | 100.0 | 92.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 72.8   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 78.7  | 100.0 | 92.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 72.8   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 83.0  | 105.0 | 97.0  | 104.3 | 103.8 | 104.2 | 104.5 | 104.8 | 104.9 | 76.1   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 84.0  | 100.0 | 95.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 73.4   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 21.3  | 0.0   | 7.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 27.2   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 21.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 26.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 20 Nov 1997      **Lifetime Generation:** 14006.7 GW(e).h  
**Date of First Criticality:** 01 Sep 2002      **Cumulative Energy Availability Factor:** 80.5%  
**Date of Grid Connection:** 16 Sep 2002      **Cumulative Load Factor:** 84.0%  
**Date of Commercial Operation:** 24 Dec 2002      **Cumulative Unit Capability Factor:** 82.9%  
**Cumulative Energy Unavailability Factor:** 19.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2003 | 7652.2         | 950.0          | 88.2   | 88.2   | 88.2                              | 88.2   | 92.0               | 92.0   | 7728               | 88.2   |
| 2004 | 6354.5         | 950.0          | 72.8   | 80.5   | 72.8                              | 80.5   | 76.1               | 84.0   | 6449               | 73.4   |

## KR-18 YONGGWANG-6

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                                |
|--------|--------|---------|------|------|--|
| 01 Jan | 2299.0 | 2184.1  | PF   | C    | REFUELING AND MAINTENANCE                  |
| 06 Jun | 36.0   | 50.5    | UF2  | A41  | ACTUATION OF GEN. EXCITER PROTECTION RELAY |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 2003 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure<br>C. Inspection, maintenance or repair<br>combined with refuelling | 2299            | 36        |          | 515   |           |          |
| Subtotal   | 2299            | 36        | 0        | 515   | 0         | 0        |
| Total  | 2335            |           |          | 515   |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                     | 2004<br>Hours Lost | 2003 to 2004<br>Average Hours Lost Per Year |
|----------------------------|--------------------|---|
| 41. Main Generator Systems | 36                 |   |
| Total                      | 36                 | 0   |

# LT-46 IGNALINA-1

**Operator:** INPP (IGNALINA NUCLEAR POWER PLANT)

**Contractor:** MAEP (MINATOMENERGOPROM, MINISTRY OF NUCLEAR POWER AND INDUSTRY)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 1185.0 MW(e)  
**Design Net RUP:** 1500.0 MW(e)  
**Design Discharge Burnup:** 21600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9214.1 GW(e).h  
**Energy Availability Factor:** 89.7%  
**Load Factor:** 88.5%  
**Operating Factor:** 91.6%  
**Energy Unavailability Factor:** 10.3%  
**Total Off-line Time:** 742 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 817.6 | 717.2 | 690.9 | 61.1 | 859.2 | 885.1 | 726.5 | 890.7 | 882.2 | 915.1 | 907.3 | 861.2 | 9214.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 84.0  | 7.4  | 100.0 | 100.0 | 83.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 84.0  | 7.4  | 100.0 | 100.0 | 83.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.7   |
| <b>LF (%)</b>   | 92.7  | 87.0  | 78.4  | 7.2  | 97.5  | 103.7 | 82.4  | 101.0 | 103.4 | 103.7 | 106.3 | 97.7  | 88.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 84.0  | 14.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 99.5  | 91.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 16.0  | 92.6 | 0.0   | 0.0   | 16.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 16.0  | 89.2 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.7    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 3.5  | 0.0   | 0.0   | 16.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

UNIT WAS SHUTDOWN ON 31TH OF DECEMBER, 2004.

## 5. Historical Summary

**Date of Construction Start:** 01 May 1977      **Lifetime Generation:** 86385.2 GW(e).h  
**Date of First Criticality:** 04 Oct 1983      **Cumulative Energy Availability Factor:** 57.5%  
**Date of Grid Connection:** 31 Dec 1983      **Cumulative Load Factor:** 54.1%  
**Date of Commercial Operation:** 01 May 1984      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 42.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 4660.8         | 1380.0         | 0.0  | 0.0    | 38.4                              | 100.0  | 38.4               | 0.0    | 6489               | 73.9   |
| 1985 | 8751.9         | 1380.0         | 83.8   | 83.8   | 83.8                              | 83.8   | 72.4               | 72.4   | 7483               | 85.4   |
| 1986 | 9143.0         | 1380.0         | 75.2   | 79.5   | 75.2                              | 79.5   | 75.6               | 74.0   | 7055               | 80.5   |
| 1987 | 6652.3         | 1500.0         | 70.3   | 76.2   | 61.4                              | 73.1   | 50.6               | 65.8   | 5378               | 61.4   |
| 1988 | 4565.9         | 1380.0         | 67.3   | 74.0   | 67.2                              | 71.7   | 37.7               | 58.9   | 4990               | 56.8   |
| 1989 | 8245.0         | 1380.0         | 82.5   | 75.7   | 67.4                              | 70.8   | 68.2               | 60.7   | 7338               | 83.8   |
| 1990 | 7450.3         | 1380.0         | 61.6   | 73.4   | 61.6                              | 69.3   | 61.6               | 60.9   | 6620               | 75.6   |
| 1991 | 6811.7         | 1380.0         | 56.9   | 71.0   | 56.8                              | 67.5   | 56.3               | 60.2   | 5895               | 67.3   |
| 1992 | 6652.1         | 1380.0         | 71.4   | 71.1   | 71.4                              | 68.0   | 54.9               | 59.6   | 6237               | 71.0   |
| 1993 | 5361.3         | 1185.0         | 55.1   | 69.6   | 35.2                              | 64.9   | 51.6               | 58.8   | 6644               | 75.8   |
| 1994 | 3460.4         | 1185.0         | 59.1   | 68.6   | 33.3                              | 62.1   | 33.3               | 56.6   | 4620               | 52.7   |
| 1995 | 5026.3         | 1185.0         | 62.0   | 68.1   | 48.4                              | 61.0   | 48.4               | 55.9   | 5059               | 57.8   |
| 1996 | 5746.8         | 1185.0         | 61.9   | 67.6   | 55.2                              | 60.6   | 55.2               | 55.9   | 5432               | 61.8   |
| 1997 | 4399.1         | 1185.0         | 49.6   | 66.4   | 49.6                              | 59.8   | 42.4               | 54.9   | 4423               | 50.5   |
| 1998 | 4113.0         | 1185.0         | 54.5   | 65.6   | 39.5                              | 58.5   | 39.6               | 53.9   | 4925               | 56.2   |
| 1999 | 3789.8         | 1185.0         | 77.8   | 66.3   | 36.5                              | 57.2   | 36.5               | 52.9   | 5663               | 64.6   |
| 2000 | 3544.0         | 1185.0         | 59.9   | 66.0   | 34.0                              | 55.8   | 34.0               | 51.8   | 4739               | 54.0   |
| 2001 | 5072.5         | 1185.0         | 80.5   | 66.8   | 51.4                              | 55.6   | 48.9               | 51.6   | 6462               | 73.8   |
| 2002 | 5485.9         | 1185.0         | 62.2   | 66.5   | 52.8                              | 55.4   | 52.8               | 51.7   | 6164               | 70.4   |
| 2003 | 6787.6         | 1185.0         | 71.4   | 66.8   | 65.4                              | 55.9   | 65.4               | 52.4   | 6299               | 71.9   |
| 2004 | 9214.1         | 1185.0         | 89.7   | 67.8   | 89.7                              | 57.5   | 88.5               | 54.1   | 8042               | 91.6   |

**LT-46 IGNALINA-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 744.0 | 64.1    | XP   | K    | POWER LIMITATIONS BY DISPATCHER  |
| 01 Feb | 696.0 | 107.6   | XP   | K    | POWER LIMITATIONS BY DISPATCHER  |
| 01 Mar | 625.0 | 49.7    | XP   | K    | POWER LIMITATIONS BY DISPATCHER  |
| 27 Mar | 119.0 | 141.0   | PF   | D    | SCHEDULED PREVENTION MAINTENANCE OF THE UNIT   |
| 01 Apr | 594.0 | 759.7   | PF   | D    | SCHEDULED PREVENTIVE MAINTENANCE   |
| 25 Apr | 25.0  | 29.6    | UF4  | A31  | AUTOMATIC PROTECTION-1 DUE TO THE FACTOR OF A SINGLE OPERATING TURBO-GENERATOR AT START-UP OF THE UNIT AFTER OUTAGE  |
| 26 Apr | 101.0 | 2.8     | XP   | K    | POWER LIMITATIONS BY DISPATCHER  |
| 01 May | 744.0 | 22.4    | XP   | K    | POWER LIMITATIONS BY DISPATCHER  |
| 01 Jul | 744.0 | 9.2     | XP   | K    | POWER LIMITATIONS BY DISPATCHER  |
| 14 Jul | 108.0 | 58.7    | UP2  | A31  | TG-1 SHUTDOWN BECAUSE OF A LEAKAGE AT A COMPOSITE WELDED JOINT OF THE HEATING STEAM CONDENSATE DISCHARGE PIPELINE FROM THE SPP-19 (STEAM RE-HEATER SEPARATOR)  |
| 24 Jul | 178.0 | 85.1    | UP1  | A31  | TG-2 SHUTDOWN TO REPAIR A BLOWHOLE AT THE STEAM LINE OF THE FIRST EXTRACTION FROM TG-2 TO HOUSE NEEDS COLLECTOR  |
| 01 Dec | 740.0 | 13.6    | XP   | K    | POWER LIMITATIONS BY DISPATCHER  |
| 31 Dec | 4.0   | 6.8     | XF   | M    | PURSUANT TO THE DECREE OF THE GOVERNMENT OF LITHUANIA NO.1491 OF 25 OCT. 2004 THERE WAS FULFILLED UNIT 1 SHUTDOWN. BEFORE THE START OF DISMANTLING WORKS AND THE FUEL UNLOADING FROM THE REACTOR, THE UNIT WILL BE STAYING AT THE STAGE OF COLD RESERVE. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 25        |          |   | 233       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 247   | 28        |          |
| D. Inspection, maintenance or repair without refuelling                              | 713             |           |          | 1437  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 22       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 93        | 108      |
| M. Governmental requirements or court decisions                                      |                 |           | 4        |   |           |          |
| Subtotal   | 713             | 25        | 4        | 1684  | 357       | 130      |
| Total  |                 | 742       |          |   | 2171      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 21  |
| 12. Reactor I&C Systems                        |                    | 10  |
| 13. Reactor Auxiliary Systems                  |                    | 17  |
| 14. Safety Systems                             |                    | 18  |
| 15. Reactor Cooling Systems                    |                    | 62  |
| 16. Steam generation systems                   |                    | 0   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 5   |
| 31. Turbine and auxiliaries                    | 25                 | 3   |
| 32. Feedwater and Main Steam System            |                    | 12  |
| 35. All other I&C Systems                      |                    | 5   |
| 41. Main Generator Systems                     |                    | 11  |
| Total  | 25                 | 164   |

**LT-47 IGNALINA-2****Operator:** INPP (IGNALINA NUCLEAR POWER PLANT)**Contractor:** MAEP (MINATOMENERGOPROM, MINISTRY OF NUCLEAR POWER AND INDUSTRY)**1. Station Details**

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 1185.0 MW(e)  
**Design Net RUP:** 1500.0 MW(e)  
**Design Discharge Burnup:** 21600 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 4703.0 GW(e).h  
**Energy Availability Factor:** 48.0%  
**Load Factor:** 45.2%  
**Operating Factor:** 53.2%  
**Energy Unavailability Factor:** 52.0%  
**Total Off-line Time:** 4111 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 924.8 | 669.9 | 899.3 | 752.7 | 160.5 | 0.0   | 0.0   | 0.0   | 0.0   | 77.4 | 517.8 | 700.7 | 4703.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 22.8  | 0.0   | 0.0   | 0.0   | 0.0   | 9.2  | 63.3  | 83.6  | 48.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 22.8  | 0.0   | 0.0   | 0.0   | 0.0   | 9.2  | 63.3  | 83.6  | 48.0   |
| <b>LF (%)</b>   | 104.9 | 81.2  | 102.0 | 88.3  | 18.2  | 0.0   | 0.0   | 0.0   | 0.0   | 8.8  | 60.7  | 79.5  | 45.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 22.8  | 0.0   | 0.0   | 0.0   | 0.0   | 18.1 | 100.0 | 100.0 | 53.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 77.2  | 100.0 | 100.0 | 100.0 | 100.0 | 90.8 | 36.7  | 16.4  | 52.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 77.2  | 100.0 | 100.0 | 100.0 | 100.0 | 90.8 | 9.9   | 0.0   | 48.4   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 26.7  | 16.4  | 3.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 01 Jan 1978  
**Date of First Criticality:** 01 Dec 1986  
**Date of Grid Connection:** 20 Aug 1987  
**Date of Commercial Operation:** 20 Aug 1987

**Lifetime Generation:** 69244.4 GW(e).h  
**Cumulative Energy Availability Factor:** 59.7%  
**Cumulative Load Factor:** 57.9%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 40.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 2520.3         | 1316.0         | 0.0  | 0.0    | 23.1                              | 100.0  | 23.1               | 0.0    | 2949               | 35.5   |
| 1988 | 7141.5         | 1380.0         | 69.7   | 69.7   | 69.7                              | 69.7   | 58.9               | 58.9   | 6213               | 70.7   |
| 1989 | 7125.8         | 1380.0         | 71.2   | 70.5   | 58.0                              | 63.9   | 58.9               | 58.9   | 6259               | 71.4   |
| 1990 | 8250.7         | 1380.0         | 68.3   | 69.8   | 68.3                              | 65.3   | 68.3               | 62.0   | 7296               | 83.3   |
| 1991 | 8802.1         | 1380.0         | 73.2   | 70.6   | 73.0                              | 67.3   | 72.8               | 64.7   | 7602               | 86.8   |
| 1992 | 6693.3         | 1380.0         | 71.3   | 70.8   | 71.3                              | 68.1   | 55.4               | 62.9   | 5977               | 68.2   |
| 1993 | 5675.9         | 1185.0         | 49.0   | 67.6   | 38.2                              | 63.7   | 54.7               | 61.7   | 5801               | 66.2   |
| 1994 | 3167.4         | 1185.0         | 76.2   | 68.7   | 30.5                              | 59.5   | 30.5               | 57.7   | 4556               | 52.0   |
| 1995 | 5610.9         | 1185.0         | 75.8   | 69.5   | 54.1                              | 58.8   | 54.1               | 57.3   | 6431               | 73.4   |
| 1996 | 6918.9         | 1185.0         | 75.8   | 70.1   | 66.5                              | 59.6   | 66.5               | 58.2   | 6778               | 77.2   |
| 1997 | 6453.5         | 1185.0         | 77.8   | 70.8   | 77.7                              | 61.3   | 62.2               | 58.6   | 6941               | 79.2   |
| 1998 | 8174.8         | 1185.0         | 89.7   | 72.4   | 78.6                              | 62.8   | 78.8               | 60.3   | 7967               | 90.9   |
| 1999 | 4926.5         | 1185.0         | 73.8   | 72.5   | 47.5                              | 61.6   | 47.5               | 59.3   | 6777               | 77.4   |
| 2000 | 3873.0         | 1185.0         | 77.6   | 72.9   | 37.2                              | 59.8   | 37.2               | 57.7   | 4890               | 55.7   |
| 2001 | 4867.4         | 1185.0         | 68.8   | 72.6   | 46.9                              | 58.9   | 46.9               | 57.0   | 4971               | 56.7   |
| 2002 | 7411.3         | 1185.0         | 78.4   | 73.0   | 70.9                              | 59.7   | 71.4               | 57.9   | 6980               | 79.7   |
| 2003 | 7461.9         | 1185.0         | 74.6   | 73.1   | 71.5                              | 60.4   | 71.9               | 58.7   | 7156               | 81.7   |
| 2004 | 4703.0         | 1185.0         | 48.0   | 71.7   | 48.0                              | 59.7   | 45.2               | 57.9   | 4673               | 53.2   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Feb | 696.0 | 154.9   | XP   | K    | POWER LIMITATION BY DISPATCHER  |
| 01 Apr | 720.0 | 100.5   | XP   | K    | POWER LIMITATIONS BY DISPATCHER   |
| 01 May | 170.0 | 40.5    | XP   | K    | POWER LIMITATIONS BY DISPATCHER   |
| 08 May | 574.0 | 680.6   | PF   | D    | SCHEDULED PREVENTIVE MAINTENANCE OF THE UNIT  |
| 01 Jun | 720.0 | 853.2   | PF   | D    | SCHEDULED PREVENTIVE MAINTENANCE OF THE UNIT  |
| 01 Jul | 744.0 | 881.6   | PF   | D    | SCHEDULED PREVENTIVE MAINTENANCE OF THE UNIT  |
| 01 Aug | 744.0 | 881.6   | PF   | D    | SCHEDULED PREVENTIVE MAINTENANCE OF THE UNIT  |
| 01 Sep | 720.0 | 853.2   | PF   | D    | SCHEDULED PREVENTIVE MAINTENANCE OF THE UNIT  |
| 01 Oct | 609.0 | 733.8   | PF   | D    | SCHEDULED PREVENTIVE MAINTENANCE OF THE UNIT  |
| 26 Oct | 135.0 | 2.8     | XP   | K    | POWER LIMITATION BY DISPATCHER  |
| 26 Oct | 135.0 | 67.6    | PP   | D41  | PLANNED MAINTENANCE OF TG-3   |
| 01 Nov | 720.0 | 22.5    | XP   | K    | POWER LIMITATION BY DISPATCHER  |
| 01 Nov | 163.0 | 84.8    | PP   | D41  | PLANNED OVERHAUL OF TG-3  |
| 08 Nov | 448.0 | 228.1   | UP3  | A41  | PROLONGATION OF TG-3 OUTAGE   |
| 01 Dec | 744.0 | 36.0    | XP   | K    | POWER LIMITATION BY DISPATCHER  |
| 11 Dec | 153.0 | 84.6    | UP1  | A31  | TG-4 SHUTDOWN TO ELIMINATE DEFECTS OF WELDING JOINTS OF SPP COLLECTOR PIPING  |
| 18 Dec | 131.0 | 60.3    | UP1  | A31  | TG SHUTDOWN TO CARRY OUT FIELD INSPECTION OF WELDED JOINTS OF SPP COLLECTOR PIPING WITH THE FUTURE ELIMINATION OF WELDED JOINTS |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 174       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 134                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 4111            |           |          | 1371                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 15       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 53        | 125      |
| L. Human factor related  |                 |           |          |  |           | 112      |
| Subtotal   | 4111            | 0         | 0        | 1506                                     | 230       | 252      |
| Total  |                 | 4111      |          |  | 1988      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 10                                       |
| 12. Reactor I&C Systems             |                 | 7  |
| 13. Reactor Auxiliary Systems       |                 | 12                                       |
| 14. Safety Systems                  |                 | 17                                       |
| 15. Reactor Cooling Systems         |                 | 68                                       |
| 16. Steam generation systems        |                 | 10                                       |
| 32. Feedwater and Main Steam System |                 | 7  |
| 41. Main Generator Systems          |                 | 2  |
| 42. Electrical Power Supply Systems |                 | 5  |
| XX. Miscellaneous Systems           |                 | 2  |
| Total                               | 0               | 140                                      |

# MX-1 LAGUNA VERDE-1

**Operator:** CFE (COMISION FEDERAL DE ELECTRICIDAD)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 680.0 MW(e)  
**Design Net RUP:** 654.0 MW(e)  
**Design Discharge Burnup:** 10093 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4168.9 GW(e).h  
**Energy Availability Factor:** 75.2%  
**Load Factor:** 69.8%  
**Operating Factor:** 77.6%  
**Energy Unavailability Factor:** 24.8%  
**Total Off-line Time:** 1966 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 478.7 | 398.4 | 395.4 | 124.1 | 0.0   | 95.6 | 428.2 | 471.7 | 370.0 | 467.9 | 458.1 | 480.9 | 4168.9 |
| <b>EAF (%)</b>  | 99.3  | 92.0  | 89.6  | 30.4  | -0.4  | 22.1 | 89.8  | 99.5  | 81.1  | 98.8  | 99.6  | 98.9  | 75.2   |
| <b>UCF (%)</b>  | 99.8  | 92.7  | 94.3  | 33.1  | -0.4  | 22.1 | 89.8  | 99.8  | 81.2  | 98.8  | 99.6  | 99.2  | 75.9   |
| <b>LF (%)</b>   | 94.6  | 84.2  | 78.2  | 25.3  | 0.0   | 19.5 | 84.6  | 93.2  | 75.6  | 92.5  | 93.6  | 95.1  | 69.8   |
| <b>OF (%)</b>   | 100.0 | 93.7  | 100.0 | 33.2  | 0.0   | 27.2 | 93.0  | 100.0 | 83.2  | 100.0 | 100.0 | 100.0 | 77.6   |
| <b>EUF (%)</b>  | 0.7   | 8.0   | 10.4  | 69.6  | 100.4 | 77.9 | 10.2  | 0.5   | 18.9  | 1.2   | 0.4   | 1.1   | 24.8   |
| <b>PUF (%)</b>  | 0.2   | 0.1   | 0.0   | 66.9  | 80.9  | 4.4  | 0.5   | 0.2   | 0.2   | 0.0   | 0.4   | 0.3   | 12.9   |
| <b>UCLF (%)</b> | 0.0   | 7.3   | 5.7   | 0.0   | 19.4  | 73.5 | 9.6   | 0.0   | 18.6  | 1.1   | 0.0   | 0.5   | 11.2   |
| <b>XUF (%)</b>  | 0.5   | 0.7   | 4.7   | 2.7   | 0.0   | 0.0  | 0.0   | 0.3   | 0.0   | 0.0   | 0.0   | 0.3   | 0.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

FEBRUARY 16TH, 2004; 11:15 HOURS. MANUAL SCRAM, BY FAILURE IN FUSE THE AC PLANT POWER SUPPLY SYSTEM. MARCH 19TH, 2004; 23:20 HOURS. REPAIR THE PIPE BY FAILURE IN THE MAIN CONDENSER. APRIL 11TH, 2004; 02:00 HOURS. MANUAL SCRAM SCHEDULED, FOR BEGINNING OF THE 10TH REFUELING. THE 10TH REFUELING STARTED IN APRIL 11TH 00:06 HOURS 2004, AND IT WAS PLANNED TO LAST FOR ABOUT 45 DAYS, BUT IT HAD TO BE EXTENDED STILL FOR ANOTHER 27.85 DAYS FOR MAINTENANCE ACTIVITIES, REPLACE TURBINE BLADE. THE REFUELING ENDED IN JUNE 22TH 20:26 HOURS 2004. JUNE 22TH : 11TH OPERATING CYCLE STARTS. JULY 11TH, 2004; 19:14 HOURS. AUTOMATIC SCRAM, BY FAILURE IN FUSE THE CONTROL IN FEEDWATER SYSTEM PUMP A; GRID CONNECTED IN JULY 13TH 22:45 HOURS. SEPTEMBER 22TH, 2004; 02:48 HOURS. MANUAL SCRAM, BY FAILURE IN MAIN CONDENSER SYSTEM BOX A; GRID CONNECTED IN SEPTEMBER 27TH 03:46 HOURS.

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1976      **Lifetime Generation:** 63863.0 GW(e).h  
**Date of First Criticality:** 08 Nov 1988      **Cumulative Energy Availability Factor:** 79.6%  
**Date of Grid Connection:** 13 Apr 1989      **Cumulative Load Factor:** 75.9%  
**Date of Commercial Operation:** 29 Jul 1990      **Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 20.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1992 | 3746.4         | 654.0          | 70.4   | 72.4   | 70.4                              | 72.4   | 65.2               | 68.8   | 7024               | 80.0   |
| 1993 | 4724.4         | 654.0          | 90.6   | 78.5   | 90.6                              | 78.5   | 82.5               | 73.4   | 7851               | 89.6   |
| 1994 | 4062.0         | 628.0          | 77.8   | 78.3   | 73.8                              | 77.4   | 73.8               | 73.5   | 7095               | 81.0   |
| 1995 | 4154.1         | 628.0          | 78.1   | 78.3   | 75.5                              | 77.0   | 75.5               | 73.9   | 7128               | 81.4   |
| 1996 | 3442.3         | 655.0          | 68.8   | 76.7   | 68.8                              | 75.6   | 59.8               | 71.5   | 6628               | 75.5   |
| 1997 | 5218.8         | 615.0          | 96.0   | 79.3   | 95.9                              | 78.4   | 96.9               | 75.0   | 8577               | 97.9   |
| 1998 | 4412.5         | 655.0          | 82.2   | 79.7   | 81.7                              | 78.8   | 76.9               | 75.2   | 7359               | 84.0   |
| 1999 | 4451.0         | 670.0          | 82.8   | 80.0   | 81.5                              | 79.1   | 75.8               | 75.3   | 7466               | 85.2   |
| 2000 | 4577.6         | 645.0          | 80.6   | 80.1   | 80.3                              | 79.2   | 80.8               | 75.8   | 7409               | 84.3   |
| 2001 | 4144.3         | 645.0          | 74.9   | 79.6   | 73.2                              | 78.7   | 73.3               | 75.6   | 6808               | 77.7   |
| 2002 | 4196.3         | 680.0          | 76.4   | 79.3   | 75.8                              | 78.4   | 70.4               | 75.2   | 6876               | 78.5   |
| 2003 | 5415.4         | 680.0          | 97.9   | 80.8   | 97.6                              | 80.0   | 90.9               | 76.4   | 8642               | 98.7   |
| 2004 | 4168.9         | 680.0          | 75.9   | 80.5   | 75.2                              | 79.6   | 69.8               | 75.9   | 6818               | 77.6   |



# MX-1 LAGUNA VERDE-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 16 Feb | 44.0   | 34.3    | UF5  | A42  | DURING POWER OPERATION, MANUAL SCRAM, BY FAILURE IN FUSE THE AC PLANT POWER SUPPLY SYSTEM.  |
| 20 Mar | 160.0  | 28.7    | UP2  | A31  | DURING COASTDOWN UNPLANNED PARTIAL REDUCTION FOR VACUUM IN MAIN CONDENSER. THE 10TH REFUELING STARTED IN APRIL 11TH 00:06 HOURS 2004, AND IT WAS PLANNED TO LAST FOR ABOUT 45 DAYS. |
| 11 Apr | 1080.0 | 737.0   | PF   | C21  |   |
| 26 May | 668.0  | 456.1   | UF3  | A31  | EXTENDED STILL FOR ANOTHER 27.85 DAYS BECAUSE A PROBLEM IN MAINTENANCE ACTIVITIES, REPLACE TURBINE BLADE. THE REFUELING ENDED IN JUNE 22TH 20:26 HOURS 2004.                        |
| 11 Jul | 52.0   | 46.1    | UF4  | A32  | AUTOMATIC SCRAM, BY FAILURE IN FUSE THE CONTROL IN FEEDWATER SYSTEM PUMP A  |
| 22 Sep | 121.0  | 82.6    | UF5  | A31  | MANUAL SCRAM, BY FAILURE IN MAIN CONDENSER SYSTEM BOX A   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 885       |          | 96                                       | 349       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1080            |           |          | 722                                      | 34        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 151                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 126                                      | 8         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 10        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 31        |          |
| Z. Others  |                 |           |          |  | 34        |          |
| Subtotal   | 1080            | 885       | 0        | 1095                                     | 479       | 0        |
| Total  |                 | 1965      |          |  | 1574      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1989 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 8  |
| 12. Reactor I&C Systems                        |                 | 20                                       |
| 13. Reactor Auxiliary Systems                  |                 | 183                                      |
| 14. Safety Systems                             |                 | 10                                       |
| 15. Reactor Cooling Systems                    |                 | 42                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 5  |
| 31. Turbine and auxiliaries                    | 789             | 28                                       |
| 32. Feedwater and Main Steam System            | 52              | 88                                       |
| 35. All other I&C Systems                      |                 | 41                                       |
| 42. Electrical Power Supply Systems            | 44              | 17                                       |
| Total  | 885             | 442                                      |

# MX-2 LAGUNA VERDE-2

**Operator:** CFE (COMISION FEDERAL DE ELECTRICIDAD)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 680.0 MW(e)  
**Design Net RUP:** 654.0 MW(e)  
**Design Discharge Burnup:** 10093 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4578.2 GW(e).h  
**Energy Availability Factor:** 83.0%  
**Load Factor:** 76.6%  
**Operating Factor:** 84.8%  
**Energy Unavailability Factor:** 17.0%  
**Total Off-line Time:** 1335 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 479.4 | 449.1 | 452.1 | 455.8 | 469.7 | 450.1 | 458.1 | 453.1 | 428.0 | 202.9 | 0.0  | 279.8 | 4578.2 |
| <b>EAF (%)</b>  | 99.0  | 99.2  | 94.9  | 99.5  | 99.3  | 99.1  | 99.2  | 99.3  | 96.8  | 44.2  | 3.6  | 61.5  | 83.0   |
| <b>UCF (%)</b>  | 99.6  | 99.6  | 94.9  | 99.5  | 99.3  | 99.1  | 99.2  | 99.4  | 99.5  | 50.1  | 3.6  | 61.6  | 83.8   |
| <b>LF (%)</b>   | 94.8  | 94.9  | 89.4  | 93.1  | 92.8  | 91.9  | 90.5  | 89.6  | 87.4  | 40.1  | 0.0  | 55.3  | 76.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 51.6  | 0.0  | 65.9  | 84.8   |
| <b>EUF (%)</b>  | 1.0   | 0.8   | 5.1   | 0.5   | 0.7   | 0.9   | 0.8   | 0.7   | 3.2   | 55.8  | 96.4 | 38.5  | 17.0   |
| <b>PUF (%)</b>  | 0.4   | 0.4   | 0.5   | 0.5   | 0.7   | 0.8   | 0.8   | 0.6   | 0.4   | 49.9  | 96.3 | 3.9   | 12.9   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 4.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 34.5  | 3.3    |
| <b>XUF (%)</b>  | 0.6   | 0.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 2.7   | 5.9   | 0.0  | 0.1   | 0.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE LAGUNA VERDE NPP UNIT 2 STARTED THE YEAR OPERATING AT FULL RATED POWER. MARCH 10TH 2004; 08:52 HOURS, PARTIAL REDUCTION TO 60% PTN FOR FAILURE IN MAIN CONDENSER. OCTOBER 16TH, 2004; 23:48 HOURS. MANUAL SCRAM SCHEDULED, FOR BEGINNING OF THE 7TH REFUELING. THE 7TH REFUELING STARTED IN OCTOBER 16TH 23:45 HOURS 2004, AND IT WAS PLANNED TO LAST FOR ABOUT 45 DAYS, BUT IT HAD TO BE EXTENDED STILL FOR ANOTHER 10.6 DAYS FOR MAINTENANCE ACTIVITIES, REPLACE TURBINE BLADE. THE REFUELING ENDED IN DECEMBER 11TH 14:08 HOURS 2004. DECEMBER 11TH: 8TH OPERATING CYCLE STARTS.

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1977      **Lifetime Generation:** 43286.9 GW(e).h  
**Date of First Criticality:** 06 Sep 1994      **Cumulative Energy Availability Factor:** 80.5%  
**Date of Grid Connection:** 11 Nov 1994      **Cumulative Load Factor:** 77.2%  
**Date of Commercial Operation:** 10 Apr 1995      **Cumulative Unit Capability Factor:** 81.9%  
**Cumulative Energy Unavailability Factor:** 19.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1995 | 3379.4         | 628.0          | 0.0  | 0.0    | 88.4                              | 100.0  | 63.1               | 0.0    | 5687               | 66.7   |
| 1996 | 3668.4         | 619.0          | 71.7   | 71.7   | 71.0                              | 71.0   | 67.5               | 67.5   | 6657               | 75.8   |
| 1997 | 4805.5         | 627.0          | 89.0   | 80.4   | 88.9                              | 80.0   | 87.5               | 77.5   | 7897               | 90.1   |
| 1998 | 4411.9         | 655.0          | 85.6   | 82.2   | 83.0                              | 81.0   | 76.9               | 77.3   | 7609               | 86.9   |
| 1999 | 5110.6         | 668.0          | 93.3   | 85.1   | 92.3                              | 84.0   | 87.3               | 79.9   | 8459               | 96.6   |
| 2000 | 3339.1         | 645.0          | 58.6   | 79.7   | 56.6                              | 78.5   | 58.9               | 75.7   | 5865               | 66.8   |
| 2001 | 4228.1         | 645.0          | 74.8   | 78.9   | 74.7                              | 77.8   | 74.8               | 75.6   | 6952               | 79.4   |
| 2002 | 5161.0         | 680.0          | 91.5   | 80.8   | 91.5                              | 79.9   | 86.6               | 77.2   | 8273               | 94.4   |
| 2003 | 4604.8         | 680.0          | 82.5   | 81.0   | 82.1                              | 80.2   | 77.3               | 77.2   | 7359               | 84.0   |
| 2004 | 4578.2         | 680.0          | 83.8   | 81.3   | 83.0                              | 80.5   | 76.6               | 77.2   | 7449               | 84.8   |

## MX-2 LAGUNA VERDE-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 10 Mar | 99.0   | 23.3    | UP2  | A31  | PARTIAL REDUCTION TO 60% PTN FOR LOST VACUUM IN MAIN CONDENSER.  |
| 16 Oct | 1080.0 | 743.4   | PF   | C    | REFUELING STARTED IN OCTOBER 16TH 23:45 HOURS 2004, AND IT WAS PLANNED TO LAST FOR ABOUT 45 DAYS.  |
| 30 Nov | 278.0  | 173.6   | UF3  | A31  | EXTENDED STILL FOR ANOTHER 10.6 DAYS FOR MAINTENANCE ACTIVITIES, REPLACE TURBINE BLADE. THE REFUELING ENDED IN DECEMBER 11TH 14:08 HOURS 2004. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1995 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 278       |          |  | 205       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1080            |           |          | 771                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 20                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 111       |          |
| Z. Others  |                 |           |          |  | 8         |          |
| Subtotal   | 1080            | 278       | 0        | 791                                      | 328       | 0        |
| Total  |                 | 1358      |          |  | 1119      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1995 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 19                                       |
| 12. Reactor I&C Systems             |                 | 28                                       |
| 13. Reactor Auxiliary Systems       |                 | 10                                       |
| 14. Safety Systems                  |                 | 4  |
| 15. Reactor Cooling Systems         |                 | 2  |
| 16. Steam generation systems        |                 | 6  |
| 31. Turbine and auxiliaries         | 278             | 8  |
| 32. Feedwater and Main Steam System |                 | 26                                       |
| 33. Circulating Water System        |                 | 15                                       |
| 35. All other I&C Systems           |                 | 2  |
| 41. Main Generator Systems          |                 | 37                                       |
| 42. Electrical Power Supply Systems |                 | 36                                       |
| Total                               | 278             | 193                                      |

# NL-2 BORSSELE

**Operator:** EPZ (N.V. ELEKTRICITEITS-PRODUKTIEMAATSCHAPPIJ ZUID-NEDERLAND)  
**Contractor:** KWU/STOR (KRAFTWERK UNION AG / STORK)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 450.0 MW(e)  
**Design Net RUP:** 450.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3604.7 GW(e).h  
**Energy Availability Factor:** 91.1%  
**Load Factor:** 91.2%  
**Operating Factor:** 91.9%  
**Energy Unavailability Factor:** 8.9%  
**Total Off-line Time:** 711 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 300.6 | 315.2 | 336.4 | 325.5 | 335.0 | 322.5 | 332.8 | 329.9 | 300.4 | 44.8 | 324.9 | 336.9 | 3604.7 |
| <b>EAF (%)</b>  | 89.3  | 100.0 | 100.0 | 100.0 | 100.0 | 99.7  | 99.6  | 98.7  | 92.9  | 14.4 | 100.0 | 100.0 | 91.1   |
| <b>UCF (%)</b>  | 89.3  | 100.0 | 100.0 | 100.0 | 100.0 | 99.7  | 99.6  | 98.8  | 92.9  | 14.4 | 100.0 | 100.0 | 91.1   |
| <b>LF (%)</b>   | 89.8  | 100.6 | 100.5 | 100.6 | 100.1 | 99.5  | 99.4  | 98.5  | 92.7  | 13.3 | 100.3 | 100.6 | 91.2   |
| <b>OF (%)</b>   | 89.9  | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 14.6 | 100.0 | 100.0 | 91.9   |
| <b>EUF (%)</b>  | 10.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.4   | 1.3   | 7.1   | 85.6 | 0.0   | 0.0   | 8.9    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7   | 71.9 | 0.0   | 0.0   | 6.7    |
| <b>UCLF (%)</b> | 10.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.4   | 1.3   | 0.3   | 13.7 | 0.0   | 0.0   | 2.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

BASE LOAD OPERATION. REFUELLING OUTAGE IN OCTOBER.

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1969      **Lifetime Generation:** 101135.1 GW(e).h  
**Date of First Criticality:** 20 Jun 1973      **Cumulative Energy Availability Factor:** 83.7%  
**Date of Grid Connection:** 04 Jul 1973      **Cumulative Load Factor:** 82.4%  
**Date of Commercial Operation:** 26 Oct 1973      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 16.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1981 | 3048.3         | 447.0          | 78.8   | 93.8   | 78.8                              | 81.1   | 77.8               | 79.5   | 7094               | 81.0   |
| 1982 | 3315.9         | 452.0          | 83.9   | 92.7   | 83.9                              | 81.4   | 83.7               | 80.0   | 7489               | 85.5   |
| 1983 | 3050.0         | 452.0          | 76.9   | 91.1   | 76.9                              | 80.9   | 77.0               | 79.7   | 6959               | 79.4   |
| 1984 | 3062.0         | 452.0          | 76.7   | 89.8   | 76.6                              | 80.5   | 77.1               | 79.5   | 6895               | 78.5   |
| 1985 | 3261.2         | 452.0          | 83.3   | 89.2   | 81.9                              | 80.7   | 82.4               | 79.7   | 7299               | 83.3   |
| 1986 | 3574.0         | 452.0          | 91.6   | 89.4   | 89.9                              | 81.4   | 90.3               | 80.5   | 8053               | 91.9   |
| 1987 | 2950.9         | 452.0          | 76.6   | 88.5   | 74.2                              | 80.9   | 74.5               | 80.1   | 6756               | 77.1   |
| 1988 | 3032.6         | 452.0          | 76.2   | 87.7   | 76.2                              | 80.5   | 76.4               | 79.8   | 6763               | 77.0   |
| 1989 | 3421.9         | 481.0          | 87.8   | 87.7   | 87.8                              | 81.0   | 81.2               | 79.9   | 7711               | 88.0   |
| 1990 | 2885.9         | 481.0          | 75.7   | 86.9   | 75.6                              | 80.7   | 68.5               | 79.2   | 6636               | 75.8   |
| 1991 | 2728.5         | 452.0          | 69.3   | 86.0   | 69.2                              | 80.1   | 68.9               | 78.7   | 6221               | 71.0   |
| 1992 | 2830.3         | 452.0          | 82.9   | 85.8   | 80.6                              | 80.1   | 71.3               | 78.3   | 6412               | 73.0   |
| 1993 | 3328.2         | 452.0          | 84.3   | 85.7   | 83.6                              | 80.3   | 84.1               | 78.6   | 7376               | 84.2   |
| 1994 | 3322.0         | 452.0          | 84.8   | 85.7   | 84.8                              | 80.5   | 83.9               | 78.8   | 7489               | 85.5   |
| 1995 | 3386.8         | 452.0          | 87.1   | 85.7   | 86.8                              | 80.8   | 85.5               | 79.1   | 7654               | 87.4   |
| 1996 | 3520.3         | 452.0          | 88.3   | 85.8   | 88.2                              | 81.1   | 88.7               | 79.5   | 7978               | 90.8   |
| 1999 | 3604.2         | 449.0          | 94.2   | 86.2   | 94.2                              | 81.6   | 91.6               | 80.0   | 8363               | 95.5   |
| 2000 | 3699.0         | 449.0          | 93.9   | 86.5   | 93.1                              | 82.1   | 93.8               | 80.6   | 8262               | 94.1   |
| 2001 | 3746.7         | 449.0          | 94.6   | 86.8   | 94.6                              | 82.6   | 95.3               | 81.1   | 8404               | 95.9   |
| 2002 | 3686.9         | 450.0          | 93.8   | 87.1   | 93.4                              | 83.0   | 93.5               | 81.6   | 8284               | 94.6   |
| 2003 | 3788.3         | 450.0          | 95.3   | 87.4   | 95.3                              | 83.4   | 96.1               | 82.1   | 8431               | 96.2   |
| 2004 | 3604.7         | 450.0          | 91.1   | 87.5   | 91.1                              | 83.7   | 91.2               | 82.4   | 8073               | 91.9   |

**NL-2 BORSSELE****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                         |
|--------|-------|---------|------|------|-------------------------------------|
| 24 Jan | 68.0  | 35.8    | UF1  | A15  | REPAIR OF PRESSURIZER RELIEF VALVE. |
| 02 Oct | 635.0 | 318.8   | PF   | B    | REFUELLING.                         |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 68        |          |   | 154       |          |
| B. Refuelling without a maintenance  | 635             |           |          | 13  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 794   | 19        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 54  |           |          |
| E. Testing of plant systems or components  |                 |           |          |   | 14        |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0   | 4         | 5        |
| Subtotal   | 635             | 68        | 0        | 861   | 192       | 6        |
| Total  |                 | 703       |          |   | 1059      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1973 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 4   |
| 13. Reactor Auxiliary Systems       |                    | 4   |
| 14. Safety Systems                  |                    | 15  |
| 15. Reactor Cooling Systems         | 68                 | 17  |
| 16. Steam generation systems        |                    | 42  |
| 31. Turbine and auxiliaries         |                    | 19  |
| 32. Feedwater and Main Steam System |                    | 33  |
| 33. Circulating Water System        |                    | 3   |
| 41. Main Generator Systems          |                    | 0   |
| 42. Electrical Power Supply Systems |                    | 12  |
| Total                               | 68                 | 149   |

# PK-2 CHASNUPP 1

**Operator:** PAEC (PAKISTAN ATOMIC ENERGY COMMISSION)  
**Contractor:** CNNC (CHINA NATIONAL NUCLEAR CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 300.0 MW(e)  
**Design Net RUP:** 300.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 1750.7 GW(e).h  
**Energy Availability Factor:** 66.4%  
**Load Factor:** 66.4%  
**Operating Factor:** 67.7%  
**Energy Unavailability Factor:** 33.6%  
**Total Off-line Time:** 2835 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 223.7 | 180.4 | 190.4 | 102.9 | 0.0   | 0.0   | 29.0 | 210.6 | 215.5 | 172.3 | 210.8 | 215.1 | 1750.7 |
| <b>EAF (%)</b>  | 99.2  | 86.4  | 85.3  | 47.7  | 0.0   | 0.0   | 13.0 | 94.4  | 99.8  | 77.2  | 97.6  | 96.4  | 66.4   |
| <b>UCF (%)</b>  | 99.7  | 86.4  | 96.9  | 48.2  | 0.0   | 0.0   | 13.0 | 99.2  | 99.8  | 77.2  | 97.6  | 99.8  | 68.1   |
| <b>LF (%)</b>   | 100.2 | 86.4  | 85.3  | 47.7  | 0.0   | 0.0   | 13.0 | 94.4  | 99.8  | 77.2  | 97.6  | 96.4  | 66.4   |
| <b>OF (%)</b>   | 100.0 | 88.6  | 84.5  | 46.5  | 0.0   | 0.0   | 24.5 | 96.4  | 100.0 | 77.0  | 100.0 | 95.7  | 67.7   |
| <b>EUF (%)</b>  | 0.8   | 13.6  | 14.7  | 52.3  | 100.0 | 100.0 | 87.0 | 5.6   | 0.2   | 22.8  | 2.4   | 3.6   | 33.6   |
| <b>PUF (%)</b>  | 0.3   | 3.5   | 0.0   | 51.8  | 100.0 | 54.4  | 11.5 | 0.7   | 0.2   | 0.2   | 2.4   | 0.2   | 18.8   |
| <b>UCLF (%)</b> | 0.0   | 10.1  | 3.1   | 0.0   | 0.0   | 45.6  | 75.5 | 0.0   | 0.0   | 22.6  | 0.0   | 0.0   | 13.1   |
| <b>XUF (%)</b>  | 0.5   | 0.0   | 11.6  | 0.6   | 0.0   | 0.0   | 0.0  | 4.9   | 0.0   | 0.0   | 0.0   | 3.4   | 1.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

REFUELLING OUTAGE-2 WAS SUCCESSFULLY COMPLETED DURING THE YEAR WITH NEARLY A MONTH LONG DELAY BEYOND SCHEDULE DUE TO EQUIPMENT PROBLEM.

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1993      **Lifetime Generation:** 7027.4 GW(e).h  
**Date of First Criticality:** 03 May 2000      **Cumulative Energy Availability Factor:** 61.9%  
**Date of Grid Connection:** 13 Jun 2000      **Cumulative Load Factor:** 61.8%  
**Date of Commercial Operation:** 15 Sep 2000      **Cumulative Unit Capability Factor:** 83.7%  
**Cumulative Energy Unavailability Factor:** 38.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2000 | 529.2          | 300.0          | 0.0  | 0.0    | 72.2                              | 100.0  | 68.7               | 0.0    | 1860               | 72.4   |
| 2001 | 1581.8         | 300.0          | 62.4   | 62.4   | 60.1                              | 60.1   | 60.2               | 60.2   | 5918               | 67.6   |
| 2002 | 1356.0         | 300.0          | 53.7   | 58.1   | 52.2                              | 56.2   | 51.6               | 55.9   | 4790               | 54.7   |
| 2003 | 1809.8         | 300.0          | 68.8   | 61.7   | 68.9                              | 60.4   | 68.9               | 60.2   | 6879               | 78.5   |
| 2004 | 1750.7         | 300.0          | 68.1   | 63.3   | 66.4                              | 61.9   | 66.4               | 61.8   | 5949               | 67.7   |

# PK-2 CHASNUPP 1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 20 Jan | 9.1    | 1.1     | XP2  | N33  | HEAVY MUD INFLOW INTO THE FOREBAY CAUSED DEGRADED SUCTION CONDITIONS FOR THE CIRCULATING COOLING WATER PUMPS               |
| 23 Jan | 7.7    | 0.7     | PP   | E31  | MONTHLY TEST OF TURBINE IMPORTANT VALVES.  |
| 03 Feb | 79.0   | 23.9    | UF4  | L12  | REACTOR TRIP ON POWER RANGE HIGH POSITIVE NEUTRON FLUX RATE  |
| 13 Feb | 101.2  | 7.3     | PP   | E31  | MONTHLY TEST OF TURBINE IMPORTANT VALVES.  |
| 15 Mar | 86.0   | 25.8    | XF4  | J41  | GENERATOR TRIP DUE TO GRID LOAD TRANSIENT.   |
| 20 Mar | 29.0   | 8.9     | UF5  | A31  | FIX EXCESSIVE LEAKAGE FROM A FLANGE CAUSED BY WEARING OUT OF THE RUBBER O-RING ON THE HP EH LINE L                         |
| 15 Apr | 8.2    | 1.3     | PP   | S11  | FUEL COASTDOWN TOWARDS THE END OF CYCLE-2.   |
| 15 Apr | 1511.2 | 453.4   | PF   | C    | PLANNED SHUT DOWN FOR RE-FUELING OUTAGE-2.   |
| 17 Jun | 889.5  | 266.8   | UF3  | A42  | RE-FUELING OUTAGE-2 EXTENSION BECAUSE OF EQUIPMENT PROBLEM.  |
| 24 Jul | 205.1  | 25.7    | PP   | C    | TO CONDUCT PLANT START UP TESTS AFTER COMPLETING RE-FUELING OUTAGE-2.  |
| 06 Aug | 71.0   | 0.6     | UP1  | A41  | GENERATOR EXCITER WINDING TEMPERATURE HIGH DUE TO HIGH AMBIENT TEMPERATURE.  |
| 23 Aug | 36.0   | 10.8    | XF4  | J    | INABILITY OF STEAM GENERATOR LEVEL CONTROL SYSTEM TO MAINTAIN HOUSE LOAD OPERATION AFTER SUDDEN LOAD TRIPPING ON THE GRID. |
| 23 Sep | 14.9   | 1.5     | PP   | E31  | MONTHLY TEST OF TURBINE IMPORTANT VALVES.  |
| 01 Oct | 171.0  | 51.3    | UF5  | A31  | TO INVESTIGATE ABNORMAL SOUND COMING OUT FROM AN EXPENSION   |
| 19 Oct | 2.0    | 0.8     | XF   | J    | GRID TRANSIENT AND EXCESSIVE LOAD FLUCTUATION  |
| 29 Oct | 5.5    | 0.5     | PP   | E31  | MONTHLY TEST OF TURBINE IMPORTANT VALVES.  |
| 14 Nov | 97.1   | 7.8     | XP2  | K    | REDUCED ENERGY DEMAND ON THE GRID.   |
| 17 Dec | 5.9    | 0.5     | PP   | E31  | MONTHLY TEST OF TURBINE IMPORTANT VALVES.  |
| 24 Dec | 8.8    | 0.2     | XP2  | N    | BLOCKAGE OF TRASH RACKS BY INFLOW OF LARGE QUANTITY OF DEBRIS CAUSED BY HEAVY RAIN/FLOOD IN THE REGION.                    |
| 29 Dec | 32.0   | 9.7     | XF4  | J    | GENERATOR TRIP ON ITS PHASE-B OVER LOAD DUE TO EXCESSIVE MVARs DEMAND ON THE GRID.   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 2000 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1089      |          |  | 847       |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1511            |           |          | 444                                      |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 115                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 14                                       | 5         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 108                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           | 156      |  |           | 190      |
| L. Human factor related  |                 | 79        |          |  | 6         |          |
| R. External restrictions on supply and services (lack of funds due to delayed payments from customers, disputes in fuel industries, fuel-rationing, labour strike outside the plant , spare part delivery problems etc.) |                 |           |          |  |           | 62       |
| Z. Others  |                 |           |          |  | 85        |          |
| Subtotal   | 1511            | 1168      | 156      | 681                                      | 943       | 252      |
| Total  |                 | 2835      |          |  | 1876      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 2000 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 21                                       |
| 14. Safety Systems                  |                 | 169                                      |
| 15. Reactor Cooling Systems         |                 | 249                                      |
| 31. Turbine and auxiliaries         | 200             | 104                                      |
| 32. Feedwater and Main Steam System |                 | 81                                       |
| 33. Circulating Water System        |                 | 21                                       |
| 35. All other I&C Systems           |                 | 9  |
| 41. Main Generator Systems          |                 | 1  |
| 42. Electrical Power Supply Systems | 889             | 189                                      |
| Total                               | 1089            | 844                                      |

**PK-1 KANUPP**

**Operator:** PAEC (PAKISTAN ATOMIC ENERGY COMMISSION)  
**Contractor:** CGE (CANADIAN GENERAL ELECTRIC)

**1. Station Details**

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 125.0 MW(e)  
**Design Net RUP:** 125.0 MW(e)  
**Design Discharge Burnup:** 8650 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 183.0 GW(e).h  
**Energy Availability Factor:** 24.7%  
**Load Factor:** 16.7%  
**Operating Factor:** 73.6%  
**Energy Unavailability Factor:** 75.3%  
**Total Off-line Time:** 2317 hours

**3. 2004 Monthly Performance Data**

|                 | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug   | Sep  | Oct  | Nov  | Dec   | Annual |
|-----------------|------|------|------|------|------|------|------|-------|------|------|------|-------|--------|
| <b>GW(e).h</b>  | 3.5  | 8.8  | 13.8 | 12.1 | 6.5  | 9.7  | 11.5 | 24.1  | 17.1 | 23.3 | 23.7 | 28.9  | 183.0  |
| <b>EAF (%)</b>  | 74.5 | 10.1 | 14.8 | 13.3 | 10.2 | 10.8 | 12.4 | 25.9  | 19.0 | 34.7 | 38.3 | 31.0  | 24.7   |
| <b>UCF (%)</b>  | 74.5 | 10.1 | 14.8 | 13.3 | 10.2 | 10.8 | 12.4 | 25.9  | 19.0 | 44.1 | 38.3 | 31.0  | 25.5   |
| <b>LF (%)</b>   | 3.8  | 10.1 | 14.8 | 13.5 | 7.0  | 10.8 | 12.4 | 25.9  | 19.0 | 25.1 | 26.4 | 31.0  | 16.7   |
| <b>OF (%)</b>   | 29.3 | 62.2 | 90.6 | 79.4 | 43.8 | 70.0 | 77.3 | 100.0 | 61.3 | 80.9 | 88.1 | 100.0 | 73.6   |
| <b>EUF (%)</b>  | 25.5 | 89.9 | 85.2 | 86.7 | 89.8 | 89.2 | 87.6 | 74.1  | 81.0 | 65.3 | 61.7 | 69.0  | 75.3   |
| <b>PUF (%)</b>  | 25.5 | 52.1 | 75.7 | 65.9 | 33.6 | 59.2 | 64.9 | 74.1  | 42.3 | 55.9 | 61.7 | 69.0  | 56.7   |
| <b>UCLF (%)</b> | 0.0  | 37.8 | 9.4  | 20.7 | 56.2 | 30.0 | 22.8 | 0.0   | 38.7 | 0.0  | 0.0  | 0.0   | 17.8   |
| <b>XUF (%)</b>  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0   | 0.0  | 9.3  | 0.0  | 0.0   | 0.8    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

KANUPP, SHUT DOWN ON 05-12-2002 TO CARRY OUT VARIOUS MAINTENANCE/REFURBISHMENT JOBS RELATED TO LIFE EXTENSION OF KANUPP BEYOND 30 YEARS OF ITS DESIGN LIFE. AFTER COMPLETION OF REFURBISHMENT JOBS, THE PLANT WAS RESTARTED AND SYNCHRONIZED WITH THE GRID ON 22-01-2004. KANUPP OPERATED AT AN AVERAGE LOAD OF 30 - 50 MWE DURING THE REPORTING PERIOD. KANUPP HAS GENERATED 183 MILLION UNITS (NET) OF ELECTRICITY. THE PEL PLANNED ENERGY LOSSES 622392 MW.H ARE DUE TO THE PLANT OPERATION AT LOW LOAD.

**5. Historical Summary**

**Date of Construction Start:** 01 Aug 1966      **Lifetime Generation:** 9969.2 GW(e).h  
**Date of First Criticality:** 01 Aug 1971      **Cumulative Energy Availability Factor:** 27.8%  
**Date of Grid Connection:** 18 Oct 1971      **Cumulative Load Factor:** 27.5%  
**Date of Commercial Operation:** 07 Dec 1972      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 72.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 171.4          | 125.0          | 16.2   | 57.7   | 15.6                              | 25.5   | 15.6               | 25.5   | 2962               | 33.7   |
| 1989 | 60.9           | 125.0          | 5.6  | 54.7   | 5.6                               | 24.4   | 5.6                | 24.3   | 1145               | 13.1   |
| 1990 | 375.9          | 125.0          | 34.3   | 53.6   | 34.3                              | 24.9   | 34.3               | 24.9   | 5331               | 60.9   |
| 1991 | 370.3          | 125.0          | 34.8   | 52.6   | 33.8                              | 25.4   | 33.8               | 25.3   | 6126               | 69.9   |
| 1992 | 499.7          | 125.0          | 45.5   | 52.3   | 45.5                              | 26.4   | 45.5               | 26.3   | 6396               | 72.8   |
| 1993 | 369.6          | 125.0          | 35.8   | 51.5   | 33.8                              | 26.7   | 33.8               | 26.7   | 4620               | 52.7   |
| 1994 | 523.6          | 125.0          | 53.6   | 51.6   | 47.8                              | 27.7   | 47.8               | 27.6   | 7518               | 85.8   |
| 1995 | 461.0          | 125.0          | 44.0   | 51.2   | 42.1                              | 28.3   | 42.1               | 28.3   | 7520               | 85.8   |
| 1996 | 310.9          | 125.0          | 32.6   | 50.5   | 28.3                              | 28.3   | 28.3               | 28.3   | 5291               | 60.2   |
| 1997 | 386.1          | 125.0          | 36.8   | 49.9   | 35.3                              | 28.6   | 35.3               | 28.5   | 6391               | 73.0   |
| 1998 | 353.4          | 125.0          | 31.3   | 49.2   | 29.7                              | 28.6   | 32.3               | 28.7   | 4799               | 54.8   |
| 1999 | 69.0           | 125.0          | 11.9   | 47.9   | 11.9                              | 28.0   | 6.3                | 27.9   | 1046               | 11.9   |
| 2000 | 368.3          | 125.0          | 34.6   | 47.4   | 33.5                              | 28.2   | 33.5               | 28.1   | 5078               | 57.8   |
| 2001 | 399.5          | 125.0          | 45.1   | 47.3   | 36.5                              | 28.5   | 36.5               | 28.3   | 6049               | 69.1   |
| 2002 | 444.0          | 125.0          | 41.3   | 47.1   | 40.5                              | 28.9   | 40.5               | 28.7   | 6601               | 75.4   |
| 2003 | 0.0            | 125.0          | 0.0  | 45.6   | 0.0                               | 27.9   | 0.0                | 27.8   | 0                  | 0.0    |
| 2004 | 183.0          | 125.0          | 25.5   | 45.0   | 24.7                              | 27.8   | 16.7               | 27.5   | 6467               | 73.6   |



# PK-1 KANUPP

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 528.0 | 66.0    | PF   | G    | REFURBISHMENT JOBS   |
| 31 Jan | 263.0 | 32.9    | UF4  | A13  | THE PLANT WAS TRIPPED (SCRAMMED) DUE TO PASSING OF DUMP VALVE (CMP-HG-CVI).  |
| 09 Mar | 70.0  | 8.8     | UF4  | A12  | THE PLANT WAS TRIPPED (SCRAMMED) DUE TO SPURIOUS SIGNAL MASTER KEY REMOVED FROM ACCESS CONTROL SYSTEM.                   |
| 05 Apr | 149.0 | 18.6    | UF2  | A21  | THE PLANT WAS SHUT DOWN DUE TO FAILURE OF CHARGE TUBE AXIAL DRIVE OF NORTH FUELING MACHINE WHILE DISCHARGING SPENT FUEL. |
| 04 May | 417.0 | 52.1    | UF2  | A21  | THE PLANT WAS SHUT DOWN DUE TO FAILURE OF NORTH FUELING MACHINE TO INSTALL THE CLOSURE PLUG ON FUEL CHANNEL.             |
| 05 Jun | 216.0 | 27.0    | UF2  | A15  | THE PLANT WAS SHUT DOWN DUE TO HIGH CLOSE COLLECTION RATE OF PRIMARY HEAT TRANSPORT SYSTEM.                              |
| 22 Jul | 169.0 | 21.1    | UF2  | A15  | THE PLANT WAS SHUT DOWN DUE TO HIGH MPCA IN BOILER ROOM.   |
| 18 Sep | 271.0 | 33.9    | UF2  | A13  | THE PLANT WAS SHUT DOWN DUE TO HIGH CHLORIDES IN BOILERS.  |
| 30 Sep | 39.0  | 4.9     | UF4  | A12  | THE PLANT WAS TRIPPED (SCRAMMED) DUE TO SPURIOUS ACTUATION OF CHANNEL TEMPERATURE HIGH TRIP CONDITION.                   |
| 25 Oct | 71.0  | 8.9     | XF4  | J42  | THE PLANT WAS SHUT DOWN (SCRAMMED) DUE TO GRID TRANSIENT.  |
| 28 Oct | 36.0  | 4.5     | UF4  | A31  | THE PLANT WAS TRIPPED (SCRAMMED) DUE TO SPURIOUS ACTUATION OF CHANNEL TEMPERATURE HIGH TRIP CONDITION                    |
| 18 Nov | 58.0  | 7.3     | XF4  | J42  | THE PLANT WAS TRIPPED (SCRAMMED) DUE TO GRID TRANSIENT.  |
| 20 Nov | 27.0  | 3.4     | XF4  | J42  | THE PLANT TRIPPED (SCRAMMED) DUE TO GRID TRANSIENT.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1630      |          |  | 1123      |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 69        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 1717                                     |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      | 528             |           |          | 289                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           | 156      |  |           | 95       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 4  | 113       | 13       |
| Subtotal   | 528             | 1630      | 156      | 2010                                     | 1305      | 108      |
| Total  |                 | 2314      |          |  | 3423      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 10                                       |
| 12. Reactor I&C Systems                        | 109             | 125                                      |
| 13. Reactor Auxiliary Systems                  | 534             | 103                                      |
| 14. Safety Systems                             |                 | 18                                       |
| 15. Reactor Cooling Systems                    | 385             | 188                                      |
| 16. Steam generation systems                   |                 | 35                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 21. Fuel Handling and Storage Facilities       | 566             | 9  |
| 31. Turbine and auxiliaries                    | 36              | 27                                       |
| 32. Feedwater and Main Steam System            |                 | 209                                      |
| 33. Circulating Water System                   |                 | 34                                       |
| 41. Main Generator Systems                     |                 | 6  |
| 42. Electrical Power Supply Systems            |                 | 144                                      |
| XX. Miscellaneous Systems                      |                 | 5  |
| Total  | 1630            | 913                                      |

# RO-1 CERNAVODA-1

**Operator:** SNN (SOCIETATEA NATIONALA NUCLEARELECTRICA S.A.)  
**Contractor:** AECL (ATOMIC ENERGY OF CANADA LTD.)

## 1. Station Details

**Type:** PHWR  
**Net Reference Unit Power at the beginning of 2004:** 655.0 MW(e)  
**Design Net RUP:** 660.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 5142.3 GW(e).h  
**Energy Availability Factor:** 89.1%  
**Load Factor:** 89.4%  
**Operating Factor:** 89.8%  
**Energy Unavailability Factor:** 10.9%  
**Total Off-line Time:** 892 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 488.9 | 456.7 | 439.5 | 466.4 | 490.7 | 469.8 | 479.6 | 416.7 | 0.1  | 474.3 | 472.3 | 487.3 | 5142.3 |
| <b>EAF (%)</b>  | 100.0 | 99.9  | 89.6  | 98.3  | 99.9  | 99.5  | 98.5  | 85.6  | 0.1  | 97.1  | 99.8  | 99.7  | 89.1   |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 89.6  | 98.3  | 99.9  | 99.9  | 100.0 | 86.8  | 0.1  | 97.4  | 99.9  | 99.7  | 89.4   |
| <b>LF (%)</b>   | 100.3 | 100.2 | 90.2  | 99.0  | 100.7 | 99.6  | 98.4  | 85.5  | 0.0  | 97.2  | 100.1 | 100.0 | 89.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 89.7  | 99.6  | 100.0 | 100.0 | 100.0 | 87.2  | 0.4  | 100.0 | 100.0 | 100.0 | 89.8   |
| <b>EUF (%)</b>  | 0.0   | 0.1   | 10.4  | 1.7   | 0.1   | 0.5   | 1.5   | 14.4  | 99.9 | 2.9   | 0.2   | 0.3   | 10.9   |
| <b>PUF (%)</b>  | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 13.2  | 77.1 | 2.6   | 0.0   | 0.1   | 7.7    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 10.4  | 1.6   | 0.1   | 0.0   | 0.0   | 0.0   | 22.8 | 0.0   | 0.1   | 0.2   | 2.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4   | 1.5   | 1.2   | 0.0  | 0.3   | 0.0   | 0.0   | 0.3    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE UNIT WAS OPERATED AT FULL POWER IN BASE LOAD MODE.THE ANNUAL PLANNED OUTAGE HAD A SCHEDULED DURATION OF 28 DAYS.THERE WAS AN OUTAGE EXTENSION OF 164 HRS.BECAUSE A FAILURE OF TWO SHUT-OFF RODS FROM SHUT DOWN SYSTEM #1. THE UNIT HAS DELIVERED 25,029 GCAL THERMAL ENERGY TO THE DISTRICT HEATING BUT THIS WAS DONE WITHOUT REDUCING THE UNIT REFERENCE POWER.

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1982      **Lifetime Generation:** 40754.6 GW(e).h  
**Date of First Criticality:** 16 Apr 1996      **Cumulative Energy Availability Factor:** 85.9%  
**Date of Grid Connection:** 11 Jul 1996      **Cumulative Load Factor:** 86.3%  
**Date of Commercial Operation:** 02 Dec 1996      **Cumulative Unit Capability Factor:** 82.2%  
**Cumulative Energy Unavailability Factor:** 14.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1996 | 1186.4         | 647.0          | 0.0  | 0.0    | 99.5                              | 100.0  | 23.6               | 0.0    | 2686               | 34.6   |
| 1997 | 4953.3         | 646.0          | 87.3   | 87.3   | 86.7                              | 86.7   | 87.5               | 87.5   | 7753               | 88.5   |
| 1998 | 4908.7         | 655.0          | 85.8   | 86.6   | 85.2                              | 86.0   | 85.5               | 86.5   | 7585               | 86.6   |
| 1999 | 4813.0         | 655.0          | 83.8   | 85.6   | 83.5                              | 85.1   | 83.9               | 85.6   | 7389               | 84.3   |
| 2000 | 5053.4         | 655.0          | 87.9   | 86.2   | 87.6                              | 85.8   | 87.8               | 86.2   | 7791               | 88.7   |
| 2001 | 5049.9         | 655.0          | 88.2   | 86.6   | 87.5                              | 86.1   | 88.0               | 86.6   | 7717               | 88.1   |
| 2002 | 5106.2         | 655.0          | 89.1   | 87.0   | 88.7                              | 86.5   | 89.0               | 87.0   | 7854               | 89.7   |
| 2003 | 4541.4         | 655.0          | 86.7   | 87.0   | 78.7                              | 85.4   | 79.1               | 85.8   | 7024               | 80.2   |
| 2004 | 5142.3         | 655.0          | 89.4   | 87.3   | 89.1                              | 85.9   | 89.4               | 86.3   | 7892               | 89.8   |

# RO-1 CERNAVODA-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 2184.0 | 0.8     | PP   | B    | REFUELLING THE REACTOR AND PLANNED MONTHLY TESTS.  |
| 28 Mar | 77.0   | 50.4    | UF4  | A12  | FAILURE OF AN ELECTRONIC CARD IN MAIN COMPUTER DCCX.   |
| 01 Apr | 27.0   | 5.1     | UP   | A12  | LOAD INCREASE FOLLOWING THE SHUTDOWN DESCRIBED IN OUTAGE 1   |
| 01 Apr | 4.0    | 2.6     | UF3  | A12  | CONTINUATION OF THE OUTAGE 1   |
| 01 Apr | 1464.0 | 0.3     | PP   | B    | EFUELLING THE REACTOR AND PLANNED MONTHLY TESTS.   |
| 01 May | 744.0  | 0.3     | UP   | A31  | LOAD REDUCTION DUE TO ISOLATION OF THE CONDENSER WATER BOXES FOR CLEANING  |
| 01 Jun | 720.0  | 0.6     | PP   | E11  | PLANNED CHANNEL FLOW VERIFICATION TEST   |
| 01 Jun | 720.0  | 1.7     | XP   | N33  | POWER REDUCTION DUE TO SEASONAL INCREASE IN COOLING WATER TEMPERATURE  |
| 01 Jul | 1393.0 | 13.4    | XP   | N33  | POWER REDUCTION DUE TO SEASONAL INCREASE IN COOLING WATER TEMPERATURE  |
| 01 Jul | 1488.0 | 0.3     | PP   | B    | REFUELLING THE REACTOR AND PLANNED MONTHLY TESTS.  |
| 27 Aug | 4.0    | 1.8     | PP   | D    | POWER DECREASE PRECEDING THE ANNUAL PLANNED OUTAGE   |
| 28 Aug | 646.0  | 424.4   | PF   | D13  | ANNUAL PLANNED OUTAGE.THE MAIN ACTIVITIES DONE WERE: - REPAIRS OF REACTOR BUILDING ROOM R-001( SPENT FUEL BAY), PREVENTIVE MAINTENANCE OF STANDBY DIESEL GENERATORS EVEN, ETC.   |
| 01 Sep | 720.0  | 0.2     | PP   | B    | REFUELLING THE REACTOR AND PLANNED MONTHLY TESTS.  |
| 23 Sep | 164.0  | 107.4   | UF3  | A12  | DURING THE ANNUAL OUTAGE A SPURIOUS SDS#1TRIP OCCURRED. FURTHER INVESTIGATION REVEALED THAT THE CABLES ON SHUT-OFF RODS WERE BROKEN WHEN THEY HAVE FALL IN THE CORE. THE GUIDE TUBES WERE INSPECTED FOR DEFECTS AND NO SIGNIFICANT PROBLEMS WERE FOUND |
| 30 Sep | 51.0   | 13.8    | PP   | D13  | LOAD INCREASE AFTER PLANNED ANNUAL OUTAGE  |
| 01 Oct | 744.0  | 1.5     | XP   | N33  | POWER REDUCTION DUE TO SEASONAL INCREASE IN COOLING WATER TEMPERATURE  |
| 01 Oct | 2184.0 | 0.9     | PP   | B    | REFUELLING THE REACTOR AND PLANNED MONTHLY TESTS.  |
| 01 Nov | 720.0  | 0.6     | UP   | A31  | LOAD REDUCTION DUE TO ISOLATION OF THE CONDENSER WATER BOXES FOR CLEANING  |
| 01 Dec | 744.0  | 1.0     | UP   | A32  | POWER REDUCTION DUE TO MAXIMIZING OF THE STEAM GENERATORS BLOWDOWN, BECAUSE INCREASING OF THE CHEMICAL PARAMETERS.   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1997 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 245       |          |  | 264       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 15        |          |
| D. Inspection, maintenance or repair without refuelling  | 646             |           |          | 625                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 31        | 5        |
| L. Human factor related  |                 |           |          |  | 0         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 79       |
| Subtotal   | 646             | 245       | 0        | 625                                      | 310       | 84       |
| Total  |                 | 891       |          |  | 1019      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1997 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 245             | 31                                       |
| 13. Reactor Auxiliary Systems       |                 | 23                                       |
| 14. Safety Systems                  |                 | 4  |
| 31. Turbine and auxiliaries         |                 | 89                                       |
| 32. Feedwater and Main Steam System |                 | 33                                       |
| 33. Circulating Water System        |                 | 0  |
| 41. Main Generator Systems          |                 | 5  |
| 42. Electrical Power Supply Systems |                 | 6  |
| XX. Miscellaneous Systems           |                 | 44                                       |
| Total                               | 245             | 235                                      |

# RU-96 BALAKOVO-1

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6626.4 GW(e).h  
**Energy Availability Factor:** 78.0%  
**Load Factor:** 79.4%  
**Operating Factor:** 78.6%  
**Energy Unavailability Factor:** 22.0%  
**Total Off-line Time:** 1883 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 719.0 | 678.3 | 85.3 | 0.0   | 180.4 | 690.1 | 708.8 | 709.6 | 696.4 | 723.1 | 703.8 | 731.5 | 6626.4 |
| <b>EAF (%)</b>  | 99.2  | 99.8  | 12.6 | 0.0   | 27.0  | 99.8  | 99.7  | 99.8  | 100.0 | 99.2  | 99.9  | 100.0 | 78.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 12.6 | 0.0   | 27.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.2   |
| <b>LF (%)</b>   | 101.7 | 102.6 | 12.1 | 0.0   | 25.5  | 100.9 | 100.3 | 100.4 | 101.8 | 102.2 | 102.9 | 103.5 | 79.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 13.1 | 0.0   | 30.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.6   |
| <b>EUF (%)</b>  | 0.8   | 0.2   | 87.4 | 100.0 | 73.0  | 0.2   | 0.3   | 0.2   | 0.0   | 0.8   | 0.1   | 0.0   | 22.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 87.4 | 100.0 | 73.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.8   | 0.2   | 0.0  | 0.0   | 0.0   | 0.2   | 0.3   | 0.2   | 0.0   | 0.8   | 0.1   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, MAY, JUNE, JULY, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 97565 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1980      **Lifetime Generation:** 93890.4 GW(e).h  
**Date of First Criticality:** 12 Dec 1985      **Cumulative Energy Availability Factor:** 62.9%  
**Date of Grid Connection:** 28 Dec 1985      **Cumulative Load Factor:** 59.2%  
**Date of Commercial Operation:** 23 May 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 37.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6476.9         | 950.0          | 80.9   | 68.9   | 80.9                              | 68.9   | 77.6               | 65.4   | 7207               | 82.0   |
| 1989 | 4473.9         | 950.0          | 56.4   | 64.8   | 56.3                              | 64.8   | 53.8               | 61.6   | 5141               | 58.7   |
| 1990 | 739.1          | 950.0          | 9.1  | 51.0   | 9.1                               | 51.0   | 8.9                | 48.6   | 887                | 10.1   |
| 1991 | 4951.6         | 950.0          | 60.2   | 52.9   | 59.8                              | 52.8   | 59.5               | 50.7   | 5780               | 66.0   |
| 1992 | 6352.3         | 950.0          | 76.4   | 56.8   | 76.3                              | 56.7   | 76.1               | 54.9   | 7666               | 87.3   |
| 1993 | 3326.1         | 950.0          | 46.1   | 55.2   | 39.9                              | 54.3   | 40.0               | 52.8   | 4230               | 48.3   |
| 1994 | 1759.5         | 950.0          | 77.3   | 58.0   | 77.3                              | 57.2   | 21.1               | 48.9   | 2307               | 26.3   |
| 1995 | 2018.0         | 950.0          | 28.6   | 54.7   | 28.6                              | 54.0   | 24.2               | 46.2   | 4810               | 54.9   |
| 1996 | 4872.5         | 950.0          | 86.5   | 57.9   | 59.0                              | 54.5   | 58.4               | 47.4   | 5913               | 67.3   |
| 1997 | 4729.0         | 950.0          | 60.4   | 58.1   | 57.2                              | 54.7   | 56.8               | 48.2   | 5818               | 66.4   |
| 1998 | 4329.8         | 950.0          | 55.8   | 57.9   | 52.2                              | 54.5   | 52.0               | 48.6   | 5671               | 64.7   |
| 1999 | 5141.3         | 950.0          | 65.6   | 58.5   | 62.1                              | 55.1   | 61.8               | 49.6   | 6337               | 72.3   |
| 2000 | 7247.4         | 950.0          | 87.5   | 60.6   | 86.5                              | 57.3   | 86.8               | 52.2   | 7705               | 87.7   |
| 2001 | 7407.9         | 950.0          | 91.6   | 62.6   | 88.2                              | 59.4   | 89.0               | 54.7   | 8041               | 91.8   |
| 2002 | 6785.7         | 950.0          | 86.5   | 64.1   | 80.5                              | 60.7   | 81.5               | 56.3   | 7501               | 85.6   |
| 2003 | 7032.2         | 950.0          | 84.7   | 65.3   | 83.1                              | 62.0   | 84.5               | 58.0   | 7460               | 85.2   |
| 2004 | 6626.4         | 950.0          | 78.2   | 66.0   | 78.0                              | 62.9   | 79.4               | 59.2   | 6901               | 78.6   |

# RU-96 BALAKOVO-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 07 Jan | 24.0   | 5.3     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER    |
| 08 Feb | 48.0   | 1.1     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER    |
| 05 Mar | 1883.0 | 1817.5  | PF   | C    | MAJOR UNIT OVERHAUL   |
| 01 Jun | 1913.0 | 5.4     | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE |
| 31 Oct | 48.0   | 6.5     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER    |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 519       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1883            |           |          | 1310                                     | 20        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 481                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 1         |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 128      |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 253      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 41        | 1        |
| L. Human factor related  |                 |           |          |  | 0         |          |
| Subtotal   | 1883            | 0         | 0        | 1793                                     | 595       | 382      |
| Total  |                 | 1883      |          |  | 2770      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 1  |
| 13. Reactor Auxiliary Systems                  |                 | 3  |
| 15. Reactor Cooling Systems                    |                 | 13                                       |
| 16. Steam generation systems                   |                 | 146                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 6  |
| 31. Turbine and auxiliaries                    |                 | 79                                       |
| 32. Feedwater and Main Steam System            |                 | 17                                       |
| 33. Circulating Water System                   |                 | 1  |
| 35. All other I&C Systems                      |                 | 14                                       |
| 41. Main Generator Systems                     |                 | 151                                      |
| 42. Electrical Power Supply Systems            |                 | 36                                       |
| XX. Miscellaneous Systems                      |                 | 2  |
| Total  | 0               | 469                                      |

## RU-97 BALAKOVO-2

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7010.4 GW(e).h  
**Energy Availability Factor:** 82.4%  
**Load Factor:** 84.0%  
**Operating Factor:** 85.5%  
**Energy Unavailability Factor:** 17.6%  
**Total Off-line Time:** 1270 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 706.3 | 678.1 | 733.9 | 698.2 | 213.4 | 0.0   | 661.8 | 701.7 | 695.9 | 715.8 | 490.6 | 714.7 | 7010.4 |
| <b>EAF (%)</b>  | 96.5  | 99.1  | 99.6  | 99.1  | 30.9  | 0.0   | 93.2  | 98.8  | 99.8  | 98.4  | 72.4  | 99.8  | 82.4   |
| <b>UCF (%)</b>  | 100.0 | 99.4  | 100.0 | 100.0 | 35.6  | 0.0   | 93.3  | 100.0 | 99.8  | 98.4  | 93.0  | 100.0 | 85.0   |
| <b>LF (%)</b>   | 99.9  | 102.5 | 103.8 | 102.2 | 30.2  | 0.0   | 93.6  | 99.3  | 101.7 | 101.1 | 71.7  | 101.1 | 84.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 35.6  | 0.0   | 97.2  | 100.0 | 100.0 | 100.0 | 93.1  | 100.0 | 85.5   |
| <b>EUF (%)</b>  | 3.5   | 0.9   | 0.4   | 0.9   | 69.1  | 100.0 | 6.8   | 1.2   | 0.2   | 1.6   | 27.6  | 0.2   | 17.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 64.4  | 100.0 | 6.8   | 0.0   | 0.2   | 1.6   | 0.0   | 0.0   | 14.4   |
| <b>UCLF (%)</b> | 0.0   | 0.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 3.5   | 0.3   | 0.4   | 0.9   | 4.7   | 0.0   | 0.0   | 1.2   | 0.0   | 0.0   | 20.6  | 0.2   | 2.6    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, JULY, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 117784 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Aug 1981      **Lifetime Generation:** 84984.9 GW(e).h  
**Date of First Criticality:** 02 Oct 1987      **Cumulative Energy Availability Factor:** 61.2%  
**Date of Grid Connection:** 08 Oct 1987      **Cumulative Load Factor:** 59.3%  
**Date of Commercial Operation:** 18 Jan 1988      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 38.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 5978.4         | 950.0          | 76.9   | 76.9   | 76.9                              | 76.9   | 71.6               | 71.6   | 6928               | 78.9   |
| 1989 | 6703.6         | 950.0          | 84.8   | 80.8   | 84.8                              | 80.8   | 80.6               | 76.1   | 7626               | 87.1   |
| 1990 | 5476.7         | 950.0          | 66.5   | 76.1   | 66.3                              | 76.0   | 65.8               | 72.7   | 6165               | 70.4   |
| 1991 | 4308.4         | 950.0          | 51.5   | 70.0   | 51.2                              | 69.8   | 51.8               | 67.4   | 4845               | 55.3   |
| 1992 | 5958.2         | 950.0          | 70.6   | 70.1   | 70.6                              | 70.0   | 71.4               | 68.2   | 6601               | 75.1   |
| 1993 | 3776.2         | 950.0          | 47.0   | 66.2   | 44.3                              | 65.7   | 45.4               | 64.4   | 4147               | 47.3   |
| 1994 | 4778.5         | 950.0          | 83.5   | 68.7   | 73.1                              | 66.7   | 57.4               | 63.4   | 8020               | 91.6   |
| 1995 | 2204.8         | 950.0          | 30.1   | 63.9   | 30.1                              | 62.2   | 26.5               | 58.8   | 3261               | 37.2   |
| 1996 | 2227.3         | 950.0          | 26.7   | 59.7   | 26.7                              | 58.2   | 26.7               | 55.2   | 2604               | 29.6   |
| 1997 | 4015.9         | 950.0          | 63.9   | 60.2   | 55.7                              | 58.0   | 48.3               | 54.5   | 6158               | 70.3   |
| 1998 | 3293.8         | 950.0          | 51.0   | 59.3   | 40.2                              | 56.4   | 39.6               | 53.2   | 4984               | 56.9   |
| 1999 | 2927.1         | 950.0          | 40.3   | 57.7   | 35.4                              | 54.6   | 35.2               | 51.7   | 3942               | 45.0   |
| 2000 | 5730.1         | 950.0          | 83.2   | 59.7   | 68.9                              | 55.7   | 68.7               | 53.0   | 7646               | 87.0   |
| 2001 | 6678.8         | 950.0          | 83.9   | 61.4   | 79.9                              | 57.4   | 80.3               | 54.9   | 7415               | 84.6   |
| 2002 | 6756.5         | 950.0          | 84.4   | 63.0   | 80.4                              | 59.0   | 81.2               | 56.7   | 7408               | 84.6   |
| 2003 | 6171.8         | 950.0          | 74.0   | 63.6   | 72.7                              | 59.8   | 74.2               | 57.8   | 6467               | 73.8   |
| 2004 | 7010.4         | 950.0          | 85.0   | 64.9   | 82.4                              | 61.2   | 84.0               | 59.3   | 7514               | 85.5   |

## RU-97 BALAKOVO-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 04 Jan | 96.0   | 25.1    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 01 Feb | 24.0   | 3.9     | UP1  | A31  | UNIT POWER REDUCTION TO DETECT INFILTRATION IN THE TURBINE CONDENSER   |
| 08 Feb | 96.0   | 2.2     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 21 Mar | 48.0   | 2.6     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 22 Apr | 481.0  | 39.7    | XP   | S    | POWER REDUCTION WHILE UNIT OPERATING IN COASTDOWN  |
| 12 May | 1220.0 | 1186.7  | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE  |
| 01 Aug | 744.0  | 1.4     | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE  |
| 09 Aug | 96.0   | 7.3     | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL TARIFF SERVICE                                |
| 12 Sep | 24.0   | 1.7     | PP   | M    | SCHEDULED POWER REDUCTION IN UNIT NO. 2 DURING STARTUP OF UNIT NO. 4   |
| 17 Oct | 72.0   | 11.6    | PP   | M    | POWER REDUCTION IN UNIT NO. 2 DURING STARTUP OF UNIT NO. 3   |
| 01 Nov | 670.0  | 141.1   | XP   | J    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 04 Nov | 50.0   | 47.6    | UF4  | A32  | UNIT SHUT DOWN BY THE REACTOR EMERGENCY PROTECTION SYSTEM OWING TO A LEAK IN THE NON-ISOLABLE SECTION OF A FEEDWATER BYPASS PIPE |
| 01 Dec | 24.0   | 1.4     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 50        |          |  | 557       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1220            |           |          | 1763                                     | 160       |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 175                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 12       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 25        |          |
| Subtotal   | 1220            | 50        | 0        | 1938                                     | 748       | 12       |
| Total  |                 | 1270      |          |  | 2698      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 9  |
| 15. Reactor Cooling Systems                    |                 | 12                                       |
| 16. Steam generation systems                   |                 | 468                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 4  |
| 31. Turbine and auxiliaries                    |                 | 0  |
| 32. Feedwater and Main Steam System            | 50              | 26                                       |
| 35. All other I&C Systems                      |                 | 5  |
| 41. Main Generator Systems                     |                 | 29                                       |
| 42. Electrical Power Supply Systems            |                 | 1  |
| Total  | 50              | 554                                      |

## RU-98 BALAKOVO-3

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7227.8 GW(e).h  
**Energy Availability Factor:** 85.1%  
**Load Factor:** 86.6%  
**Operating Factor:** 86.6%  
**Energy Unavailability Factor:** 14.9%  
**Total Off-line Time:** 1177 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 729.4 | 678.5 | 727.8 | 683.4 | 713.1 | 688.6 | 667.8 | 610.3 | 0.0   | 329.3 | 692.3 | 707.1 | 7227.8 |
| <b>EAF (%)</b>  | 99.9  | 99.7  | 100.0 | 97.8  | 98.7  | 99.7  | 94.2  | 86.2  | 0.0   | 46.5  | 99.8  | 98.9  | 85.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.3  | 0.0   | 46.5  | 100.0 | 99.3  | 86.4   |
| <b>LF (%)</b>   | 103.2 | 102.6 | 103.0 | 100.0 | 100.9 | 100.7 | 94.5  | 86.3  | 0.0   | 46.5  | 101.2 | 100.0 | 86.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 90.5  | 0.0   | 48.2  | 100.0 | 100.0 | 86.6   |
| <b>EUF (%)</b>  | 0.1   | 0.3   | 0.0   | 2.2   | 1.3   | 0.3   | 5.8   | 13.8  | 100.0 | 53.5  | 0.2   | 1.1   | 14.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.7   | 100.0 | 53.5  | 0.0   | 0.0   | 13.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 0.1    |
| <b>XUF (%)</b>  | 0.1   | 0.3   | 0.0   | 2.2   | 1.3   | 0.3   | 5.8   | 4.2   | 0.0   | 0.0   | 0.2   | 0.4   | 1.2    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, JULY, AUGUST, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 85577MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Nov 1982      **Lifetime Generation:** 85617.0 GW(e).h  
**Date of First Criticality:** 16 Dec 1988      **Cumulative Energy Availability Factor:** 65.8%  
**Date of Grid Connection:** 25 Dec 1988      **Cumulative Load Factor:** 63.2%  
**Date of Commercial Operation:** 08 Apr 1989      **Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 34.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 50.2           | 950.0          | 0.0  | 0.0    | 0.6                               | 100.0  | 0.6                | 0.0    | 168                | 2.0    |
| 1989 | 6621.4         | 950.0          | 0.0  | 0.0    | 80.7                              | 100.0  | 79.6               | 0.0    | 7792               | 88.9   |
| 1990 | 5718.7         | 950.0          | 68.0   | 68.0   | 67.8                              | 67.8   | 68.7               | 68.7   | 6696               | 76.4   |
| 1991 | 5403.4         | 950.0          | 67.1   | 67.6   | 64.2                              | 66.0   | 64.9               | 66.8   | 6124               | 69.9   |
| 1992 | 5545.4         | 950.0          | 66.4   | 67.2   | 64.8                              | 65.6   | 66.4               | 66.7   | 6202               | 70.6   |
| 1993 | 4378.6         | 950.0          | 61.6   | 65.8   | 52.7                              | 62.4   | 52.6               | 63.2   | 5461               | 62.3   |
| 1994 | 3340.1         | 950.0          | 70.7   | 66.8   | 70.7                              | 64.0   | 40.1               | 58.6   | 5389               | 61.5   |
| 1995 | 2674.7         | 950.0          | 53.1   | 64.5   | 47.5                              | 61.3   | 32.1               | 54.2   | 5511               | 62.9   |
| 1996 | 5315.4         | 950.0          | 75.9   | 66.1   | 64.3                              | 61.7   | 63.7               | 55.5   | 7085               | 80.7   |
| 1997 | 2058.8         | 950.0          | 38.8   | 62.7   | 25.3                              | 57.2   | 24.7               | 51.7   | 3395               | 38.8   |
| 1998 | 5348.5         | 950.0          | 73.0   | 63.9   | 64.4                              | 58.0   | 64.3               | 53.1   | 7136               | 81.5   |
| 1999 | 5458.0         | 950.0          | 72.0   | 64.7   | 65.6                              | 58.7   | 65.6               | 54.3   | 6552               | 74.8   |
| 2000 | 6482.9         | 950.0          | 82.0   | 66.3   | 77.2                              | 60.4   | 77.7               | 56.5   | 7327               | 83.4   |
| 2001 | 6050.7         | 950.0          | 78.7   | 67.3   | 72.1                              | 61.4   | 72.7               | 57.8   | 6927               | 79.1   |
| 2002 | 6926.3         | 950.0          | 85.3   | 68.7   | 82.0                              | 63.0   | 83.2               | 59.8   | 7478               | 85.4   |
| 2003 | 7016.1         | 950.0          | 85.0   | 69.8   | 83.2                              | 64.4   | 84.3               | 61.5   | 7471               | 85.3   |
| 2004 | 7227.8         | 950.0          | 86.4   | 71.0   | 85.1                              | 65.8   | 86.6               | 63.2   | 7607               | 86.6   |



## RU-98 BALAKOVO-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 11 Jan | 24.0   | 1.0     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 08 Feb | 96.0   | 2.2     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 02 Apr | 144.0  | 6.7     | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL ENERGY COMMISSION   |
| 18 Apr | 48.0   | 8.5     | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL ENERGY COMMISSION   |
| 07 May | 96.0   | 9.5     | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL ENERGY COMMISSION   |
| 01 Jun | 720.0  | 1.8     | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE  |
| 01 Jul | 144.0  | 40.9    | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL TARIFF SERVICE  |
| 11 Aug | 433.0  | 29.4    | XP   | S    | POWER REDUCTION WHILE UNIT OPERATING IN COASTDOWN  |
| 29 Aug | 1150.0 | 1131.2  | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE  |
| 13 Nov | 24.0   | 1.5     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 12 Dec | 34.0   | 2.9     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 13 Dec | 9.0    | 5.0     | UP   | A32  | UNIT POWER REDUCTION WHEN REACTOR COOLANT PUMP NO. 1 WAS SHUT DOWN BY THE PROTECTION SYSTEM FOR A LEVEL INCREASE IN THE STEAM GENERATOR OWING TO A CONTROL VALVE OPERATING FAILURE |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 126       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1150            |           |          | 1543                                     | 41        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 333                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 2         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 91       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 4         |          |
| Subtotal   | 1150            | 0         | 0        | 1876                                     | 183       | 91       |
| Total  |                 | 1150      |          |  | 2150      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1989 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 40                                       |
| 13. Reactor Auxiliary Systems       |                 | 0  |
| 15. Reactor Cooling Systems         |                 | 2  |
| 31. Turbine and auxiliaries         |                 | 14                                       |
| 32. Feedwater and Main Steam System |                 | 9  |
| 33. Circulating Water System        |                 | 12                                       |
| 35. All other I&C Systems           |                 | 8  |
| 41. Main Generator Systems          |                 | 8  |
| 42. Electrical Power Supply Systems |                 | 18                                       |
| Total                               | 0               | 111                                      |

**RU-99 BALAKOVO-4****Operator:** REA (ROSENERGOATOM, CONSORTIUM)**Contractor:** FAEA (Federal Atomic Energy Agency)**1. Station Details**

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** —

**2. Production Summary 2004**

**Energy Production:** 7022.9 GW(e).h  
**Energy Availability Factor:** 82.5%  
**Load Factor:** 84.2%  
**Operating Factor:** 85.8%  
**Energy Unavailability Factor:** 17.5%  
**Total Off-line Time:** 1244 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 678.1 | 677.1 | 658.8 | 696.3 | 722.9 | 452.0 | 0.0   | 422.6 | 673.0 | 723.7 | 667.2 | 651.2 | 7022.9 |
| <b>EAF (%)</b>  | 93.0  | 98.9  | 91.7  | 98.4  | 98.9  | 66.2  | 0.0   | 60.7  | 96.4  | 99.7  | 96.5  | 91.7  | 82.5   |
| <b>UCF (%)</b>  | 96.1  | 100.0 | 100.0 | 100.0 | 100.0 | 73.5  | 0.0   | 60.7  | 96.4  | 99.7  | 100.0 | 100.0 | 85.4   |
| <b>LF (%)</b>   | 95.9  | 102.4 | 93.2  | 101.9 | 102.3 | 66.1  | 0.0   | 59.8  | 98.4  | 102.3 | 97.6  | 92.1  | 84.2   |
| <b>OF (%)</b>   | 96.4  | 100.0 | 99.9  | 100.1 | 100.0 | 73.5  | 0.0   | 64.5  | 97.5  | 100.0 | 100.0 | 100.0 | 85.8   |
| <b>EUF (%)</b>  | 7.0   | 1.1   | 8.3   | 1.6   | 1.1   | 33.8  | 100.0 | 39.3  | 3.6   | 0.3   | 3.5   | 8.3   | 17.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 26.5  | 100.0 | 38.6  | 3.6   | 0.3   | 0.0   | 0.0   | 14.2   |
| <b>UCLF (%)</b> | 3.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |
| <b>XUF (%)</b>  | 3.0   | 1.1   | 8.3   | 1.6   | 1.1   | 7.3   | 0.0   | 0.1   | 0.0   | 0.0   | 3.5   | 8.3   | 2.9    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 108203 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

**5. Historical Summary**

**Date of Construction Start:** 01 Apr 1984      **Lifetime Generation:** 66928.1 GW(e).h  
**Date of First Criticality:** 24 Mar 1993      **Cumulative Energy Availability Factor:** 70.7%  
**Date of Grid Connection:** 11 Apr 1993      **Cumulative Load Factor:** 69.0%  
**Date of Commercial Operation:** 22 Dec 1993      **Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 29.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 3676.3         | 950.0          | 0.0  | 0.0    | 73.3                              | 100.0  | 45.5               | 0.0    | 5206               | 61.2   |
| 1994 | 3828.5         | 950.0          | 69.5   | 69.5   | 48.5                              | 48.5   | 46.0               | 46.0   | 4604               | 52.6   |
| 1995 | 5610.0         | 950.0          | 88.7   | 79.1   | 86.5                              | 67.5   | 67.4               | 56.7   | 8760               | 100.0  |
| 1996 | 4545.5         | 950.0          | 59.9   | 72.7   | 55.5                              | 63.5   | 54.5               | 56.0   | 6652               | 75.7   |
| 1997 | 4637.7         | 950.0          | 71.3   | 72.3   | 59.6                              | 62.5   | 55.7               | 55.9   | 6637               | 75.8   |
| 1998 | 5042.5         | 950.0          | 71.3   | 72.1   | 60.9                              | 62.2   | 60.6               | 56.8   | 6936               | 79.2   |
| 1999 | 5803.9         | 950.0          | 77.5   | 73.0   | 69.6                              | 63.4   | 69.7               | 59.0   | 7268               | 83.0   |
| 2000 | 6665.9         | 950.0          | 81.0   | 74.2   | 78.9                              | 65.6   | 79.9               | 62.0   | 7216               | 82.1   |
| 2001 | 6578.1         | 950.0          | 83.9   | 75.4   | 78.3                              | 67.2   | 79.0               | 64.1   | 7354               | 83.9   |
| 2002 | 6292.9         | 950.0          | 77.3   | 75.6   | 72.8                              | 67.8   | 75.6               | 65.4   | 6723               | 76.7   |
| 2003 | 7223.8         | 950.0          | 85.8   | 76.6   | 84.6                              | 69.5   | 86.8               | 67.5   | 7541               | 86.1   |
| 2004 | 7022.9         | 950.0          | 85.4   | 77.4   | 82.5                              | 70.7   | 84.2               | 69.0   | 7540               | 85.8   |

# RU-99 BALAKOVO-4

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 96.0   | 21.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 15 Jan | 27.0   | 27.7    | UF4  | A12  | UNIT SHUT DOWN WHEN THE REACTOR EMERGENCY PROTECTION SYSTEM WAS TRIGGERED BY A BREACH IN THE RCPS CONTROL PANEL COIL LEADING TO A LOSS OF POWER IN THE RCPS CONTROL ROD DRIVE POWER CONTROL PANELS. |
| 08 Feb | 120.0  | 3.4     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Feb | 767.0  | 23.4    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Mar | 791.0  | 41.0    | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL ENERGY COMMISSION  |
| 11 Apr | 72.0   | 6.1     | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL ENERGY COMMISSION  |
| 07 May | 96.0   | 7.5     | XP   | M    | UNIT POWER REDUCTION WHILE KEEPING LOAD IN LINE WITH INSTRUCTIONS FROM THE FEDERAL ENERGY COMMISSION  |
| 04 Jun | 529.0  | 50.1    | XP   | S    | POWER REDUCTION WHILE UNIT OPERATING IN COASTDOWN   |
| 23 Jun | 1199.0 | 1161.1  | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 27 Aug | 25.0   | 4.7     | UP2  | A32  | UNIT POWER REDUCTION WHEN REACTOR COOLANT PUMP NO. 3 CUT OUT OWING TO A FAILURE IN A MAIN CONTROL VALVE   |
| 11 Sep | 18.0   | 24.6    | PF   | D    | SCHEDULED ROUTINE UNIT MAINTENANCE  |
| 17 Oct | 72.0   | 2.3     | PP   | M    | POWER REDUCTION IN UNIT NO. 4 DURING STARTUP OF UNIT NO. 3  |
| 01 Nov | 1464.0 | 82.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1994 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 27        |          |  | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1199            |           |          | 1414                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 18              |           |          | 22                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 30       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 152      |
| Subtotal   | 1217            | 27        | 0        | 1436                                     | 11        | 182      |
| Total  |                 | 1244      |          |  | 1629      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1994 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 27              |  |
| 31. Turbine and auxiliaries         |                 | 3  |
| 32. Feedwater and Main Steam System |                 | 2  |
| 35. All other I&C Systems           |                 | 2  |
| 41. Main Generator Systems          |                 | 1  |
| 42. Electrical Power Supply Systems |                 | 0  |
| Total                               | 27              | 8  |

# RU-21 BELOYARSKY-3(BN-600)

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** FBR  
**Net Reference Unit Power at the beginning of 2004:** 560.0 MW(e)  
**Design Net RUP:** 560.0 MW(e)  
**Design Discharge Burnup:** 100000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3927.6 GW(e).h  
**Energy Availability Factor:** 80.0%  
**Load Factor:** 79.8%  
**Operating Factor:** 81.8%  
**Energy Unavailability Factor:** 20.0%  
**Total Off-line Time:** 1599 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 411.0 | 382.7 | 380.2 | 159.7 | 0.0   | 381.5 | 411.8 | 415.1 | 400.9 | 170.8 | 404.3 | 409.7 | 3927.6 |
| <b>EAF (%)</b>  | 91.3  | 97.9  | 98.6  | 40.9  | 0.0   | 94.9  | 99.0  | 99.4  | 99.6  | 42.3  | 99.9  | 98.3  | 80.0   |
| <b>UCF (%)</b>  | 92.9  | 100.0 | 100.0 | 41.4  | 0.0   | 94.9  | 100.0 | 100.0 | 99.9  | 42.3  | 100.0 | 100.0 | 80.8   |
| <b>LF (%)</b>   | 98.6  | 98.2  | 91.2  | 39.7  | 0.0   | 94.6  | 98.8  | 99.6  | 99.4  | 40.9  | 100.3 | 98.3  | 79.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 98.7  | 39.9  | 0.0   | 99.7  | 100.0 | 100.0 | 100.0 | 44.8  | 100.0 | 100.0 | 81.8   |
| <b>EUF (%)</b>  | 8.7   | 2.1   | 1.4   | 59.1  | 100.0 | 5.1   | 1.0   | 0.6   | 0.4   | 57.7  | 0.1   | 1.7   | 20.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 58.6  | 100.0 | 4.9   | 0.0   | 0.0   | 0.2   | 57.5  | 0.0   | 0.0   | 18.6   |
| <b>UCLF (%)</b> | 7.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.0   | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 1.7   | 2.1   | 1.4   | 0.5   | 0.0   | 0.0   | 1.0   | 0.6   | 0.3   | 0.0   | 0.1   | 1.7   | 0.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JUNE, JULY, AUGUST, SEPTEMBER, OCTOBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 1171 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1969      **Lifetime Generation:** 87291.2 GW(e).h  
**Date of First Criticality:** 26 Feb 1980      **Cumulative Energy Availability Factor:** 73.9%  
**Date of Grid Connection:** 08 Apr 1980      **Cumulative Load Factor:** 73.7%  
**Date of Commercial Operation:** 01 Nov 1981      **Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 26.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 3762.2         | 560.0          | 77.0   | 76.4   | 77.0                              | 76.4   | 76.5               | 75.3   | 6810               | 77.5   |
| 1989 | 3694.4         | 560.0          | 77.0   | 76.6   | 77.0                              | 76.6   | 75.3               | 75.3   | 6800               | 77.6   |
| 1990 | 3198.0         | 560.0          | 66.7   | 74.2   | 65.9                              | 74.0   | 65.2               | 72.8   | 6627               | 75.7   |
| 1991 | 3394.0         | 560.0          | 63.6   | 72.1   | 63.6                              | 71.9   | 69.2               | 72.1   | 6631               | 75.7   |
| 1992 | 4095.0         | 560.0          | 83.1   | 73.9   | 82.8                              | 73.7   | 83.3               | 73.9   | 7449               | 84.8   |
| 1993 | 3914.9         | 560.0          | 79.6   | 74.7   | 79.5                              | 74.5   | 79.8               | 74.8   | 7065               | 80.7   |
| 1994 | 3810.7         | 560.0          | 78.9   | 75.2   | 78.8                              | 75.1   | 77.7               | 75.1   | 6977               | 79.6   |
| 1995 | 3413.3         | 560.0          | 72.3   | 74.9   | 70.7                              | 74.6   | 69.6               | 74.5   | 6953               | 79.4   |
| 1996 | 3722.3         | 560.0          | 78.1   | 75.2   | 76.3                              | 74.7   | 75.7               | 74.6   | 7010               | 79.8   |
| 1997 | 3545.8         | 560.0          | 74.6   | 75.2   | 73.0                              | 74.6   | 72.3               | 74.4   | 6596               | 75.3   |
| 1998 | 2335.3         | 560.0          | 49.2   | 73.0   | 47.7                              | 72.4   | 47.6               | 72.2   | 4385               | 50.1   |
| 1999 | 3721.0         | 560.0          | 78.0   | 73.4   | 76.2                              | 72.7   | 75.9               | 72.5   | 6972               | 79.6   |
| 2000 | 3565.8         | 560.0          | 75.5   | 73.5   | 72.5                              | 72.6   | 72.5               | 72.5   | 6820               | 77.6   |
| 2001 | 3891.1         | 560.0          | 80.7   | 74.0   | 79.9                              | 73.1   | 79.3               | 72.9   | 7214               | 82.4   |
| 2002 | 3774.4         | 560.0          | 79.3   | 74.3   | 77.3                              | 73.4   | 76.9               | 73.2   | 7069               | 80.7   |
| 2003 | 3693.3         | 560.0          | 76.8   | 74.5   | 75.7                              | 73.5   | 75.3               | 73.3   | 6836               | 78.0   |
| 2004 | 3927.6         | 560.0          | 80.8   | 74.8   | 80.0                              | 73.9   | 79.8               | 73.7   | 7185               | 81.8   |

## RU-21 BELOYARSKY-3(BN-600)

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1440.0 | 14.9    | XP   | H    | UNIT POWER REDUCTION OWING TO HEAT EXTRACTION FOR HEATING ABOVE THE LEVEL PERMITTED IN THE TECHNICAL SPECIFICATIONS FOR THE TURBINE      |
| 08 Mar | 109.0  | 29.5    | UP1  | A41  | UNIT POWER REDUCTION OWING TO CUT-OUT OF GENERATOR NO. 4 BECAUSE OF A FAULT IN THE BRUSH CONTACTS  |
| 13 Mar | 10.0   | 6.0     | XF   | H    | UNIT POWER REDUCTION OWING TO HEAT EXTRACTION FOR HEATING ABOVE THE LEVEL PERMITTED IN THE TECHNICAL SPECIFICATIONS FOR THE TURBINE      |
| 13 Apr | 1178.0 | 672.1   | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE  |
| 10 Jun | 168.0  | 1.1     | UP1  | A32  | UNIT POWER REDUCTION OWING TO CUT-OUT OF A GROUP OF HIGH-PRESSURE HEATERS IN TURBOGENERATOR NO. 1 BECAUSE OF A DEFECT IN A CONTROL VALVE |
| 01 Jul | 1488.0 | 6.8     | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE  |
| 01 Sep | 720.0  | 1.0     | XP   | H    | UNIT POWER REDUCTION OWING TO HEAT EXTRACTION FOR HEATING ABOVE THE LEVEL PERMITTED IN THE TECHNICAL SPECIFICATIONS FOR THE TURBINE      |
| 30 Sep | 411.0  | 240.6   | PF   | C    | ROUTINE UNIT MAINTENANCE   |
| 01 Oct | 421.0  | 0.7     | UP1  | A15  | UNIT POWER REDUCTION WITH ONE LOOP DISCONNECTED OWING TO A FAILURE IN A REACTOR COOLANT PUMP ROTATION SPEED CONTROL CIRCUIT              |
| 01 Dec | 744.0  | 6.9     | XP   | H    | UNIT POWER REDUCTION OWING TO HEAT EXTRACTION FOR HEATING ABOVE THE LEVEL PERMITTED IN THE TECHNICAL SPECIFICATIONS FOR THE TURBINE      |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 204       |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1589            |           |          | 1148                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 547                                      | 7         |          |
| H. Nuclear regulatory requirements                            |                 |           | 10       |  |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |  |           | 4        |
| Subtotal  | 1589            | 0         | 10       | 1695                                     | 213       | 4        |
| Total   |                 | 1599      |          |  | 1912      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 13. Reactor Auxiliary Systems            |                 | 20                                       |
| 15. Reactor Cooling Systems              |                 | 49                                       |
| 21. Fuel Handling and Storage Facilities |                 | 5  |
| 32. Feedwater and Main Steam System      |                 | 3  |
| 35. All other I&C Systems                |                 | 6  |
| 42. Electrical Power Supply Systems      |                 | 1  |
| Total                                    | 0               | 84                                       |

# RU-141 BILIBINO-1

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 11.0 MW(e)  
**Design Net RUP:** 11.0 MW(e)  
**Design Discharge Burnup:** 3000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 34.6 GW(e).h  
**Energy Availability Factor:** 46.6%  
**Load Factor:** 35.8%  
**Operating Factor:** 84.6%  
**Energy Unavailability Factor:** 53.4%  
**Total Off-line Time:** 1350 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec  | Annual |
|-----------------|-------|-------|------|-------|------|-------|-------|-------|-------|------|-------|------|--------|
| <b>GW(e).h</b>  | 2.1   | 3.6   | 3.5  | 3.3   | 2.8  | 2.9   | 3.7   | 4.7   | 4.5   | 1.1  | 0.0   | 2.4  | 34.6   |
| <b>EAF (%)</b>  | 40.3  | 57.0  | 54.3 | 51.9  | 45.9 | 47.6  | 56.6  | 72.8  | 69.1  | 22.5 | 0.0   | 41.7 | 46.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 99.8 | 100.0 | 99.2 | 100.0 | 100.0 | 100.0 | 100.0 | 32.4 | 0.0   | 90.6 | 85.2   |
| <b>LF (%)</b>   | 25.8  | 46.8  | 42.5 | 41.5  | 34.2 | 37.2  | 44.8  | 57.4  | 56.4  | 13.7 | 0.0   | 29.8 | 35.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.3 | 100.1 | 96.8 | 100.0 | 100.0 | 100.0 | 100.0 | 29.0 | 0.0   | 90.2 | 84.6   |
| <b>EUF (%)</b>  | 59.7  | 43.0  | 45.7 | 48.1  | 54.1 | 52.4  | 43.4  | 27.2  | 30.9  | 77.5 | 100.0 | 58.3 | 53.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.2  | 0.0   | 0.8  | 0.0   | 0.0   | 0.0   | 0.0   | 67.6 | 100.0 | 9.4  | 14.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0    |
| <b>XUF (%)</b>  | 59.7  | 43.0  | 45.5 | 48.1  | 53.3 | 52.4  | 43.4  | 27.2  | 30.9  | 9.9  | 0.0   | 48.9 | 38.6   |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES.

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1970      **Lifetime Generation:** 1746.5 GW(e).h  
**Date of First Criticality:** 11 Dec 1973      **Cumulative Energy Availability Factor:** 71.5%  
**Date of Grid Connection:** 12 Jan 1974      **Cumulative Load Factor:** 60.6%  
**Date of Commercial Operation:** 01 Apr 1974      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 28.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 77.7           | 10.0           | 91.2   | 85.7   | 88.4                              | 80.7   | 88.7               | 70.7   | 8025               | 91.6   |
| 1986 | 73.2           | 10.0           | 86.1   | 85.7   | 83.2                              | 80.9   | 83.5               | 71.8   | 7603               | 86.8   |
| 1987 | 76.7           | 12.0           | 81.3   | 85.3   | 81.3                              | 80.9   | 73.0               | 71.9   | 7117               | 81.2   |
| 1988 | 79.6           | 11.0           | 90.3   | 85.7   | 90.3                              | 81.6   | 82.4               | 72.7   | 7895               | 89.9   |
| 1989 | 70.9           | 11.0           | 90.0   | 86.0   | 90.0                              | 82.2   | 73.5               | 72.8   | 7841               | 89.5   |
| 1990 | 76.6           | 11.0           | 85.1   | 86.0   | 85.1                              | 82.4   | 79.5               | 73.2   | 7397               | 84.4   |
| 1991 | 71.6           | 11.0           | 78.6   | 85.5   | 78.6                              | 82.2   | 74.3               | 73.3   | 6802               | 77.6   |
| 1992 | 67.1           | 11.0           | 85.8   | 85.5   | 85.8                              | 82.4   | 69.4               | 73.1   | 7477               | 85.1   |
| 1993 | 53.2           | 11.0           | 86.3   | 85.6   | 62.7                              | 81.3   | 55.2               | 72.1   | 7492               | 85.5   |
| 1994 | 49.6           | 11.0           | 86.9   | 85.6   | 86.9                              | 81.6   | 51.5               | 71.0   | 7501               | 85.6   |
| 1995 | 26.6           | 11.0           | 41.6   | 83.4   | 41.6                              | 79.6   | 27.6               | 68.8   | 3624               | 41.4   |
| 1996 | 29.6           | 11.0           | 54.1   | 82.0   | 54.1                              | 78.4   | 30.7               | 67.0   | 4572               | 52.0   |
| 1997 | 35.2           | 11.0           | 56.5   | 80.9   | 56.5                              | 77.4   | 36.6               | 65.6   | 4877               | 55.7   |
| 1998 | 55.5           | 11.0           | 96.3   | 81.5   | 67.0                              | 76.9   | 57.6               | 65.3   | 8414               | 96.1   |
| 1999 | 33.4           | 11.0           | 55.0   | 80.4   | 40.3                              | 75.4   | 34.7               | 64.0   | 4779               | 54.6   |
| 2000 | 58.8           | 11.0           | 87.4   | 80.7   | 68.1                              | 75.1   | 60.8               | 63.9   | 7616               | 86.7   |
| 2001 | 45.9           | 11.0           | 72.9   | 80.4   | 55.0                              | 74.4   | 47.6               | 63.2   | 6393               | 73.0   |
| 2002 | 49.6           | 11.0           | 84.5   | 80.6   | 60.0                              | 73.8   | 51.5               | 62.8   | 7375               | 84.2   |
| 2003 | 25.8           | 11.0           | 55.8   | 79.7   | 34.1                              | 72.4   | 26.8               | 61.5   | 4805               | 54.9   |
| 2004 | 34.6           | 11.0           | 85.2   | 79.9   | 46.6                              | 71.5   | 35.8               | 60.6   | 7434               | 84.6   |

# RU-141 BILIBINO-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 6763.0 | 33.3    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 20 May | 24.0   | 0.1     | PF   | E31  | UNIT SHUTDOWN TO CHECK THE AUTOMATED TURBINE SAFETY SYSTEM         |
| 10 Oct | 1321.0 | 13.9    | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE                                      |
| 04 Dec | 671.0  | 4.0     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure  |                 |           |          |  | 79        |          |
| C. Inspection, maintenance or repair combined with refuelling                                 | 1321            |           |          | 1127                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                                       |                 |           |          | 427                                      | 19        |          |
| E. Testing of plant systems or components   | 24              |           |          | 1  |           |          |
| J. Grid failure or grid unavailability  |                 |           |          | 2  | 0         | 43       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)          |                 |           |          | 8  | 12        |          |
| S. Fuel management limitation (including high flux tilt, stretch out or coast-down operation) |                 |           |          |  | 2         |          |
| Subtotal  | 1345            | 0         | 0        | 1565                                     | 112       | 43       |
| Total   |                 | 1345      |          |  | 1720      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 2  |
| 12. Reactor I&C Systems             |                 | 0  |
| 13. Reactor Auxiliary Systems       |                 | 5  |
| 14. Safety Systems                  |                 | 1  |
| 15. Reactor Cooling Systems         |                 | 2  |
| 31. Turbine and auxiliaries         |                 | 26                                       |
| 32. Feedwater and Main Steam System |                 | 11                                       |
| 33. Circulating Water System        |                 | 5  |
| 35. All other I&C Systems           |                 | 3  |
| 41. Main Generator Systems          |                 | 18                                       |
| 42. Electrical Power Supply Systems |                 | 1  |
| Total                               | 0               | 74                                       |

# RU-142 BILIBINO-2

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 11.0 MW(e)  
**Design Net RUP:** 11.0 MW(e)  
**Design Discharge Burnup:** 3000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 17.9 GW(e).h  
**Energy Availability Factor:** 27.2%  
**Load Factor:** 18.5%  
**Operating Factor:** 66.6%  
**Energy Unavailability Factor:** 72.8%  
**Total Off-line Time:** 2933 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul  | Aug   | Sep  | Oct  | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|------|-------|------|------|------|-------|--------|
| <b>GW(e).h</b>  | 4.0   | 0.0   | 0.0   | 0.0   | 0.9  | 1.4   | 1.4  | 1.3   | 0.7  | 1.8  | 3.5  | 3.1   | 17.9   |
| <b>EAF (%)</b>  | 58.0  | 0.0   | 0.0   | 0.0   | 21.8 | 28.8  | 29.6 | 28.1  | 21.7 | 34.2 | 54.3 | 48.5  | 27.2   |
| <b>UCF (%)</b>  | 100.0 | 2.0   | 0.0   | 0.0   | 51.3 | 100.0 | 99.5 | 100.0 | 93.1 | 95.7 | 97.7 | 100.0 | 70.3   |
| <b>LF (%)</b>   | 48.6  | 0.0   | 0.0   | 0.0   | 10.6 | 17.9  | 16.7 | 15.8  | 8.8  | 21.6 | 43.7 | 37.6  | 18.5   |
| <b>OF (%)</b>   | 100.0 | 0.0   | 0.0   | 0.0   | 49.1 | 100.0 | 97.7 | 100.0 | 71.3 | 81.7 | 95.1 | 100.0 | 66.6   |
| <b>EUF (%)</b>  | 42.0  | 100.0 | 100.0 | 100.0 | 78.2 | 71.3  | 70.4 | 71.9  | 78.3 | 65.8 | 45.7 | 51.5  | 72.8   |
| <b>PUF (%)</b>  | 0.0   | 98.0  | 100.0 | 100.0 | 48.7 | 0.0   | 0.5  | 0.0   | 6.9  | 4.3  | 2.3  | 0.0   | 29.7   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0  | 0.0  | 0.0  | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 42.0  | 2.0   | 0.0   | 0.0   | 29.6 | 71.3  | 69.9 | 71.9  | 71.5 | 61.5 | 43.4 | 51.5  | 43.1   |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES.

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1970      **Lifetime Generation:** 1674.8 GW(e).h  
**Date of First Criticality:** 07 Dec 1974      **Cumulative Energy Availability Factor:** 71.9%  
**Date of Grid Connection:** 30 Dec 1974      **Cumulative Load Factor:** 59.5%  
**Date of Commercial Operation:** 01 Feb 1975      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 28.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 78.0           | 10.0           | 90.3   | 85.2   | 88.6                              | 82.1   | 89.0               | 72.1   | 7940               | 90.6   |
| 1986 | 76.3           | 10.0           | 87.0   | 85.4   | 84.7                              | 82.4   | 87.1               | 73.5   | 7679               | 87.7   |
| 1987 | 88.4           | 12.0           | 89.1   | 85.8   | 89.1                              | 83.0   | 84.1               | 74.5   | 7794               | 89.0   |
| 1988 | 75.1           | 11.0           | 90.8   | 86.2   | 90.8                              | 83.7   | 77.7               | 74.8   | 7927               | 90.2   |
| 1989 | 74.8           | 11.0           | 91.4   | 86.6   | 91.4                              | 84.3   | 77.6               | 75.0   | 7943               | 90.7   |
| 1990 | 72.6           | 11.0           | 84.6   | 86.4   | 84.6                              | 84.3   | 75.4               | 75.0   | 7274               | 83.0   |
| 1991 | 57.8           | 11.0           | 64.9   | 85.0   | 64.9                              | 83.0   | 60.0               | 74.0   | 4821               | 55.0   |
| 1992 | 68.2           | 11.0           | 89.9   | 85.3   | 89.9                              | 83.4   | 70.6               | 73.8   | 7857               | 89.4   |
| 1993 | 52.4           | 11.0           | 81.9   | 85.1   | 62.2                              | 82.2   | 54.4               | 72.7   | 7072               | 80.7   |
| 1994 | 47.8           | 11.0           | 78.7   | 84.8   | 77.3                              | 81.9   | 49.6               | 71.4   | 6763               | 77.2   |
| 1995 | 45.4           | 11.0           | 99.2   | 85.5   | 97.2                              | 82.7   | 47.2               | 70.2   | 8677               | 99.1   |
| 1996 | 16.8           | 11.0           | 33.5   | 82.9   | 33.5                              | 80.3   | 17.4               | 67.5   | 2894               | 32.9   |
| 1997 | 44.1           | 11.0           | 92.7   | 83.4   | 87.7                              | 80.6   | 45.8               | 66.5   | 8050               | 91.9   |
| 1998 | 18.2           | 11.0           | 42.9   | 81.6   | 23.3                              | 78.0   | 18.8               | 64.3   | 3727               | 42.5   |
| 1999 | 54.2           | 11.0           | 84.7   | 81.7   | 64.1                              | 77.4   | 56.2               | 64.0   | 7355               | 84.0   |
| 2000 | 48.5           | 11.0           | 78.2   | 81.5   | 56.3                              | 76.5   | 50.2               | 63.4   | 6656               | 75.8   |
| 2001 | 56.7           | 11.0           | 85.2   | 81.7   | 65.8                              | 76.1   | 58.9               | 63.2   | 7439               | 84.9   |
| 2002 | 30.0           | 11.0           | 66.4   | 81.1   | 38.4                              | 74.7   | 31.2               | 62.0   | 5744               | 65.6   |
| 2003 | 33.3           | 11.0           | 82.2   | 81.2   | 44.5                              | 73.6   | 34.5               | 61.0   | 7162               | 81.8   |
| 2004 | 17.9           | 11.0           | 70.3   | 80.8   | 27.2                              | 71.9   | 18.5               | 59.5   | 5851               | 66.6   |



## RU-142 BILIBINO-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 769.0  | 3.6     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 01 Feb | 2514.0 | 26.4    | PF   | C    | MAJOR UNIT OVERHAUL  |
| 16 May | 1812.0 | 13.8    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 07 Jul | 17.0   | 0.0     | PF   | D15  | UNIT SHUTDOWN TO ADJUST THE MAIN SAFETY VALVE                      |
| 01 Aug | 1257.0 | 11.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 22 Sep | 342.0  | 0.9     | PF   | D    | ROUTINE UNIT MAINTENANCE   |
| 06 Oct | 1294.0 | 8.5     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 18 Nov | 35.0   | 0.2     | PF   | D    | ROUTINE UNIT MAINTENANCE   |
| 01 Dec | 744.0  | 4.2     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 144       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 2514            |           |          | 1258                                     | 99        |          |
| D. Inspection, maintenance or repair without refuelling                              | 394             |           |          | 144                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 0         | 19       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 7  |           |          |
| Subtotal   | 2908            | 0         | 0        | 1411                                     | 248       | 19       |
| Total  |                 | 2908      |          |  | 1678      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 84                                       |
| 12. Reactor I&C Systems             |                 | 2  |
| 14. Safety Systems                  |                 | 0  |
| 15. Reactor Cooling Systems         |                 | 8  |
| 31. Turbine and auxiliaries         |                 | 24                                       |
| 32. Feedwater and Main Steam System |                 | 10                                       |
| 33. Circulating Water System        |                 | 0  |
| 41. Main Generator Systems          |                 | 8  |
| Total                               | 0               | 136                                      |

# RU-143 BILIBINO-3

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 11.0 MW(e)  
**Design Net RUP:** 11.0 MW(e)  
**Design Discharge Burnup:** 3000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 31.1 GW(e).h  
**Energy Availability Factor:** 42.0%  
**Load Factor:** 32.2%  
**Operating Factor:** 81.6%  
**Energy Unavailability Factor:** 58.0%  
**Total Off-line Time:** 1618 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec  | Annual |
|-----------------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|-------|------|--------|
| <b>GW(e).h</b>  | 0.7   | 3.9   | 3.0   | 1.9   | 0.4  | 0.0   | 2.4  | 3.8   | 4.0   | 3.8   | 4.1   | 3.1  | 31.1   |
| <b>EAF (%)</b>  | 26.5  | 60.4  | 45.7  | 35.9  | 12.7 | 0.0   | 42.2 | 55.9  | 59.6  | 56.7  | 61.5  | 47.7 | 42.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 32.3 | 0.0   | 98.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.5 | 85.8   |
| <b>LF (%)</b>   | 9.1   | 50.7  | 36.2  | 24.6  | 4.8  | 0.0   | 29.7 | 46.1  | 50.6  | 46.0  | 52.1  | 37.4 | 32.2   |
| <b>OF (%)</b>   | 62.1  | 100.0 | 100.0 | 100.1 | 29.0 | 0.0   | 93.7 | 100.0 | 100.0 | 99.9  | 100.0 | 94.5 | 81.6   |
| <b>EUF (%)</b>  | 73.5  | 39.6  | 54.3  | 64.1  | 87.3 | 100.0 | 57.8 | 44.1  | 40.4  | 43.3  | 38.5  | 52.3 | 58.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 67.7 | 100.0 | 2.0  | 0.0   | 0.0   | 0.0   | 0.0   | 1.5  | 14.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0    |
| <b>XUF (%)</b>  | 73.5  | 39.6  | 54.3  | 64.1  | 19.6 | 0.0   | 55.8 | 44.1  | 40.4  | 43.3  | 38.5  | 50.8 | 43.8   |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES.

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1970      **Lifetime Generation:** 1681.9 GW(e).h  
**Date of First Criticality:** 06 Dec 1975      **Cumulative Energy Availability Factor:** 71.4%  
**Date of Grid Connection:** 22 Dec 1975      **Cumulative Load Factor:** 62.2%  
**Date of Commercial Operation:** 01 Feb 1976      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 28.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 69.8           | 10.0           | 80.3   | 90.0   | 78.5                              | 86.7   | 79.7               | 80.9   | 7119               | 81.3   |
| 1986 | 77.1           | 10.0           | 91.0   | 90.1   | 87.7                              | 86.8   | 88.0               | 81.6   | 8001               | 91.3   |
| 1987 | 89.1           | 12.0           | 89.1   | 90.0   | 89.1                              | 87.1   | 84.7               | 81.9   | 7801               | 89.1   |
| 1988 | 76.7           | 11.0           | 89.5   | 90.0   | 89.5                              | 87.3   | 79.4               | 81.7   | 7815               | 89.0   |
| 1989 | 74.3           | 11.0           | 89.5   | 89.9   | 89.1                              | 87.4   | 77.1               | 81.3   | 7756               | 88.5   |
| 1990 | 73.7           | 11.0           | 92.0   | 90.1   | 91.1                              | 87.7   | 76.5               | 81.0   | 8024               | 91.6   |
| 1991 | 66.2           | 11.0           | 78.1   | 89.2   | 76.6                              | 86.9   | 68.7               | 80.1   | 6749               | 77.0   |
| 1992 | 70.9           | 11.0           | 88.5   | 89.2   | 79.7                              | 86.4   | 73.4               | 79.7   | 7727               | 88.0   |
| 1993 | 52.6           | 11.0           | 83.2   | 88.8   | 61.5                              | 84.9   | 54.6               | 78.1   | 7218               | 82.4   |
| 1994 | 44.7           | 11.0           | 73.7   | 87.9   | 72.0                              | 84.2   | 46.4               | 76.3   | 6342               | 72.4   |
| 1995 | 17.3           | 11.0           | 38.1   | 85.2   | 34.9                              | 81.4   | 17.9               | 73.1   | 3293               | 37.6   |
| 1996 | 52.6           | 11.0           | 82.3   | 85.0   | 82.3                              | 81.5   | 54.5               | 72.1   | 7142               | 81.3   |
| 1997 | 25.8           | 11.0           | 42.9   | 83.0   | 42.9                              | 79.6   | 26.8               | 69.8   | 3769               | 43.0   |
| 1998 | 23.2           | 11.0           | 49.1   | 81.3   | 29.1                              | 77.2   | 24.0               | 67.7   | 4200               | 47.9   |
| 1999 | 51.4           | 11.0           | 75.8   | 81.1   | 59.9                              | 76.4   | 53.4               | 67.0   | 6607               | 75.4   |
| 2000 | 45.2           | 11.0           | 86.8   | 81.3   | 54.8                              | 75.5   | 46.8               | 66.2   | 7569               | 86.2   |
| 2001 | 53.9           | 11.0           | 84.9   | 81.5   | 63.0                              | 75.0   | 56.0               | 65.7   | 7383               | 84.3   |
| 2002 | 30.7           | 11.0           | 71.5   | 81.1   | 39.4                              | 73.6   | 31.9               | 64.4   | 6250               | 71.3   |
| 2003 | 35.4           | 11.0           | 81.5   | 81.1   | 46.7                              | 72.5   | 36.8               | 63.3   | 7097               | 81.0   |
| 2004 | 31.1           | 11.0           | 85.8   | 81.3   | 42.0                              | 71.4   | 32.2               | 62.2   | 7166               | 81.6   |

**RU-143 BILIBINO-3****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 2838.0 | 19.2    | XP   | K    | POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER      |
| 15 Jan | 282.0  | 1.0     | XF   | K    | UNIT SHUTDOWN OWING TO LIMITATION IMPOSED BY THE DISPATCHER        |
| 10 May | 1287.0 | 13.1    | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE                                      |
| 14 Jul | 8.0    | 0.2     | PF   | D    | ROUTINE UNIT MAINTENANCE   |
| 20 Jul | 3625.0 | 18.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 09 Dec | 41.0   | 0.1     | PF   | D    | ROUTINE UNIT MAINTENANCE   |
| 10 Dec | 703.0  | 4.2     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 70        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1287            |           |          | 1135  |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 49              |           |          | 388   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 6   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 1         | 53       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           | 282      | 17  | 1         |          |
| Subtotal   | 1336            | 0         | 282      | 1546  | 72        | 53       |
| Total  |                 | 1618      |          |   | 1671      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1976 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 13. Reactor Auxiliary Systems       |                    | 2   |
| 15. Reactor Cooling Systems         |                    | 19  |
| 31. Turbine and auxiliaries         |                    | 16  |
| 32. Feedwater and Main Steam System |                    | 11  |
| 33. Circulating Water System        |                    | 0   |
| Total                               | 0                  | 48  |

# RU-144 BILIBINO-4

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 11.0 MW(e)  
**Design Net RUP:** 11.0 MW(e)  
**Design Discharge Burnup:** 3000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 26.1 GW(e).h  
**Energy Availability Factor:** 36.7%  
**Load Factor:** 27.0%  
**Operating Factor:** 83.1%  
**Energy Unavailability Factor:** 63.3%  
**Total Off-line Time:** 1481 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 2.5   | 3.2   | 2.4   | 1.8   | 2.9   | 2.0   | 0.6  | 0.0   | 1.1  | 2.8   | 3.6   | 3.0   | 26.1   |
| <b>EAF (%)</b>  | 43.9  | 51.5  | 39.6  | 33.4  | 45.1  | 41.1  | 16.2 | 0.0   | 25.3 | 43.8  | 55.5  | 46.3  | 36.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 35.4 | 4.6   | 69.0 | 100.0 | 100.0 | 100.0 | 83.9   |
| <b>LF (%)</b>   | 30.4  | 41.7  | 29.6  | 23.3  | 35.5  | 25.8  | 7.4  | 0.0   | 14.1 | 34.3  | 45.9  | 37.1  | 27.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 32.4 | 0.0   | 67.5 | 99.9  | 100.0 | 100.0 | 83.1   |
| <b>EUF (%)</b>  | 56.1  | 48.5  | 60.4  | 66.6  | 54.9  | 58.9  | 83.8 | 100.0 | 74.7 | 56.2  | 44.5  | 53.7  | 63.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 64.6 | 95.5  | 31.0 | 0.0   | 0.0   | 0.0   | 16.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 56.1  | 48.5  | 60.4  | 66.6  | 54.9  | 58.9  | 19.2 | 4.5   | 43.7 | 56.2  | 44.5  | 53.7  | 47.2   |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES.

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1970      **Lifetime Generation:** 1594.7 GW(e).h  
**Date of First Criticality:** 12 Dec 1976      **Cumulative Energy Availability Factor:** 69.8%  
**Date of Grid Connection:** 27 Dec 1976      **Cumulative Load Factor:** 60.8%  
**Date of Commercial Operation:** 01 Jan 1977      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 30.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 81.2           | 10.0           | 90.3   | 90.1   | 89.5                              | 87.9   | 92.7               | 83.0   | 7919               | 90.4   |
| 1986 | 74.5           | 10.0           | 79.9   | 89.1   | 79.8                              | 87.1   | 85.1               | 83.2   | 7083               | 80.9   |
| 1987 | 95.5           | 12.0           | 93.3   | 89.5   | 93.3                              | 87.8   | 90.9               | 84.0   | 8154               | 93.1   |
| 1988 | 75.8           | 11.0           | 87.3   | 89.3   | 87.3                              | 87.7   | 78.5               | 83.5   | 7617               | 86.7   |
| 1989 | 71.4           | 11.0           | 93.2   | 89.7   | 93.2                              | 88.2   | 74.1               | 82.7   | 7853               | 89.6   |
| 1990 | 75.3           | 11.0           | 87.2   | 89.5   | 86.4                              | 88.0   | 78.1               | 82.4   | 7588               | 86.6   |
| 1991 | 61.3           | 11.0           | 71.4   | 88.2   | 69.9                              | 86.8   | 63.6               | 81.1   | 6139               | 70.1   |
| 1992 | 69.8           | 11.0           | 87.8   | 88.2   | 87.8                              | 86.8   | 72.3               | 80.5   | 7756               | 88.3   |
| 1993 | 56.0           | 11.0           | 80.2   | 87.7   | 64.4                              | 85.4   | 58.1               | 79.1   | 6918               | 79.0   |
| 1994 | 38.5           | 11.0           | 62.0   | 86.2   | 61.8                              | 84.1   | 39.9               | 76.8   | 5266               | 60.1   |
| 1995 | 29.9           | 11.0           | 63.9   | 85.0   | 62.7                              | 82.9   | 31.0               | 74.3   | 5083               | 58.0   |
| 1996 | 35.2           | 11.0           | 59.1   | 83.6   | 59.1                              | 81.7   | 36.4               | 72.3   | 5109               | 58.2   |
| 1997 | 15.1           | 11.0           | 37.0   | 81.3   | 28.4                              | 79.0   | 15.7               | 69.5   | 2490               | 28.4   |
| 1998 | 37.3           | 11.0           | 63.1   | 80.5   | 44.5                              | 77.4   | 38.7               | 68.1   | 5510               | 62.9   |
| 1999 | 28.7           | 11.0           | 46.7   | 78.9   | 34.8                              | 75.5   | 29.8               | 66.4   | 3993               | 45.6   |
| 2000 | 55.8           | 11.0           | 88.7   | 79.4   | 64.2                              | 75.0   | 57.8               | 66.0   | 7740               | 88.1   |
| 2001 | 35.4           | 11.0           | 68.0   | 78.9   | 43.2                              | 73.7   | 36.8               | 64.8   | 5931               | 67.7   |
| 2002 | 33.1           | 11.0           | 73.8   | 78.7   | 46.3                              | 72.6   | 34.4               | 63.6   | 6419               | 73.3   |
| 2003 | 24.5           | 11.0           | 67.5   | 78.3   | 34.0                              | 71.1   | 25.4               | 62.1   | 5849               | 66.8   |
| 2004 | 26.1           | 11.0           | 83.9   | 78.5   | 36.7                              | 69.8   | 27.0               | 60.8   | 7303               | 83.1   |

## RU-144 BILIBINO-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 2425.0 | 16.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 11 Jul | 1481.0 | 15.6    | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE                                      |
| 09 Oct | 4878.0 | 29.2    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 66        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1481            |           |          | 1337  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 494   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 6   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 83       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 1         |          |
| Subtotal   | 1481            | 0         | 0        | 1837  | 67        | 83       |
| Total  |                 | 1481      |          |   | 1987      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1977 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 16  |
| 13. Reactor Auxiliary Systems       |                    | 9   |
| 15. Reactor Cooling Systems         |                    | 1   |
| 31. Turbine and auxiliaries         |                    | 4   |
| 32. Feedwater and Main Steam System |                    | 7   |
| 33. Circulating Water System        |                    | 6   |
| 41. Main Generator Systems          |                    | 20  |
| Total                               | 0                  | 63  |

# RU-30 KALININ-1

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6937.0 GW(e).h  
**Energy Availability Factor:** 80.7%  
**Load Factor:** 83.1%  
**Operating Factor:** 81.7%  
**Energy Unavailability Factor:** 19.3%  
**Total Off-line Time:** 1605 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 691.3 | 653.8 | 705.2 | 693.3 | 734.6 | 282.4 | 0.0   | 465.0 | 713.2 | 546.7 | 714.0 | 737.5 | 6937.0 |
| <b>EAF (%)</b>  | 95.3  | 96.5  | 98.0  | 99.9  | 100.0 | 40.5  | 0.0   | 65.1  | 100.0 | 74.6  | 100.0 | 100.0 | 80.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 40.6  | 0.0   | 65.1  | 100.0 | 74.6  | 100.0 | 100.0 | 81.6   |
| <b>LF (%)</b>   | 97.8  | 98.9  | 99.8  | 101.5 | 103.9 | 41.3  | 0.0   | 65.8  | 104.3 | 77.2  | 104.4 | 104.3 | 83.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 41.0  | 0.0   | 65.3  | 100.0 | 76.1  | 100.0 | 100.0 | 81.7   |
| <b>EUF (%)</b>  | 4.7   | 3.5   | 2.0   | 0.1   | 0.0   | 59.5  | 100.0 | 34.9  | 0.0   | 25.4  | 0.0   | 0.0   | 19.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 59.5  | 100.0 | 34.9  | 0.0   | 0.0   | 0.0   | 0.0   | 16.3   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 25.4  | 0.0   | 0.0   | 2.2    |
| <b>XUF (%)</b>  | 4.7   | 3.5   | 2.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 186877 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1977      **Lifetime Generation:** 118216.7 GW(e).h  
**Date of First Criticality:** 10 Apr 1984      **Cumulative Energy Availability Factor:** 70.2%  
**Date of Grid Connection:** 09 May 1984      **Cumulative Load Factor:** 70.9%  
**Date of Commercial Operation:** 12 Jun 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 29.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 5891.6         | 950.0          | 70.1   | 70.7   | 70.1                              | 70.7   | 70.6               | 70.9   | 6187               | 70.4   |
| 1989 | 6129.7         | 950.0          | 71.9   | 71.0   | 71.9                              | 71.0   | 73.7               | 71.6   | 6396               | 73.0   |
| 1990 | 5192.3         | 950.0          | 61.6   | 69.1   | 61.5                              | 69.1   | 62.4               | 69.8   | 5435               | 62.0   |
| 1991 | 6482.7         | 950.0          | 78.1   | 70.6   | 77.1                              | 70.4   | 77.9               | 71.1   | 7161               | 81.7   |
| 1992 | 6781.4         | 950.0          | 80.4   | 72.0   | 80.3                              | 71.8   | 81.3               | 72.6   | 7388               | 84.1   |
| 1993 | 4927.2         | 950.0          | 66.6   | 71.3   | 59.4                              | 70.3   | 59.2               | 70.9   | 6133               | 70.0   |
| 1994 | 4437.6         | 950.0          | 54.4   | 69.5   | 54.1                              | 68.5   | 53.3               | 69.0   | 5440               | 62.1   |
| 1995 | 4699.0         | 950.0          | 57.0   | 68.2   | 56.8                              | 67.3   | 56.5               | 67.7   | 6265               | 71.5   |
| 1996 | 4431.7         | 950.0          | 53.3   | 66.9   | 53.2                              | 66.1   | 53.1               | 66.4   | 5628               | 64.1   |
| 1997 | 5197.1         | 950.0          | 65.0   | 66.7   | 63.2                              | 65.8   | 62.4               | 66.1   | 6195               | 70.7   |
| 1998 | 6101.0         | 950.0          | 73.3   | 67.2   | 73.0                              | 66.4   | 73.3               | 66.6   | 6937               | 79.2   |
| 1999 | 5775.1         | 950.0          | 73.1   | 67.6   | 69.3                              | 66.6   | 69.4               | 66.8   | 6589               | 75.2   |
| 2000 | 6289.7         | 950.0          | 76.8   | 68.2   | 75.0                              | 67.1   | 75.4               | 67.4   | 6784               | 77.2   |
| 2001 | 6627.5         | 950.0          | 79.4   | 68.9   | 78.2                              | 67.8   | 79.6               | 68.2   | 7020               | 80.1   |
| 2002 | 7248.4         | 950.0          | 86.1   | 69.9   | 84.7                              | 68.8   | 87.1               | 69.3   | 7568               | 86.4   |
| 2003 | 7155.9         | 950.0          | 83.8   | 70.7   | 83.1                              | 69.6   | 86.0               | 70.2   | 7408               | 84.6   |
| 2004 | 6937.0         | 950.0          | 81.5   | 71.3   | 80.7                              | 70.2   | 83.1               | 70.9   | 7179               | 81.7   |

# RU-30 KALININ-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 414.0  | 33.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER                             |
| 03 Feb | 264.0  | 16.1    | XP   | M    |  |
| 10 Feb | 29.0   | 6.7     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER                             |
| 08 Mar | 90.0   | 13.4    | XP   | M    |  |
| 13 Jun | 1427.0 | 1360.4  | PF   | C    | MAJOR UNIT OVERHAUL  |
| 09 Oct | 178.0  | 179.5   | UF1  | A16  | UNIT SHUT DOWN TO ELIMINATE DEFECTS IN THE HEAT EXCHANGE TUBES OF STEAM GENERATORS NOS 2 AND 4 |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 178       |          |  | 280       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1427            |           |          | 1590                                     | 44        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 126                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 63        |          |
| Subtotal   | 1427            | 178       | 0        | 1716                                     | 394       | 0        |
| Total  |                 | 1605      |          |  | 2110      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 8  |
| 12. Reactor I&C Systems                        |                 | 2  |
| 15. Reactor Cooling Systems                    |                 | 3  |
| 16. Steam generation systems                   | 178             | 35                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 6  |
| 31. Turbine and auxiliaries                    |                 | 41                                       |
| 32. Feedwater and Main Steam System            |                 | 30                                       |
| 35. All other I&C Systems                      |                 | 9  |
| 41. Main Generator Systems                     |                 | 123                                      |
| 42. Electrical Power Supply Systems            |                 | 11                                       |
| Total  | 178             | 268                                      |

## RU-31 KALININ-2

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7398.2 GW(e).h  
**Energy Availability Factor:** 86.7%  
**Load Factor:** 88.7%  
**Operating Factor:** 87.4%  
**Energy Unavailability Factor:** 13.3%  
**Total Off-line Time:** 1110 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 728.4 | 674.9 | 705.4 | 41.8 | 270.5 | 698.0 | 718.1 | 723.6 | 701.9 | 725.2 | 682.8 | 727.5 | 7398.2 |
| <b>EAF (%)</b>  | 99.9  | 99.4  | 98.4  | 6.8  | 38.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.2  | 99.3  | 86.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 98.9  | 6.8  | 39.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.1   |
| <b>LF (%)</b>   | 103.1 | 102.1 | 99.8  | 6.1  | 38.3  | 102.0 | 101.6 | 102.4 | 102.6 | 102.5 | 99.8  | 102.9 | 88.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 7.4  | 40.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.4   |
| <b>EUF (%)</b>  | 0.1   | 0.6   | 1.6   | 93.2 | 61.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.8   | 0.7   | 13.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 93.2 | 60.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 1.1   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>XUF (%)</b>  | 0.1   | 0.6   | 0.5   | 0.0  | 0.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.8   | 0.7   | 0.4    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, JULY, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 135942 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Feb 1982      **Lifetime Generation:** 106674.5 GW(e).h  
**Date of First Criticality:** 25 Nov 1986      **Cumulative Energy Availability Factor:** 68.9%  
**Date of Grid Connection:** 03 Dec 1986      **Cumulative Load Factor:** 70.8%  
**Date of Commercial Operation:** 03 Mar 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 31.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 5829.4         | 950.0          | 71.7   | 71.7   | 71.7                              | 71.7   | 69.9               | 69.9   | 6446               | 73.4   |
| 1989 | 6580.5         | 950.0          | 78.5   | 75.1   | 78.5                              | 75.1   | 79.1               | 74.5   | 7034               | 80.3   |
| 1990 | 6788.2         | 950.0          | 79.5   | 76.5   | 79.5                              | 76.5   | 81.6               | 76.8   | 7083               | 80.9   |
| 1991 | 4729.7         | 950.0          | 49.8   | 69.8   | 49.8                              | 69.8   | 56.8               | 71.8   | 5154               | 58.8   |
| 1992 | 5496.3         | 950.0          | 65.7   | 69.0   | 65.7                              | 69.0   | 65.9               | 70.6   | 6145               | 70.0   |
| 1993 | 5862.3         | 950.0          | 58.1   | 67.2   | 51.9                              | 66.2   | 70.4               | 70.6   | 7078               | 80.8   |
| 1994 | 4463.8         | 950.0          | 54.9   | 65.4   | 54.9                              | 64.6   | 53.6               | 68.2   | 6989               | 79.8   |
| 1995 | 5769.7         | 950.0          | 72.4   | 66.3   | 69.5                              | 65.2   | 69.3               | 68.3   | 7283               | 83.1   |
| 1996 | 4595.2         | 950.0          | 78.4   | 67.7   | 56.0                              | 64.2   | 55.1               | 66.9   | 7501               | 85.4   |
| 1997 | 3880.6         | 950.0          | 62.7   | 67.2   | 47.3                              | 62.5   | 46.6               | 64.8   | 6117               | 69.8   |
| 1998 | 4946.7         | 950.0          | 60.0   | 66.5   | 59.7                              | 62.2   | 59.4               | 64.3   | 6839               | 78.1   |
| 1999 | 6379.3         | 950.0          | 80.0   | 67.6   | 76.2                              | 63.4   | 76.7               | 65.4   | 7155               | 81.7   |
| 2000 | 6418.7         | 950.0          | 83.6   | 68.9   | 76.3                              | 64.4   | 76.9               | 66.3   | 7441               | 84.7   |
| 2001 | 6709.0         | 950.0          | 80.0   | 69.7   | 79.2                              | 65.4   | 80.6               | 67.3   | 7070               | 80.7   |
| 2002 | 7003.4         | 950.0          | 85.8   | 70.7   | 82.7                              | 66.6   | 84.2               | 68.4   | 7554               | 86.2   |
| 2003 | 7329.5         | 950.0          | 85.9   | 71.7   | 85.3                              | 67.7   | 88.1               | 69.6   | 7541               | 86.1   |
| 2004 | 7398.2         | 950.0          | 87.1   | 72.6   | 86.7                              | 68.9   | 88.7               | 70.8   | 7674               | 87.4   |



## RU-31 KALININ-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 27 Feb | 80.0   | 4.5     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 14 Mar | 328.0  | 2.2     | XP   | M    | UNIT POWER REDUCTION OWING TO ELECTRICITY GENERATION CONDITIONS IN THE FREE TRADE SECTOR  |
| 27 Mar | 31.0   | 8.1     | UP2  | A15  | UNIT POWER REDUCTION WHEN REACTOR COOLANT PUMP NO. 3 WAS SHUT DOWN BY THE EMERGENCY PROTECTION SYSTEM FOR A SHORT CIRCUIT TO EARTH AS A RESULT OF A SHORT CIRCUIT IN A SUPPLY CABLE |
| 03 Apr | 1110.0 | 1067.0  | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 20 May | 24.0   | 4.4     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER WHEN THE 'LENINGRAD' 750 OVERHEAD LINE WAS SHUT DOWN FOR MAINTENANCE   |
| 07 Nov | 84.0   | 18.9    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER (TWICE IN NOVEMBER: 7 NOVEMBER 2004 FOR 54 HOURS AND 14 NOVEMBER FOR 30 HOURS)                                   |
| 31 Dec | 22.0   | 4.7     | XP   | K    | UNIT POWER REDUCTION IN ACCORDANCE WITH THE ASSIGNED DISPATCHER SCHEDULE  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 201       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1110            |           |          | 1343                                     | 12        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 108                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 4         |          |
| Z. Others  |                 |           |          |  | 1         |          |
| Subtotal   | 1110            | 0         | 0        | 1451                                     | 234       | 0        |
| Total  |                 | 1110      |          |  | 1685      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 6  |
| 12. Reactor I&C Systems                        |                 | 8  |
| 15. Reactor Cooling Systems                    |                 | 36                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 51                                       |
| 32. Feedwater and Main Steam System            |                 | 5  |
| 35. All other I&C Systems                      |                 | 3  |
| 41. Main Generator Systems                     |                 | 68                                       |
| 42. Electrical Power Supply Systems            |                 | 2  |
| XX. Miscellaneous Systems                      |                 | 2  |
| Total  | 0               | 183                                      |

**RU-12 KOLA-1****Operator:** REA (ROSENERGOATOM, CONSORTIUM)**Contractor:** FAEA (Federal Atomic Energy Agency)**1. Station Details**

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 411.0 MW(e)  
**Design Net RUP:** 411.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 2440.5 GW(e).h  
**Energy Availability Factor:** 68.2%  
**Load Factor:** 67.6%  
**Operating Factor:** 83.4%  
**Energy Unavailability Factor:** 31.8%  
**Total Off-line Time:** 1458 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar  | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 265.7 | 281.9 | 84.9 | 0.0   | 92.8 | 181.6 | 155.0 | 299.7 | 191.3 | 295.1 | 289.4 | 303.1 | 2440.5 |
| <b>EAF (%)</b>  | 87.3  | 98.5  | 28.5 | 0.0   | 32.5 | 62.7  | 52.0  | 98.1  | 66.0  | 96.4  | 97.8  | 99.1  | 68.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 38.6 | 0.0   | 64.9 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.6   |
| <b>LF (%)</b>   | 86.9  | 98.5  | 27.8 | 0.0   | 30.3 | 61.4  | 50.7  | 98.0  | 64.6  | 96.4  | 97.8  | 99.1  | 67.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 35.7 | 0.0   | 65.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.4   |
| <b>EUF (%)</b>  | 12.7  | 1.5   | 71.5 | 100.0 | 67.5 | 37.3  | 48.0  | 1.9   | 34.0  | 3.6   | 2.2   | 0.9   | 31.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 61.4 | 100.0 | 35.1 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.4   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 12.7  | 1.5   | 10.2 | 0.0   | 32.4 | 37.3  | 48.0  | 1.9   | 34.0  | 3.6   | 2.2   | 0.9   | 15.4   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. THE UNIT WAS IN THE OVERHAUL OUTAGE FROM 04.03.13 TO 04.05.11. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

**5. Historical Summary**

**Date of Construction Start:** 01 May 1970      **Lifetime Generation:** 73716.0 GW(e).h  
**Date of First Criticality:** 26 Jun 1973      **Cumulative Energy Availability Factor:** 69.6%  
**Date of Grid Connection:** 29 Jun 1973      **Cumulative Load Factor:** 65.2%  
**Date of Commercial Operation:** 28 Dec 1973      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 30.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 2805.8         | 411.0          | 85.1   | 77.8   | 85.1                              | 77.7   | 77.9               | 71.9   | 8074               | 92.2   |
| 1987 | 3268.2         | 440.0          | 86.0   | 78.4   | 86.0                              | 78.4   | 84.8               | 72.8   | 7972               | 91.0   |
| 1988 | 2925.0         | 411.0          | 82.7   | 78.7   | 82.7                              | 78.6   | 81.0               | 73.4   | 7482               | 85.2   |
| 1989 | 2675.5         | 411.0          | 76.2   | 78.5   | 75.4                              | 78.4   | 74.3               | 73.4   | 6731               | 76.8   |
| 1990 | 2735.5         | 411.0          | 76.0   | 78.4   | 76.0                              | 78.3   | 76.0               | 73.6   | 6838               | 78.1   |
| 1991 | 2773.1         | 411.0          | 77.3   | 78.3   | 77.3                              | 78.2   | 77.0               | 73.8   | 6965               | 79.5   |
| 1992 | 2271.4         | 411.0          | 63.7   | 77.5   | 63.4                              | 77.5   | 62.9               | 73.2   | 6651               | 75.7   |
| 1993 | 1992.6         | 411.0          | 59.6   | 76.7   | 56.1                              | 76.4   | 55.3               | 72.3   | 5663               | 64.6   |
| 1994 | 1971.6         | 411.0          | 58.6   | 75.8   | 56.5                              | 75.5   | 54.8               | 71.5   | 5359               | 61.2   |
| 1995 | 1581.4         | 411.0          | 62.2   | 75.2   | 62.2                              | 74.9   | 43.9               | 70.2   | 5398               | 61.6   |
| 1996 | 1410.0         | 411.0          | 47.4   | 74.0   | 46.4                              | 73.6   | 39.1               | 68.9   | 4466               | 50.8   |
| 1997 | 2404.1         | 411.0          | 88.5   | 74.6   | 88.5                              | 74.2   | 66.8               | 68.8   | 7942               | 90.7   |
| 1998 | 1291.7         | 411.0          | 59.3   | 74.0   | 37.7                              | 72.8   | 35.9               | 67.5   | 5658               | 64.6   |
| 1999 | 2028.5         | 411.0          | 86.6   | 74.5   | 58.0                              | 72.2   | 56.3               | 67.1   | 7355               | 84.0   |
| 2000 | 1298.8         | 411.0          | 84.1   | 74.8   | 37.2                              | 70.9   | 36.0               | 65.9   | 4643               | 52.9   |
| 2001 | 2243.2         | 411.0          | 81.6   | 75.0   | 63.3                              | 70.6   | 62.3               | 65.8   | 7098               | 81.0   |
| 2002 | 1841.5         | 411.0          | 68.9   | 74.8   | 51.7                              | 70.0   | 51.1               | 65.3   | 5660               | 64.6   |
| 2003 | 2164.0         | 411.0          | 75.5   | 74.9   | 60.4                              | 69.7   | 60.1               | 65.1   | 6444               | 73.6   |
| 2004 | 2440.5         | 411.0          | 83.6   | 75.1   | 68.2                              | 69.6   | 67.6               | 65.2   | 7326               | 83.4   |

# RU-12 KOLA-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1706.0 | 69.6    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWNS OF TURBOGENERATOR NO. 2 (TWICE)                  |
| 12 Mar | 22.0   | 4.6     | XF   | K    | UNIT SHUTDOWN OWING TO DISCONNECTION OF THE LAST OPERATIONAL TURBOGENERATOR, NO. 1, OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 13 Mar | 1436.0 | 590.6   | PF   | D    | MAJOR UNIT OVERHAUL   |
| 11 May | 1383.0 | 246.3   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 1 AND 2            |
| 01 Jul | 1339.0 | 2.8     | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |
| 08 Jul | 3885.0 | 201.3   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 1 AND 2            |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 66        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1407                                     | 4         |          |
| D. Inspection, maintenance or repair without refuelling                              | 1436            |           |          | 158                                      |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 84                                       |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 7        |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 148      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           | 22       |  | 13        | 2        |
| Subtotal   | 1436            | 0         | 22       | 1649                                     | 84        | 157      |
| Total  |                 | 1458      |          |  | 1890      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 5  |
| 13. Reactor Auxiliary Systems                  |                 | 5  |
| 15. Reactor Cooling Systems                    |                 | 18                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 2  |
| 32. Feedwater and Main Steam System            |                 | 9  |
| 35. All other I&C Systems                      |                 | 1  |
| 42. Electrical Power Supply Systems            |                 | 1  |
| Total  | 0               | 42                                       |

# RU-13 KOLA-2

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 411.0 MW(e)  
**Design Net RUP:** 411.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1787.1 GW(e).h  
**Energy Availability Factor:** 49.9%  
**Load Factor:** 49.5%  
**Operating Factor:** 65.2%  
**Energy Unavailability Factor:** 50.1%  
**Total Off-line Time:** 3053 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 267.6 | 272.8 | 212.9 | 293.4 | 304.5 | 89.2 | 0.0   | 0.0   | 58.6 | 0.9   | 126.2 | 161.0 | 1787.1 |
| <b>EAF (%)</b>  | 87.6  | 95.1  | 70.2  | 98.7  | 99.1  | 31.3 | 0.0   | 0.0   | 21.4 | 1.0   | 43.8  | 53.7  | 49.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 78.8  | 100.0 | 100.0 | 66.7 | 0.0   | 0.0   | 42.8 | 100.0 | 100.0 | 100.0 | 73.8   |
| <b>LF (%)</b>   | 87.5  | 95.4  | 69.6  | 99.3  | 99.6  | 30.1 | 0.0   | 0.0   | 19.8 | 0.3   | 42.6  | 52.6  | 49.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 79.0  | 100.1 | 100.0 | 62.5 | 0.0   | 0.0   | 42.8 | 2.3   | 100.0 | 100.0 | 65.2   |
| <b>EUF (%)</b>  | 12.4  | 4.9   | 29.8  | 1.3   | 0.9   | 68.7 | 100.0 | 100.0 | 78.6 | 99.0  | 56.2  | 46.3  | 50.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 20.8  | 0.0   | 0.0   | 33.3 | 100.0 | 100.0 | 57.2 | 0.0   | 0.0   | 0.0   | 26.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 12.4  | 4.9   | 8.6   | 1.3   | 0.9   | 35.4 | 0.0   | 0.0   | 21.4 | 99.0  | 56.2  | 46.3  | 23.9   |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1973      **Lifetime Generation:** 70602.3 GW(e).h  
**Date of First Criticality:** 30 Nov 1974      **Cumulative Energy Availability Factor:** 69.2%  
**Date of Grid Connection:** 09 Dec 1974      **Cumulative Load Factor:** 66.1%  
**Date of Commercial Operation:** 21 Feb 1975      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 30.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 2844.2         | 411.0          | 79.8   | 81.4   | 79.7                              | 81.3   | 79.0               | 79.5   | 7405               | 84.5   |
| 1987 | 3345.4         | 440.0          | 89.6   | 82.2   | 89.6                              | 82.0   | 86.8               | 80.1   | 7900               | 90.2   |
| 1988 | 2873.3         | 411.0          | 80.5   | 82.0   | 80.5                              | 81.9   | 79.6               | 80.1   | 7451               | 84.8   |
| 1989 | 2707.3         | 411.0          | 78.0   | 81.8   | 74.8                              | 81.4   | 75.2               | 79.7   | 6859               | 78.3   |
| 1990 | 2610.9         | 411.0          | 72.9   | 81.2   | 72.7                              | 80.8   | 72.5               | 79.2   | 6751               | 77.1   |
| 1991 | 2701.9         | 411.0          | 75.4   | 80.8   | 75.3                              | 80.5   | 75.0               | 79.0   | 6983               | 79.7   |
| 1992 | 2133.0         | 411.0          | 61.9   | 79.7   | 61.8                              | 79.4   | 59.1               | 77.8   | 5871               | 66.8   |
| 1993 | 2138.8         | 411.0          | 65.7   | 78.9   | 60.7                              | 78.4   | 59.4               | 76.8   | 6377               | 72.8   |
| 1994 | 398.6          | 411.0          | 16.7   | 75.7   | 16.7                              | 75.1   | 11.1               | 73.4   | 1466               | 16.7   |
| 1995 | 2205.8         | 411.0          | 93.6   | 76.5   | 93.6                              | 76.0   | 61.3               | 72.8   | 6846               | 78.2   |
| 1996 | 1946.2         | 411.0          | 66.3   | 76.1   | 65.5                              | 75.5   | 53.9               | 71.9   | 6243               | 71.1   |
| 1997 | 1157.9         | 411.0          | 53.4   | 75.0   | 40.6                              | 74.0   | 32.2               | 70.1   | 3955               | 45.1   |
| 1998 | 2655.6         | 411.0          | 83.6   | 75.4   | 74.5                              | 74.0   | 73.8               | 70.2   | 8029               | 91.7   |
| 1999 | 1272.6         | 411.0          | 49.0   | 74.3   | 36.3                              | 72.4   | 35.3               | 68.8   | 4423               | 50.5   |
| 2000 | 2430.5         | 411.0          | 83.4   | 74.7   | 68.2                              | 72.3   | 67.3               | 68.7   | 7626               | 86.8   |
| 2001 | 1722.3         | 411.0          | 84.7   | 75.1   | 49.1                              | 71.4   | 47.8               | 67.9   | 6574               | 75.0   |
| 2002 | 1738.7         | 411.0          | 83.2   | 75.4   | 48.7                              | 70.5   | 48.3               | 67.2   | 5564               | 63.5   |
| 2003 | 1866.1         | 411.0          | 66.4   | 75.0   | 52.0                              | 69.9   | 51.8               | 66.6   | 5459               | 62.3   |
| 2004 | 1787.1         | 411.0          | 73.8   | 75.0   | 49.9                              | 69.2   | 49.5               | 66.1   | 5731               | 65.2   |

## RU-13 KOLA-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1440.0 | 51.3    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 2 AND 1 (TWICE)          |
| 01 Mar | 155.0  | 63.7    | PF   | D    | ROUTINE UNIT MAINTENANCE  |
| 07 Mar | 250.0  | 131.4   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 1 AND 2                  |
| 01 May | 1347.0 | 259.8   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN OF TURBOGENERATOR NO. 2                                 |
| 19 Jun | 30.0   | 6.2     | XF   | K    | UNIT SHUTDOWN AS A RESULT OF DISCONNECTION OF THE LAST OPERATIONAL TURBOGENERATOR, NO. 1, OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 21 Jun | 2140.0 | 879.5   | PF   | F    | MEDIUM-SCALE UNIT MAINTENANCE INCLUDING UPGRADING OF A NUMBER OF SYSTEMS  |
| 18 Sep | 325.0  | 216.3   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWNS OF TURBOGENERATOR NO. 2 (TWICE)                        |
| 01 Oct | 728.0  | 198.1   | XF   | K    | UNIT SHUTDOWN OWING TO DISCONNECTION OF THE LAST OPERATIONAL TURBOGENERATOR, NO. 1, OWING TO LIMITATION IMPOSED BY THE DISPATCHER       |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 97        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 1448                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  | 155             |           |          | 77                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 10                                       |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling   | 2140            |           |          | 92                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 190      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           | 758      |  | 0         | 3        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  | 0         |          |
| Subtotal   | 2295            | 0         | 758      | 1627                                     | 97        | 193      |
| Total  |                 | 3053      |          |  | 1917      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 56                                       |
| 12. Reactor I&C Systems                        |                 | 1  |
| 13. Reactor Auxiliary Systems                  |                 | 3  |
| 14. Safety Systems                             |                 | 3  |
| 15. Reactor Cooling Systems                    |                 | 24                                       |
| 16. Steam generation systems                   |                 | 4  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 0  |
| 32. Feedwater and Main Steam System            |                 | 0  |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     |                 | 0  |
| 42. Electrical Power Supply Systems            |                 | 0  |
| Total  | 0               | 92                                       |

**RU-32 KOLA-3****Operator:** REA (ROSENERGOATOM, CONSORTIUM)**Contractor:** FAEA (Federal Atomic Energy Agency)**1. Station Details**

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 411.0 MW(e)  
**Design Net RUP:** 411.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 2816.8 GW(e).h  
**Energy Availability Factor:** 77.4%  
**Load Factor:** 78.0%  
**Operating Factor:** 87.5%  
**Energy Unavailability Factor:** 22.6%  
**Total Off-line Time:** 1096 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 236.9 | 263.5 | 319.7 | 286.6 | 292.2 | 249.3 | 187.1 | 0.0   | 151.4 | 275.8 | 265.4 | 288.9 | 2816.8 |
| <b>EAF (%)</b>  | 77.5  | 91.6  | 100.0 | 95.9  | 94.8  | 84.0  | 61.3  | 0.0   | 52.0  | 89.5  | 88.3  | 94.7  | 77.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 95.6  | 99.3  | 69.4  | 0.0   | 96.0  | 100.0 | 99.1  | 100.0 | 88.1   |
| <b>LF (%)</b>   | 77.5  | 92.1  | 104.6 | 97.0  | 95.6  | 84.2  | 61.2  | 0.0   | 51.2  | 90.1  | 89.7  | 94.5  | 78.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 75.9  | 0.0   | 76.0  | 100.0 | 100.0 | 100.0 | 87.5   |
| <b>EUF (%)</b>  | 22.5  | 8.4   | 0.0   | 4.1   | 5.2   | 16.0  | 38.7  | 100.0 | 48.0  | 10.5  | 11.7  | 5.3   | 22.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.6  | 100.0 | 4.0   | 0.0   | 0.0   | 0.0   | 11.4   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 4.5   | 0.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.9   | 0.0   | 0.5    |
| <b>XUF (%)</b>  | 22.5  | 8.4   | 0.0   | 4.1   | 0.7   | 15.3  | 8.0   | 0.0   | 44.0  | 10.5  | 10.8  | 5.3   | 10.7   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN MARCH. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 10062 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

**5. Historical Summary**

**Date of Construction Start:** 01 Apr 1977      **Lifetime Generation:** 61090.0 GW(e).h  
**Date of First Criticality:** 07 Feb 1981      **Cumulative Energy Availability Factor:** 76.0%  
**Date of Grid Connection:** 24 Mar 1981      **Cumulative Load Factor:** 73.3%  
**Date of Commercial Operation:** 03 Dec 1982      **Cumulative Unit Capability Factor:** 77.9%  
**Cumulative Energy Unavailability Factor:** 24.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 2837.8         | 440.0          | 74.8   | 78.0   | 74.8                              | 78.0   | 73.6               | 75.2   | 7024               | 80.2   |
| 1988 | 2933.2         | 411.0          | 81.5   | 78.6   | 81.4                              | 78.6   | 81.2               | 76.2   | 7913               | 90.1   |
| 1989 | 3186.7         | 411.0          | 90.5   | 80.3   | 87.8                              | 79.9   | 88.5               | 77.9   | 8047               | 91.9   |
| 1990 | 3256.9         | 411.0          | 89.8   | 81.5   | 89.7                              | 81.1   | 90.5               | 79.5   | 8022               | 91.6   |
| 1991 | 2935.2         | 411.0          | 79.8   | 81.3   | 79.8                              | 81.0   | 81.5               | 79.7   | 7188               | 82.1   |
| 1992 | 2806.4         | 411.0          | 88.0   | 81.9   | 87.8                              | 81.6   | 77.7               | 79.5   | 7396               | 84.2   |
| 1993 | 2548.0         | 411.0          | 81.9   | 81.9   | 70.5                              | 80.6   | 70.8               | 78.7   | 6833               | 78.0   |
| 1994 | 2466.0         | 411.0          | 70.9   | 81.0   | 70.8                              | 79.8   | 68.5               | 77.9   | 6373               | 72.8   |
| 1995 | 2526.1         | 411.0          | 81.0   | 81.0   | 80.6                              | 79.9   | 70.2               | 77.3   | 7083               | 80.9   |
| 1996 | 2327.3         | 411.0          | 79.8   | 80.9   | 79.8                              | 79.9   | 64.5               | 76.4   | 6928               | 78.9   |
| 1997 | 2340.5         | 411.0          | 78.5   | 80.8   | 75.0                              | 79.5   | 65.0               | 75.6   | 7114               | 81.2   |
| 1998 | 2006.3         | 411.0          | 86.3   | 81.1   | 56.3                              | 78.1   | 55.7               | 74.4   | 6705               | 76.5   |
| 1999 | 2140.6         | 411.0          | 72.6   | 80.6   | 59.9                              | 77.0   | 59.5               | 73.5   | 7040               | 80.4   |
| 2000 | 2244.7         | 411.0          | 87.9   | 81.0   | 62.5                              | 76.2   | 62.2               | 72.9   | 7731               | 88.0   |
| 2001 | 2543.3         | 411.0          | 85.3   | 81.2   | 70.6                              | 75.9   | 70.6               | 72.8   | 7057               | 80.6   |
| 2002 | 2742.4         | 411.0          | 91.4   | 81.8   | 75.9                              | 75.9   | 76.2               | 72.9   | 7909               | 90.3   |
| 2003 | 2740.7         | 411.0          | 83.7   | 81.8   | 75.6                              | 75.9   | 76.1               | 73.1   | 7335               | 83.7   |
| 2004 | 2816.8         | 411.0          | 88.1   | 82.1   | 77.4                              | 76.0   | 78.0               | 73.3   | 7688               | 87.5   |

## RU-32 KOLA-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1440.0 | 92.8    | XP   | K    | POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 1 AND 2 (TWICE)          |
| 01 Apr | 1464.0 | 14.3    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN OF TURBOGENERATOR NO. 2                            |
| 29 May | 73.0   | 15.0    | UP1  | A31  | UNIT POWER REDUCTION WHEN TURBOGENERATOR NO. 1 WAS SHUT DOWN TO ELIMINATE A FAULT IN THE TURBINE CONTROL SYSTEM                    |
| 01 Jun | 1286.0 | 61.2    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 2 AND 1 (TWICE)     |
| 19 Jul | 144.0  | 34.5    | PP   | D    | UNIT POWER REDUCTION DURING SHUTDOWN OF TURBOGENERATOR NO. 1 FOR MEDIUM-SCALE MAINTENANCE  |
| 24 Jul | 34.0   | 7.0     | XF   | K    | UNIT SHUTDOWN OWING TO DISCONNECTION OF THE LAST OPERATIONAL TURBOGENERATOR, NO. 2, OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 26 Jul | 917.0  | 376.6   | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE  |
| 02 Sep | 547.0  | 100.6   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 1 AND 2             |
| 05 Sep | 145.0  | 29.7    | XF   | K    | UNIT SHUT DOWN OWING TO DISCONNECTION OF THE LAST OPERATIONAL TURBOGENERATOR, NO. 2, OWING TO LIMITATION IMPOSED BY THE DISPATCHER |
| 01 Oct | 2209.0 | 80.2    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN OF TURBOGENERATOR NO. 1                            |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 80        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 917             |           |          | 1040                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 95                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 17                                       | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 17        | 99       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           | 179      |  | 5         | 1        |
| L. Human factor related  |                 |           |          |  | 1         |          |
| Subtotal   | 917             | 0         | 179      | 1152                                     | 104       | 100      |
| Total  |                 | 1096      |          |  | 1356      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 8  |
| 12. Reactor I&C Systems                        |                 | 39                                       |
| 15. Reactor Cooling Systems                    |                 | 8  |
| 16. Steam generation systems                   |                 | 9  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 0  |
| 32. Feedwater and Main Steam System            |                 | 8  |
| 42. Electrical Power Supply Systems            |                 | 5  |
| XX. Miscellaneous Systems                      |                 | 0  |
| Total  | 0               | 77                                       |

**RU-33 KOLA-4****Operator:** REA (ROSENERGOATOM, CONSORTIUM)**Contractor:** FAEA (Federal Atomic Energy Agency)**1. Station Details**

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 411.0 MW(e)  
**Design Net RUP:** 411.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 2391.6 GW(e).h  
**Energy Availability Factor:** 66.4%  
**Load Factor:** 66.2%  
**Operating Factor:** 89.5%  
**Energy Unavailability Factor:** 33.6%  
**Total Off-line Time:** 921 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 242.2 | 130.7 | 291.0 | 183.9 | 41.6 | 56.1 | 253.4 | 304.7 | 215.3 | 251.1 | 161.4 | 260.2 | 2391.6 |
| <b>EAF (%)</b>  | 79.3  | 46.9  | 94.4  | 62.4  | 14.4 | 20.0 | 82.4  | 98.6  | 73.0  | 81.8  | 55.4  | 84.8  | 66.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 85.0  | 17.8 | 38.7 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.8   |
| <b>LF (%)</b>   | 79.2  | 45.7  | 95.2  | 62.2  | 13.6 | 19.0 | 82.9  | 99.6  | 72.7  | 82.0  | 54.5  | 85.1  | 66.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 35.5 | 38.8 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.5   |
| <b>EUF (%)</b>  | 20.7  | 53.1  | 5.6   | 37.6  | 85.6 | 80.0 | 17.6  | 1.4   | 27.0  | 18.2  | 44.6  | 15.2  | 33.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 15.0  | 82.2 | 61.3 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 20.7  | 53.1  | 5.6   | 22.5  | 3.4  | 18.7 | 17.6  | 1.4   | 27.0  | 18.2  | 44.6  | 15.2  | 20.4   |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

**5. Historical Summary**

**Date of Construction Start:** 01 Aug 1976      **Lifetime Generation:** 52046.8 GW(e).h  
**Date of First Criticality:** 07 Oct 1984      **Cumulative Energy Availability Factor:** 73.4%  
**Date of Grid Connection:** 11 Oct 1984      **Cumulative Load Factor:** 71.6%  
**Date of Commercial Operation:** 06 Dec 1984      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 26.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 2690.2         | 411.0          | 72.4   | 75.3   | 72.4                              | 75.3   | 74.7               | 73.3   | 7230               | 82.5   |
| 1987 | 3341.2         | 440.0          | 85.5   | 78.8   | 85.5                              | 78.8   | 86.7               | 77.9   | 7861               | 89.7   |
| 1988 | 3124.2         | 411.0          | 85.0   | 80.3   | 84.9                              | 80.3   | 86.5               | 80.1   | 7762               | 88.4   |
| 1989 | 3111.5         | 411.0          | 87.6   | 81.8   | 85.8                              | 81.4   | 86.4               | 81.3   | 7793               | 89.0   |
| 1990 | 2930.4         | 411.0          | 80.3   | 81.5   | 80.2                              | 81.2   | 81.4               | 81.3   | 7142               | 81.5   |
| 1991 | 2790.5         | 411.0          | 76.7   | 80.8   | 76.7                              | 80.6   | 77.5               | 80.8   | 7429               | 84.8   |
| 1992 | 2764.9         | 411.0          | 80.5   | 80.8   | 80.0                              | 80.5   | 76.6               | 80.3   | 7253               | 82.6   |
| 1993 | 2827.0         | 411.0          | 92.4   | 82.1   | 79.0                              | 80.3   | 78.5               | 80.1   | 8247               | 94.1   |
| 1994 | 1939.8         | 411.0          | 62.7   | 80.2   | 55.8                              | 77.9   | 53.9               | 77.5   | 5915               | 67.5   |
| 1995 | 2288.8         | 411.0          | 73.8   | 79.6   | 73.8                              | 77.5   | 63.6               | 76.2   | 7022               | 80.2   |
| 1996 | 2537.7         | 411.0          | 84.1   | 80.0   | 84.1                              | 78.1   | 70.3               | 75.7   | 7792               | 88.7   |
| 1997 | 2271.7         | 411.0          | 76.2   | 79.7   | 74.6                              | 77.8   | 63.1               | 74.8   | 6848               | 78.2   |
| 1998 | 1927.6         | 411.0          | 69.4   | 78.9   | 49.2                              | 75.8   | 53.5               | 73.3   | 6336               | 72.3   |
| 1999 | 2567.5         | 411.0          | 82.0   | 79.1   | 71.2                              | 75.5   | 71.3               | 73.1   | 7193               | 82.1   |
| 2000 | 2177.5         | 411.0          | 86.3   | 79.6   | 60.4                              | 74.5   | 60.3               | 72.3   | 7096               | 80.8   |
| 2001 | 2447.1         | 411.0          | 87.4   | 80.0   | 68.0                              | 74.1   | 68.0               | 72.1   | 7149               | 81.6   |
| 2002 | 2601.7         | 411.0          | 79.7   | 80.0   | 71.5                              | 74.0   | 72.3               | 72.1   | 7281               | 83.1   |
| 2003 | 2480.8         | 411.0          | 90.9   | 80.6   | 68.7                              | 73.7   | 68.9               | 71.9   | 6663               | 76.1   |
| 2004 | 2391.6         | 411.0          | 86.8   | 80.9   | 66.4                              | 73.4   | 66.2               | 71.6   | 7863               | 89.5   |



## RU-33 KOLA-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 3167.0 | 309.0   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 1 (THREE TIMES) AND NO. 2 (TWICE) |
| 24 Apr | 432.0  | 98.6    | PP   | D    | UNIT POWER REDUCTION DURING SHUTDOWN OF TURBOGENERATOR NO. 2 FOR MAJOR OVERHAUL  |
| 12 May | 921.0  | 378.5   | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE  |
| 01 Jun | 4696.0 | 424.4   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER AND SHUTDOWN IN TURN OF TURBOGENERATORS NOS 2 AND 1 (TWICE)                   |
| 02 Jul | 149.0  | 30.1    | XP   | K    | DISCONNECTION OF THE LAST OPERATIONAL TURBOGENERATOR, NO. 1, OWING TO LIMITATION IMPOSED BY THE DISPATCHER                                       |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 67        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 921             |           |          | 1048                                     | 29        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 102                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 8  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 164      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         | 0        |
| Subtotal   | 921             | 0         | 0        | 1158                                     | 97        | 164      |
| Total  |                 | 921       |          |  | 1419      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 3  |
| 12. Reactor I&C Systems                        |                 | 14                                       |
| 14. Safety Systems                             |                 | 3  |
| 15. Reactor Cooling Systems                    |                 | 7  |
| 16. Steam generation systems                   |                 | 9  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 32. Feedwater and Main Steam System            |                 | 9  |
| 42. Electrical Power Supply Systems            |                 | 20                                       |
| Total  | 0               | 65                                       |

**RU-17 KURSK-1****Operator:** REA (ROSENERGOATOM, CONSORTIUM)**Contractor:** FAEA (Federal Atomic Energy Agency)**1. Station Details**

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 6601.3 GW(e).h  
**Energy Availability Factor:** 81.1%  
**Load Factor:** 81.2%  
**Operating Factor:** 83.8%  
**Energy Unavailability Factor:** 18.9%  
**Total Off-line Time:** 1421 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr  | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 691.6 | 649.4 | 687.7 | 68.3 | 78.1 | 452.5 | 648.7 | 659.4 | 644.1 | 671.1 | 664.1 | 686.3 | 6601.3 |
| <b>EAF (%)</b>  | 98.4  | 99.3  | 98.8  | 11.1 | 12.8 | 69.2  | 94.7  | 96.1  | 96.7  | 97.4  | 99.2  | 98.9  | 81.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 11.3 | 13.8 | 72.0  | 100.0 | 100.0 | 100.0 | 98.5  | 99.9  | 100.0 | 83.0   |
| <b>LF (%)</b>   | 100.5 | 100.9 | 99.9  | 10.3 | 11.4 | 67.9  | 94.3  | 95.8  | 96.7  | 97.4  | 99.7  | 99.7  | 81.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 11.7 | 18.1 | 75.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.8   |
| <b>EUF (%)</b>  | 1.6   | 0.7   | 1.2   | 88.9 | 87.2 | 30.8  | 5.3   | 3.9   | 3.3   | 2.6   | 0.8   | 1.1   | 18.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 88.7 | 86.3 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 14.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0  | 0.0  | 28.0  | 0.0   | 0.0   | 0.0   | 1.5   | 0.1   | 0.0   | 2.4    |
| <b>XUF (%)</b>  | 1.6   | 0.7   | 1.2   | 0.2  | 0.9  | 2.8   | 5.3   | 3.9   | 3.3   | 1.1   | 0.7   | 1.1   | 1.9    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 26803 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

**5. Historical Summary**

**Date of Construction Start:** 01 Jun 1972      **Lifetime Generation:** 127714.2 GW(e).h  
**Date of First Criticality:** 25 Oct 1976      **Cumulative Energy Availability Factor:** 56.8%  
**Date of Grid Connection:** 19 Dec 1976      **Cumulative Load Factor:** 56.5%  
**Date of Commercial Operation:** 12 Oct 1977      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 43.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6638.0         | 925.0          | 81.8   | 77.6   | 81.7                              | 77.5   | 81.7               | 77.5   | 7350               | 83.7   |
| 1989 | 5745.4         | 925.0          | 68.3   | 76.8   | 68.3                              | 76.7   | 70.9               | 77.0   | 6582               | 75.1   |
| 1990 | 5090.5         | 925.0          | 65.7   | 76.0   | 65.7                              | 75.9   | 62.8               | 75.9   | 6817               | 77.8   |
| 1991 | 4163.1         | 925.0          | 53.5   | 74.4   | 52.5                              | 74.2   | 51.4               | 74.2   | 7038               | 80.3   |
| 1992 | 3669.2         | 925.0          | 46.3   | 72.5   | 46.3                              | 72.3   | 45.2               | 72.2   | 6103               | 69.5   |
| 1993 | 4809.4         | 925.0          | 91.6   | 73.7   | 61.8                              | 71.7   | 59.4               | 71.4   | 8145               | 93.0   |
| 1994 | 1560.6         | 925.0          | 20.6   | 70.6   | 19.8                              | 68.7   | 19.3               | 68.4   | 2686               | 30.7   |
| 1995 | 0.0            | 925.0          | 0.0  | 66.7   | 0.0                               | 64.9   | 0.0                | 64.6   | 0                  | 0.0    |
| 1996 | 0.0            | 925.0          | 0.0  | 63.2   | 0.0                               | 61.5   | 0.0                | 61.2   | 0                  | 0.0    |
| 1997 | 27.8           | 925.0          | 0.5  | 60.1   | 0.5                               | 58.4   | 0.3                | 58.2   | 61                 | 0.7    |
| 1998 | 4508.6         | 925.0          | 59.3   | 60.0   | 57.4                              | 58.4   | 55.6               | 58.1   | 7845               | 89.6   |
| 1999 | 4557.0         | 925.0          | 58.7   | 60.0   | 57.6                              | 58.3   | 56.2               | 58.0   | 7464               | 85.2   |
| 2000 | 3449.7         | 925.0          | 44.3   | 59.3   | 43.6                              | 57.7   | 42.5               | 57.3   | 5531               | 63.0   |
| 2001 | 1296.1         | 925.0          | 16.6   | 57.5   | 16.4                              | 56.0   | 16.0               | 55.6   | 2042               | 23.3   |
| 2002 | 2462.7         | 925.0          | 32.5   | 56.5   | 30.8                              | 55.0   | 30.4               | 54.6   | 3439               | 39.3   |
| 2003 | 6452.7         | 925.0          | 80.2   | 57.4   | 78.9                              | 55.9   | 79.6               | 55.5   | 7262               | 82.9   |
| 2004 | 6601.3         | 925.0          | 83.0   | 58.4   | 81.1                              | 56.8   | 81.2               | 56.5   | 7363               | 83.8   |

**RU-17 KURSK-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 456.0  | 10.7    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 04 Apr | 1245.0 | 1183.6  | PF   | D    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 29 May | 168.0  | 10.9    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Jun | 3672.0 | 101.6   | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |
| 11 Jun | 176.0  | 186.5   | PF   | E    | UNIT SHUT DOWN IN ORDER TO TEST EMERGENCY CORE COOLING SYSTEM CHANNEL (ECCS-2)  |
| 02 Oct | 25.0   | 10.1    | UP2  | A31  | UNIT POWER REDUCTION AND SHUTDOWN OF TG-2 TO ELIMINATE A FAULT IN THE FIRST STAGE OF MOISTURE SEPARATOR/REHEATER NO. 22 |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 59        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                |                 |           |          | 499                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                      | 1245            |           |          | 1908                                     | 17        |          |
| E. Testing of plant systems or components                                    | 176             |           |          |  |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling |                 |           |          | 185                                      |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 13        |          |
| J. Grid failure or grid unavailability                                       |                 |           |          |  | 0         |          |
| Z. Others  |                 |           |          |  | 5         |          |
| Subtotal   | 1421            | 0         | 0        | 2592                                     | 96        | 0        |
| Total  |                 | 1421      |          |  | 2688      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 0  |
| 12. Reactor I&C Systems                        |                 | 6  |
| 13. Reactor Auxiliary Systems                  |                 | 2  |
| 15. Reactor Cooling Systems                    |                 | 17                                       |
| 16. Steam generation systems                   |                 | 4  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 3  |
| 32. Feedwater and Main Steam System            |                 | 3  |
| 35. All other I&C Systems                      |                 | 1  |
| 41. Main Generator Systems                     |                 | 2  |
| 42. Electrical Power Supply Systems            |                 | 6  |
| Total  | 0               | 45                                       |

# RU-22 KURSK-2

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3692.1 GW(e).h  
**Energy Availability Factor:** 45.0%  
**Load Factor:** 45.4%  
**Operating Factor:** 49.2%  
**Energy Unavailability Factor:** 55.0%  
**Total Off-line Time:** 4466 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 25.2 | 362.8 | 532.4 | 673.5 | 704.9 | 680.4 | 712.8 | 3692.1 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.0  | 54.4  | 77.9  | 99.8  | 100.0 | 99.3  | 100.0 | 45.0   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.0  | 54.4  | 78.0  | 100.0 | 100.0 | 100.0 | 100.0 | 45.1   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.8  | 52.7  | 77.4  | 101.1 | 102.3 | 102.2 | 103.6 | 45.4   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.9 | 82.0  | 88.3  | 100.0 | 100.0 | 100.0 | 100.0 | 49.2   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.0 | 45.6  | 22.1  | 0.2   | 0.0   | 0.7   | 0.0   | 55.0   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.3 | 42.3  | 19.9  | 0.0   | 0.0   | 0.0   | 0.0   | 53.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.7 | 3.3   | 2.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.2   | 0.2   | 0.0   | 0.7   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN AUGUST, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 48712 MWH. THE UNIT WAS IN THE OVERHAUL OUTAGE FROM 04.01.01 TO 04.06.20 INVOLVING PARTIAL FUEL CHANNEL REPLACEMENT. REACTOR THERMAL POWER REDUCED TO 0.7 NNOM ON INSTRUCTIONS FROM THE RUSSIAN GOSATOMNADZOR. TWO UNIT SHUTDOWNS OCCURRED DUE TO PERSONNEL ERRORS. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1973      **Lifetime Generation:** 123053.4 GW(e).h  
**Date of First Criticality:** 16 Dec 1978      **Cumulative Energy Availability Factor:** 59.4%  
**Date of Grid Connection:** 28 Jan 1979      **Cumulative Load Factor:** 58.7%  
**Date of Commercial Operation:** 17 Aug 1979      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 40.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 4789.7         | 925.0          | 62.2   | 74.5   | 62.2                              | 74.4   | 59.1               | 74.2   | 6874               | 78.5   |
| 1991 | 4376.0         | 925.0          | 56.3   | 73.0   | 55.3                              | 72.9   | 54.0               | 72.5   | 7361               | 84.0   |
| 1992 | 2158.4         | 925.0          | 27.2   | 69.5   | 27.2                              | 69.4   | 26.6               | 69.0   | 3552               | 40.4   |
| 1993 | 4438.2         | 925.0          | 85.0   | 70.6   | 57.1                              | 68.5   | 54.8               | 68.0   | 7432               | 84.8   |
| 1994 | 4212.2         | 925.0          | 55.3   | 69.6   | 53.5                              | 67.5   | 52.0               | 66.9   | 7385               | 84.3   |
| 1995 | 4745.4         | 925.0          | 90.8   | 70.9   | 59.8                              | 67.0   | 58.6               | 66.4   | 7708               | 88.0   |
| 1996 | 4196.1         | 925.0          | 52.8   | 69.8   | 52.7                              | 66.2   | 51.6               | 65.5   | 7099               | 80.8   |
| 1997 | 4354.3         | 925.0          | 55.3   | 69.0   | 54.9                              | 65.6   | 53.7               | 64.9   | 7076               | 80.8   |
| 1998 | 1685.1         | 925.0          | 21.7   | 66.5   | 21.3                              | 63.2   | 20.8               | 62.6   | 2805               | 32.0   |
| 1999 | 3708.1         | 925.0          | 48.0   | 65.6   | 46.8                              | 62.4   | 45.8               | 61.7   | 6066               | 69.2   |
| 2000 | 3668.1         | 925.0          | 48.9   | 64.8   | 46.2                              | 61.7   | 45.1               | 60.9   | 6211               | 70.7   |
| 2001 | 4768.1         | 925.0          | 61.1   | 64.7   | 60.1                              | 61.6   | 58.8               | 60.9   | 7667               | 87.5   |
| 2002 | 3027.8         | 925.0          | 38.3   | 63.5   | 38.1                              | 60.6   | 37.4               | 59.8   | 4770               | 54.5   |
| 2003 | 3756.2         | 925.0          | 47.1   | 62.8   | 46.4                              | 60.0   | 46.4               | 59.3   | 5834               | 66.6   |
| 2004 | 3692.1         | 925.0          | 45.1   | 62.1   | 45.0                              | 59.4   | 45.4               | 58.7   | 4318               | 49.2   |

## RU-22 KURSK-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 4118.0 | 1145.2  | PP   | H    | UNIT POWER REDUCTION OWING TO REACTOR THERMAL POWER LIMITATION BY ORDER OF GOSATOMNADZOR RUSSIA   |
| 01 Jan | 4118.0 | 3809.0  | PF   | F    | MAJOR UNIT OVERHAUL   |
| 20 Jun | 1569.0 | 305.7   | PP   | F    | UNIT POWER LIMITATION IN ACCORDANCE WITH STAGED POWER RAISE SCHEDULE WHILE THE UNIT IS BUILDING UP TO RATED POWER FOLLOWING UPGRADING   |
| 21 Jun | 127.0  | 111.0   | UF4  | A16  | UNIT SHUTDOWN BECAUSE FAST POWER REDUCTION MODE 1 AND 2 WAS TRIGGERED BY THE REACTOR'S AUTOMATIC PROCESS PROTECTION SYSTEMS FOR A LEVEL DROP IN THE DRUM-TYPE STEAM SEPARATOR ON THE RIGHT SIDE OF THE MULTI-PASS FORCED CIRCULATION SYSTEM |
| 03 Jul | 24.0   | 22.7    | UF2  | A41  | UNIT SHUTDOWN OWING TO A DROP IN THE RESISTANCE OF THE INSULATION OF THE TURBOGENERATOR NO. 3 EXCITATION CIRCUITS   |
| 28 Jul | 175.0  | 175.1   | PF   | D    | ROUTINE UNIT MAINTENANCE  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1979 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 151       |          |  | 112       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 821                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 175             |           |          | 986                                      | 22        |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         | 4118            |           |          |  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 46        |          |
| Subtotal   | 4293            | 151       | 0        | 1807                                     | 183       | 0        |
| Total  |                 | 4444      |          |  | 1990      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1979 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 63                                       |
| 12. Reactor I&C Systems             |                 | 11                                       |
| 13. Reactor Auxiliary Systems       |                 | 7  |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 17                                       |
| 16. Steam generation systems        | 127             |  |
| 32. Feedwater and Main Steam System |                 | 4  |
| 41. Main Generator Systems          | 24              | 2  |
| 42. Electrical Power Supply Systems |                 | 1  |
| Total                               | 151             | 107                                      |

# RU-38 KURSK-3

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6894.2 GW(e).h  
**Energy Availability Factor:** 84.3%  
**Load Factor:** 84.8%  
**Operating Factor:** 87.2%  
**Energy Unavailability Factor:** 15.7%  
**Total Off-line Time:** 1124 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 688.0 | 653.0 | 688.3 | 653.4 | 699.2 | 128.2 | 148.6 | 679.5 | 668.5 | 693.8 | 547.5 | 646.1 | 6894.2 |
| <b>EAF (%)</b>  | 97.6  | 99.1  | 95.9  | 99.8  | 100.0 | 20.2  | 23.1  | 98.9  | 99.8  | 100.0 | 83.1  | 94.3  | 84.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 97.1  | 100.0 | 100.0 | 20.6  | 23.9  | 100.0 | 100.0 | 100.0 | 94.4  | 100.0 | 86.3   |
| <b>LF (%)</b>   | 100.0 | 101.4 | 100.0 | 98.2  | 101.6 | 19.3  | 21.6  | 98.7  | 100.4 | 100.7 | 82.2  | 93.9  | 84.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 20.8  | 25.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.2   |
| <b>EUF (%)</b>  | 2.4   | 0.9   | 4.1   | 0.2   | 0.0   | 79.8  | 76.9  | 1.1   | 0.2   | 0.0   | 16.9  | 5.7   | 15.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 79.4  | 76.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 2.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.6   | 0.0   | 0.7    |
| <b>XUF (%)</b>  | 2.4   | 0.9   | 1.2   | 0.2   | 0.0   | 0.3   | 0.7   | 1.1   | 0.2   | 0.0   | 11.2  | 5.7   | 2.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 71436 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1978      **Lifetime Generation:** 122440.3 GW(e).h  
**Date of First Criticality:** 09 Aug 1983      **Cumulative Energy Availability Factor:** 72.2%  
**Date of Grid Connection:** 17 Oct 1983      **Cumulative Load Factor:** 71.3%  
**Date of Commercial Operation:** 30 Mar 1984      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 27.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6693.6         | 925.0          | 83.6   | 72.7   | 83.6                              | 71.8   | 82.4               | 70.2   | 7471               | 85.1   |
| 1989 | 5900.5         | 925.0          | 74.3   | 73.0   | 74.3                              | 72.3   | 72.8               | 70.7   | 7200               | 82.2   |
| 1990 | 6889.4         | 925.0          | 86.5   | 75.2   | 86.5                              | 74.6   | 85.0               | 73.1   | 8096               | 92.4   |
| 1991 | 5139.0         | 925.0          | 63.4   | 73.6   | 63.2                              | 73.0   | 63.4               | 71.7   | 5704               | 65.1   |
| 1992 | 6630.5         | 925.0          | 82.1   | 74.6   | 82.1                              | 74.1   | 81.6               | 72.9   | 8126               | 92.5   |
| 1993 | 5562.3         | 925.0          | 71.2   | 74.3   | 70.3                              | 73.7   | 68.6               | 72.5   | 6438               | 73.5   |
| 1994 | 5077.9         | 925.0          | 73.6   | 74.2   | 66.7                              | 73.0   | 62.7               | 71.5   | 6495               | 74.1   |
| 1995 | 5318.1         | 925.0          | 65.7   | 73.4   | 65.4                              | 72.3   | 65.6               | 71.0   | 5974               | 68.2   |
| 1996 | 6739.3         | 925.0          | 82.9   | 74.2   | 82.7                              | 73.2   | 82.9               | 71.9   | 7383               | 84.1   |
| 1997 | 6548.7         | 925.0          | 82.5   | 74.8   | 81.6                              | 73.8   | 80.8               | 72.6   | 7325               | 83.6   |
| 1998 | 4528.3         | 925.0          | 60.3   | 73.8   | 56.5                              | 72.6   | 55.9               | 71.4   | 5405               | 61.7   |
| 1999 | 6006.9         | 925.0          | 75.3   | 73.9   | 74.3                              | 72.7   | 74.1               | 71.6   | 6749               | 77.0   |
| 2000 | 6382.3         | 925.0          | 78.8   | 74.2   | 78.3                              | 73.1   | 78.5               | 72.0   | 7415               | 84.4   |
| 2001 | 3535.2         | 925.0          | 44.6   | 72.5   | 43.5                              | 71.3   | 43.6               | 70.4   | 3948               | 45.1   |
| 2002 | 6699.8         | 925.0          | 88.2   | 73.3   | 85.1                              | 72.1   | 82.7               | 71.1   | 7788               | 88.9   |
| 2003 | 5100.6         | 925.0          | 62.2   | 72.8   | 61.8                              | 71.6   | 62.9               | 70.6   | 5469               | 62.4   |
| 2004 | 6894.2         | 925.0          | 86.3   | 73.4   | 84.3                              | 72.2   | 84.8               | 71.3   | 7660               | 87.2   |

**RU-38 KURSK-3****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 432.0  | 16.3    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 13 Apr | 53.0   | 18.7    | UP2  | A31  | UNIT POWER REDUCTION OWING TO AN EMERGENCY REQUEST TO SHUT DOWN TG-6 FOR MAINTENANCE AS A RESULT OF A BREACH IN THE LEAK-TIGHTNESS OF THE SEAL EJECTOR PIPING SYSTEM |
| 07 Jun | 1123.0 | 1053.1  | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE  |
| 24 Jul | 1654.0 | 13.2    | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE  |
| 06 Nov | 96.0   | 37.5    | UP2  | A16  | UNIT POWER REDUCTION AND DISCONNECTION OF TURBOGENERATOR NO. 5 FOR MAINTENANCE OF THE EVAPORATOR DRAIN HEAT EXCHANGER  |
| 10 Nov | 1248.0 | 113.7   | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 163       |          |
| C. Inspection, maintenance or repair combined with refuelling | 1123            |           |          | 972   |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 829   |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   | 2         | 2        |
| Subtotal  | 1123            | 0         | 0        | 1801  | 165       | 2        |
| Total   |                 | 1123      |          |   | 1968      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 26  |
| 12. Reactor I&C Systems                        |                    | 5   |
| 13. Reactor Auxiliary Systems                  |                    | 5   |
| 14. Safety Systems                             |                    | 19  |
| 15. Reactor Cooling Systems                    |                    | 73  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 4   |
| 31. Turbine and auxiliaries                    |                    | 4   |
| 32. Feedwater and Main Steam System            |                    | 10  |
| 41. Main Generator Systems                     |                    | 1   |
| 42. Electrical Power Supply Systems            |                    | 2   |
| Total  | 0                  | 149   |

## RU-39 KURSK-4

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 5422.9 GW(e).h  
**Energy Availability Factor:** 66.7%  
**Load Factor:** 66.7%  
**Operating Factor:** 68.4%  
**Energy Unavailability Factor:** 33.3%  
**Total Off-line Time:** 2779 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 663.4 | 638.6 | 667.7 | 654.9 | 681.4 | 641.4 | 147.1 | 0.0   | 0.0   | 0.0   | 643.8 | 684.7 | 5422.9 |
| <b>EAF (%)</b>  | 95.4  | 98.9  | 98.2  | 98.1  | 98.8  | 96.4  | 22.2  | 0.0   | 0.0   | 0.0   | 96.4  | 99.0  | 66.7   |
| <b>UCF (%)</b>  | 97.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 23.3  | 0.0   | 0.0   | 0.0   | 98.2  | 100.0 | 68.0   |
| <b>LF (%)</b>   | 96.4  | 99.2  | 97.0  | 98.5  | 99.0  | 96.3  | 21.4  | 0.0   | 0.0   | 0.0   | 96.7  | 99.5  | 66.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 23.4  | 0.0   | 0.0   | 0.0   | 100.0 | 100.0 | 68.4   |
| <b>EUF (%)</b>  | 4.6   | 1.1   | 1.8   | 1.9   | 1.2   | 3.6   | 77.8  | 100.0 | 100.0 | 100.0 | 3.6   | 1.0   | 33.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 76.8  | 100.0 | 100.0 | 100.0 | 1.8   | 0.0   | 31.8   |
| <b>UCLF (%)</b> | 2.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 2.4   | 1.1   | 1.8   | 1.9   | 1.2   | 3.6   | 1.0   | 0.0   | 0.0   | 0.0   | 1.8   | 1.0   | 1.3    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 12916 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 May 1981      **Lifetime Generation:** 117930.1 GW(e).h  
**Date of First Criticality:** 31 Oct 1985      **Cumulative Energy Availability Factor:** 75.9%  
**Date of Grid Connection:** 02 Dec 1985      **Cumulative Load Factor:** 76.0%  
**Date of Commercial Operation:** 05 Feb 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 24.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6653.0         | 925.0          | 81.7   | 76.9   | 81.7                              | 76.8   | 81.9               | 75.9   | 7390               | 84.1   |
| 1989 | 6131.8         | 925.0          | 76.0   | 76.6   | 76.0                              | 76.6   | 75.7               | 75.8   | 6954               | 79.4   |
| 1990 | 6050.0         | 925.0          | 73.7   | 75.9   | 73.6                              | 75.8   | 74.7               | 75.6   | 6922               | 79.0   |
| 1991 | 7356.1         | 925.0          | 92.5   | 79.2   | 90.3                              | 78.7   | 90.8               | 78.6   | 8469               | 96.7   |
| 1992 | 6117.4         | 925.0          | 75.4   | 78.6   | 75.4                              | 78.1   | 75.3               | 78.0   | 7324               | 83.4   |
| 1993 | 5638.3         | 925.0          | 71.7   | 77.6   | 71.0                              | 77.1   | 69.6               | 76.8   | 6439               | 73.5   |
| 1994 | 5369.4         | 925.0          | 71.5   | 76.8   | 67.0                              | 75.9   | 66.3               | 75.5   | 6255               | 71.4   |
| 1995 | 6207.5         | 925.0          | 78.6   | 77.0   | 77.0                              | 76.0   | 76.6               | 75.6   | 7001               | 79.9   |
| 1996 | 6590.2         | 925.0          | 81.4   | 77.5   | 80.2                              | 76.4   | 81.1               | 76.2   | 7373               | 83.9   |
| 1997 | 5971.7         | 925.0          | 73.9   | 77.2   | 73.1                              | 76.1   | 73.7               | 76.0   | 6664               | 76.1   |
| 1998 | 6641.4         | 925.0          | 86.7   | 77.9   | 82.3                              | 76.6   | 82.0               | 76.5   | 7751               | 88.5   |
| 1999 | 5895.4         | 925.0          | 74.2   | 77.7   | 72.8                              | 76.3   | 72.8               | 76.2   | 6595               | 75.3   |
| 2000 | 6778.8         | 925.0          | 83.5   | 78.1   | 82.8                              | 76.8   | 83.4               | 76.7   | 7423               | 84.5   |
| 2001 | 6671.6         | 925.0          | 82.2   | 78.3   | 81.5                              | 77.1   | 82.3               | 77.1   | 7281               | 83.1   |
| 2002 | 5531.0         | 925.0          | 68.3   | 77.7   | 67.6                              | 76.5   | 68.3               | 76.5   | 6094               | 69.6   |
| 2003 | 6233.4         | 925.0          | 77.3   | 77.7   | 75.8                              | 76.5   | 76.9               | 76.5   | 6802               | 77.6   |
| 2004 | 5422.9         | 925.0          | 68.0   | 77.2   | 66.7                              | 75.9   | 66.7               | 76.0   | 6005               | 68.4   |



**RU-39 KURSK-4****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 456.0  | 16.6    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER                               |
| 10 Jan | 22.0   | 15.0    | UP2  | A31  | UNIT POWER REDUCTION AND SHUTDOWN OF TG-7 TO ELIMINATE A FAULT IN MOISTURE SEPARATOR/REHEATER 72 |
| 14 Mar | 1824.0 | 30.9    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER                               |
| 01 May | 1638.0 | 33.3    | XP   | N    | UNIT POWER LIMITATION OWING TO INCREASED CIRCULATING WATER TEMPERATURE                           |
| 08 Jul | 2728.0 | 2560.6  | PF   | F    | MAJOR UNIT OVERHAUL  |
| 01 Nov | 48.0   | 12.1    | PP   | F    | UNIT POWER REDUCTION IN CONNECTION WITH POWER RAISE AFTER COMPLETION OF A MAJOR OVERHAUL         |
| 03 Nov | 1296.0 | 17.6    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER                               |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 63        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 776   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 741   |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         | 2728            |           |          |   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 10        |          |
| Subtotal   | 2728            | 0         | 0        | 1517  | 79        | 0        |
| Total  |                 | 2728      |          |   | 1596      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 2   |
| 12. Reactor I&C Systems             |                    | 2   |
| 15. Reactor Cooling Systems         |                    | 16  |
| 32. Feedwater and Main Steam System |                    | 12  |
| 42. Electrical Power Supply Systems |                    | 28  |
| Total                               | 0                  | 60  |

# RU-15 LENINGRAD-1

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1328.5 GW(e).h  
**Energy Availability Factor:** 16.7%  
**Load Factor:** 16.4%  
**Operating Factor:** 19.5%  
**Energy Unavailability Factor:** 83.3%  
**Total Off-line Time:** 7069 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 238.9 | 629.6 | 460.0 | 1328.5 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 37.7  | 94.9  | 68.0  | 16.7   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 37.8  | 100.0 | 80.3  | 18.2   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 34.7  | 94.5  | 66.8  | 16.4   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 51.0  | 100.0 | 82.7  | 19.5   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 62.3  | 5.1   | 32.0  | 83.3   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 35.1  | 0.0   | 0.0   | 77.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 27.1  | 0.0   | 19.7  | 4.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.1   | 12.3  | 1.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN OCTOBER, NOVEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 937 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1970      **Lifetime Generation:** 167324.5 GW(e).h  
**Date of First Criticality:** 12 Sep 1973      **Cumulative Energy Availability Factor:** 67.6%  
**Date of Grid Connection:** 21 Dec 1973      **Cumulative Load Factor:** 67.1%  
**Date of Commercial Operation:** 01 Nov 1974      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 32.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 8113.0         | 1000.0         | 93.5   | 74.3   | 92.7                              | 74.1   | 92.6               | 73.8   | 8255               | 94.2   |
| 1988 | 6620.3         | 925.0          | 81.7   | 74.8   | 81.7                              | 74.7   | 81.5               | 74.4   | 7519               | 85.6   |
| 1989 | 4577.0         | 925.0          | 56.4   | 73.6   | 56.0                              | 73.4   | 56.5               | 73.2   | 4993               | 57.0   |
| 1990 | 0.0            | 925.0          | 0.0  | 69.0   | 0.0                               | 68.9   | 0.0                | 68.6   | 0                  | 0.0    |
| 1991 | 3934.0         | 925.0          | 49.9   | 67.9   | 49.9                              | 67.8   | 48.5               | 67.5   | 6385               | 72.9   |
| 1992 | 7191.6         | 925.0          | 88.6   | 69.1   | 88.1                              | 68.9   | 88.5               | 68.6   | 7995               | 91.0   |
| 1993 | 6520.4         | 925.0          | 83.5   | 69.8   | 81.7                              | 69.6   | 80.5               | 69.2   | 7354               | 83.9   |
| 1994 | 5531.2         | 925.0          | 77.7   | 70.2   | 77.6                              | 70.0   | 68.3               | 69.2   | 6956               | 79.4   |
| 1995 | 0.0            | 925.0          | 0.0  | 66.9   | 0.0                               | 66.6   | 0.0                | 65.9   | 0                  | 0.0    |
| 1996 | 3852.8         | 925.0          | 47.6   | 66.0   | 47.5                              | 65.8   | 47.4               | 65.1   | 4454               | 50.7   |
| 1997 | 6872.4         | 925.0          | 88.6   | 67.0   | 86.1                              | 66.7   | 84.8               | 65.9   | 7785               | 88.9   |
| 1998 | 5630.3         | 925.0          | 69.8   | 67.1   | 68.8                              | 66.7   | 69.5               | 66.1   | 6220               | 71.0   |
| 1999 | 6637.9         | 925.0          | 81.8   | 67.7   | 81.3                              | 67.3   | 81.9               | 66.7   | 7431               | 84.8   |
| 2000 | 6317.8         | 925.0          | 78.5   | 68.1   | 77.2                              | 67.7   | 77.8               | 67.1   | 7069               | 80.5   |
| 2001 | 7097.8         | 925.0          | 89.2   | 68.9   | 87.4                              | 68.4   | 87.6               | 67.9   | 7923               | 90.4   |
| 2002 | 5824.6         | 925.0          | 72.4   | 69.0   | 71.2                              | 68.5   | 71.9               | 68.0   | 7104               | 81.1   |
| 2003 | 7446.3         | 925.0          | 95.0   | 69.9   | 92.2                              | 69.3   | 91.9               | 68.9   | 8495               | 97.0   |
| 2004 | 1328.5         | 925.0          | 18.2   | 68.2   | 16.7                              | 67.6   | 16.4               | 67.1   | 1715               | 19.5   |

## RU-15 LENINGRAD-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 6777.0 | 6283.9  | PF   | G    | MAJOR UNIT OVERHAUL PRIOR TO EXTENSION OF OPERATING LIFE (START: 20 DECEMBER 2003)   |
| 09 Oct | 22.0   | 28.8    | PF   | D    | UNIT SHUTDOWN DURING PROGRAMME TO BRING THE UNIT TO RATED POWER FOLLOWING MAJOR OVERHAUL   |
| 10 Oct | 141.0  | 130.8   | PF   | D    | UNIT SHUTDOWN DURING PROGRAMME TO BRING THE UNIT TO RATED POWER FOLLOWING MAJOR OVERHAUL   |
| 16 Oct | 271.0  | 82.5    | PP   | D31  | UNIT POWER REDUCTION TO REPAIR CONDENSERS  |
| 12 Nov | 588.0  | 36.4    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 06 Dec | 129.0  | 116.1   | UF2  | A12  | UNIT SHUTDOWN OWING TO A SIGNAL FOR A LOCAL POWER INCREASE FROM THE IN-CORE SENSORS  |
| 11 Dec | 446.0  | 82.1    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 12 Dec | 37.0   | 12.3    | UP1  | A41  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 1 OWING TO SPURIOUS OPERATION OF THE ALARM FOR AN OIL LEVEL DROP IN THE GENERATOR HYDRAULIC SEAL |
| 30 Dec | 5.0    | 7.3     | UP1  | A41  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 2 OWING TO A FAULT IN THE DIFFERENTIAL GENERATOR PROTECTION SYSTEM CURRENT CIRCUITS              |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 129       |          |  | 114       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1101                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 163             |           |          | 725                                      |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 8  |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      | 6777            |           |          |  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         |          |
| Subtotal   | 6940            | 129       | 0        | 1834                                     | 129       | 0        |
| Total  |                 | 7069      |          |  | 1963      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        | 129             | 16                                       |
| 14. Safety Systems                             |                 | 8  |
| 15. Reactor Cooling Systems                    |                 | 38                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 21. Fuel Handling and Storage Facilities       |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 3  |
| 32. Feedwater and Main Steam System            |                 | 4  |
| 35. All other I&C Systems                      |                 | 3  |
| 41. Main Generator Systems                     |                 | 2  |
| 42. Electrical Power Supply Systems            |                 | 1  |
| Total  | 129             | 77                                       |

## RU-16 LENINGRAD-2

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6711.5 GW(e).h  
**Energy Availability Factor:** 82.9%  
**Load Factor:** 82.6%  
**Operating Factor:** 89.2%  
**Energy Unavailability Factor:** 17.1%  
**Total Off-line Time:** 952 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 675.8 | 612.8 | 653.3 | 426.4 | 4.9  | 622.4 | 664.4 | 621.9 | 618.6 | 619.1 | 591.6 | 600.3 | 6711.5 |
| <b>EAF (%)</b>  | 97.9  | 95.3  | 95.3  | 64.3  | 2.0  | 93.5  | 96.3  | 91.2  | 93.3  | 90.2  | 89.1  | 87.2  | 82.9   |
| <b>UCF (%)</b>  | 98.7  | 96.9  | 99.8  | 66.2  | 2.0  | 95.2  | 99.1  | 93.1  | 95.6  | 91.2  | 100.0 | 100.0 | 86.4   |
| <b>LF (%)</b>   | 98.2  | 95.2  | 94.9  | 64.1  | 0.7  | 93.5  | 96.5  | 90.4  | 92.9  | 89.8  | 88.8  | 87.2  | 82.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 65.5  | 5.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.2   |
| <b>EUF (%)</b>  | 2.1   | 4.7   | 4.7   | 35.7  | 98.0 | 6.5   | 3.7   | 8.8   | 6.7   | 9.8   | 10.9  | 12.8  | 17.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 33.5  | 97.9 | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.0   |
| <b>UCLF (%)</b> | 1.3   | 3.1   | 0.2   | 0.3   | 0.2  | 4.7   | 0.9   | 6.9   | 4.4   | 8.8   | 0.0   | 0.0   | 2.6    |
| <b>XUF (%)</b>  | 0.8   | 1.6   | 4.5   | 1.9   | 0.0  | 1.7   | 2.8   | 1.9   | 2.3   | 1.0   | 10.9  | 12.8  | 3.5    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, JUNE, JULY, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 12505 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Jun 1970      **Lifetime Generation:** 169381.0 GW(e).h  
**Date of First Criticality:** 06 May 1975      **Cumulative Energy Availability Factor:** 71.4%  
**Date of Grid Connection:** 11 Jul 1975      **Cumulative Load Factor:** 71.3%  
**Date of Commercial Operation:** 11 Feb 1976      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 28.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6814.9         | 925.0          | 83.6   | 79.1   | 83.6                              | 78.9   | 83.9               | 78.9   | 7417               | 84.4   |
| 1989 | 6111.5         | 925.0          | 75.8   | 78.9   | 75.6                              | 78.6   | 75.4               | 78.6   | 7102               | 81.1   |
| 1990 | 5998.3         | 925.0          | 75.5   | 78.6   | 75.3                              | 78.4   | 74.0               | 78.3   | 8125               | 92.8   |
| 1991 | 4410.8         | 925.0          | 56.4   | 77.2   | 56.3                              | 76.9   | 54.4               | 76.7   | 7204               | 82.2   |
| 1992 | 0.0            | 925.0          | 0.0  | 72.3   | 0.0                               | 72.2   | 0.0                | 71.9   | 0                  | 0.0    |
| 1993 | 0.0            | 925.0          | 0.0  | 68.1   | 0.0                               | 67.9   | 0.0                | 67.7   | 0                  | 0.0    |
| 1994 | 164.1          | 925.0          | 2.3  | 64.5   | 2.3                               | 64.3   | 2.0                | 64.1   | 660                | 7.5    |
| 1995 | 6812.0         | 925.0          | 93.4   | 66.0   | 86.2                              | 65.4   | 84.1               | 65.1   | 8280               | 94.5   |
| 1996 | 7244.9         | 925.0          | 89.4   | 67.2   | 89.1                              | 66.6   | 89.2               | 66.3   | 7922               | 90.2   |
| 1997 | 6587.1         | 925.0          | 83.1   | 67.9   | 82.6                              | 67.4   | 81.3               | 67.0   | 7342               | 83.8   |
| 1998 | 5916.7         | 925.0          | 73.4   | 68.2   | 72.5                              | 67.6   | 73.0               | 67.3   | 6643               | 75.8   |
| 1999 | 6557.8         | 925.0          | 80.6   | 68.7   | 80.2                              | 68.2   | 80.9               | 67.9   | 7299               | 83.3   |
| 2000 | 7252.5         | 925.0          | 90.1   | 69.6   | 88.6                              | 69.0   | 89.3               | 68.8   | 7972               | 90.8   |
| 2001 | 7073.5         | 925.0          | 88.5   | 70.3   | 86.6                              | 69.7   | 87.3               | 69.5   | 7904               | 90.2   |
| 2002 | 7024.9         | 925.0          | 88.7   | 71.1   | 86.6                              | 70.4   | 86.7               | 70.2   | 7961               | 90.9   |
| 2003 | 7134.4         | 925.0          | 90.9   | 71.8   | 88.0                              | 71.0   | 88.0               | 70.8   | 8298               | 94.7   |
| 2004 | 6711.5         | 925.0          | 86.4   | 72.3   | 82.9                              | 71.4   | 82.6               | 71.3   | 7832               | 89.2   |

## RU-16 LENINGRAD-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Feb | 139.0  | 10.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 12 Feb | 38.0   | 19.7    | UP1  | A31  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 2 WHEN THE PROTECTION SYSTEM FOR AN AXIAL DISPLACEMENT WAS SPURIOUSLY TRIGGERED                                   |
| 01 Mar | 743.0  | 31.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Apr | 720.0  | 12.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 20 Apr | 4.0    | 2.1     | UP   | A31  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 1 BY STAFF OWING TO DAMAGE TO THE PROTECTION MECHANISMS   |
| 20 Apr | 951.0  | 897.3   | PF   | D    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 31 May | 73.0   | 32.4    | PP   | D    | ONGOING MAINTENANCE OF TURBOGENERATOR NO. 2   |
| 04 Jun | 600.0  | 11.6    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Jul | 2208.0 | 23.5    | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |
| 11 Jul | 216.0  | 15.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Aug | 744.0  | 15.0    | UP1  | A31  | UNIT POWER REDUCTION BECAUSE CONDENSERS OPERATING ON SEA WATER  |
| 08 Aug | 1180.0 | 44.3    | UP1  | A13  | UNIT POWER REDUCTION OWING TO A DETERIORATION IN THE OPERATION OF A COOLANT CIRCUIT HEAT EXCHANGER IN THE REACTOR CONTROL AND PROTECTION SYSTEM                           |
| 19 Aug | 27.0   | 14.5    | UP1  | A32  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 1 TO ELIMINATE A LEAK IN THE CONDENSATE TANK HATCH  |
| 01 Oct | 720.0  | 79.8    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 16 Oct | 114.0  | 56.3    | UP1  | A32  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 2 IN ORDER TO LOCATE AND ELIMINATE LEAKS IN THE PIPING SYSTEM OF THE MOISTURE SEPARATOR TANK DRAIN HEAT EXCHANGER |
| 04 Dec | 521.0  | 87.8    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1976 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 88        |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 735                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       | 951             |           |          | 1070                                     | 10        |          |
| E. Testing of plant systems or components                     |                 |           |          |  | 2         |          |
| Subtotal  | 951             | 0         | 0        | 1805                                     | 103       | 0        |
| Total   |                 | 951       |          |  | 1908      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1976 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 9  |
| 12. Reactor I&C Systems                        |                 | 8  |
| 13. Reactor Auxiliary Systems                  |                 | 7  |
| 15. Reactor Cooling Systems                    |                 | 20                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 31. Turbine and auxiliaries                    |                 | 5  |
| 35. All other I&C Systems                      |                 | 1  |
| 42. Electrical Power Supply Systems            |                 | 5  |
| Total  | 0               | 58                                       |

# RU-34 LENINGRAD-3

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6909.1 GW(e).h  
**Energy Availability Factor:** 86.5%  
**Load Factor:** 85.0%  
**Operating Factor:** 95.9%  
**Energy Unavailability Factor:** 13.5%  
**Total Off-line Time:** 358 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 319.5 | 606.1 | 661.7 | 634.2 | 649.0 | 631.0 | 600.8 | 309.6 | 655.1 | 677.1 | 567.2 | 597.7 | 6909.1 |
| <b>EAF (%)</b>  | 49.3  | 95.3  | 97.4  | 96.3  | 95.4  | 95.9  | 89.0  | 46.8  | 99.5  | 99.5  | 86.8  | 88.1  | 86.5   |
| <b>UCF (%)</b>  | 49.5  | 99.6  | 100.0 | 99.3  | 98.8  | 99.8  | 97.3  | 47.8  | 100.0 | 100.0 | 100.0 | 100.0 | 90.9   |
| <b>LF (%)</b>   | 46.4  | 94.1  | 96.2  | 95.4  | 94.3  | 94.7  | 87.3  | 45.0  | 98.4  | 98.3  | 85.2  | 86.9  | 85.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 51.9  | 100.0 | 100.0 | 100.0 | 100.0 | 95.9   |
| <b>EUF (%)</b>  | 50.7  | 4.7   | 2.6   | 3.7   | 4.6   | 4.1   | 11.0  | 53.2  | 0.5   | 0.5   | 13.2  | 11.9  | 13.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 50.9  | 0.0   | 0.0   | 0.0   | 0.0   | 4.3    |
| <b>UCLF (%)</b> | 50.5  | 0.4   | 0.0   | 0.7   | 1.2   | 0.2   | 2.7   | 1.3   | 0.0   | 0.0   | 0.0   | 0.0   | 4.8    |
| <b>XUF (%)</b>  | 0.2   | 4.3   | 2.6   | 3.0   | 3.4   | 3.9   | 8.3   | 1.0   | 0.5   | 0.5   | 13.2  | 11.9  | 4.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN FEBRUARY, MARCH, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 1127 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1973      **Lifetime Generation:** 139760.9 GW(e).h  
**Date of First Criticality:** 17 Sep 1979      **Cumulative Energy Availability Factor:** 69.8%  
**Date of Grid Connection:** 07 Dec 1979      **Cumulative Load Factor:** 68.8%  
**Date of Commercial Operation:** 29 Jun 1980      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 30.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6951.7         | 925.0          | 86.5   | 81.4   | 86.5                              | 80.9   | 85.6               | 80.2   | 7885               | 89.8   |
| 1989 | 6938.1         | 925.0          | 86.2   | 82.0   | 85.9                              | 81.5   | 85.6               | 80.8   | 7455               | 85.1   |
| 1990 | 7531.9         | 925.0          | 93.0   | 83.0   | 92.4                              | 82.6   | 93.0               | 82.0   | 8280               | 94.5   |
| 1991 | 6506.6         | 925.0          | 80.6   | 82.8   | 80.6                              | 82.4   | 80.3               | 81.9   | 7197               | 82.2   |
| 1992 | 5516.6         | 925.0          | 68.5   | 81.6   | 68.4                              | 81.2   | 67.9               | 80.7   | 6122               | 69.7   |
| 1993 | 7143.8         | 925.0          | 90.1   | 82.3   | 88.9                              | 81.8   | 88.2               | 81.3   | 7966               | 90.9   |
| 1994 | 6631.8         | 925.0          | 92.4   | 83.0   | 91.0                              | 82.5   | 81.8               | 81.3   | 8135               | 92.9   |
| 1995 | 3586.0         | 925.0          | 49.4   | 80.8   | 46.5                              | 80.1   | 44.3               | 78.9   | 4332               | 49.5   |
| 1996 | 0.0            | 925.0          | 0.0  | 75.8   | 0.0                               | 75.1   | 0.0                | 74.0   | 0                  | 0.0    |
| 1997 | 0.0            | 925.0          | 0.0  | 71.3   | 0.0                               | 70.7   | 0.0                | 69.6   | 0                  | 0.0    |
| 1998 | 1390.1         | 925.0          | 17.5   | 68.3   | 17.5                              | 67.8   | 17.2               | 66.7   | 1610               | 18.4   |
| 1999 | 7853.1         | 925.0          | 99.7   | 70.0   | 97.1                              | 69.3   | 96.9               | 68.3   | 8701               | 99.3   |
| 2000 | 6352.8         | 925.0          | 79.6   | 70.5   | 78.2                              | 69.7   | 78.2               | 68.8   | 7169               | 81.6   |
| 2001 | 6173.5         | 925.0          | 78.9   | 70.9   | 76.6                              | 70.1   | 76.2               | 69.2   | 7007               | 80.0   |
| 2002 | 2514.7         | 925.0          | 33.6   | 69.2   | 31.9                              | 68.3   | 31.0               | 67.4   | 3332               | 38.0   |
| 2003 | 6729.2         | 925.0          | 86.7   | 69.9   | 84.5                              | 69.0   | 83.0               | 68.1   | 8100               | 92.5   |
| 2004 | 6909.1         | 925.0          | 90.9   | 70.8   | 86.5                              | 69.8   | 85.0               | 68.8   | 8426               | 95.9   |

## RU-34 LENINGRAD-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 742.0  | 343.9   | UP1  | A41  | UNIT POWER REDUCTION CAUSED BY CONTINUATION OF MAINTENANCE WORK TO REPLACE THE TURBOGENERATOR NO. 1 GENERATOR STATOR OWING TO MELTING OF PART OF THE WINDING (START: 19 DECEMBER 2003) |
| 01 Feb | 195.0  | 16.4    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 20 Feb | 42.0   | 6.5     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 01 May | 1489.0 | 48.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 01 May | 67.0   | 9.4     | PP   | D    | MEDIUM-SCALE UNIT MAINTENANCE  |
| 27 Jun | 1872.0 | 21.9    | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE  |
| 01 Jul | 1560.0 | 27.2    | UP1  | A31  | UNIT POWER REDUCTION BECAUSE CONDENSERS OPERATING ON SEA WATER   |
| 01 Jul | 115.0  | 42.0    | XP   | K    | UNIT POWER REDUCTION OWING TO MAINTENANCE OF A POWER TRANSMISSION LINE   |
| 13 Aug | 358.0  | 333.0   | PF   | D    | INTERMEDIATE UNIT MAINTENANCE  |
| 01 Oct | 1094.0 | 91.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |
| 01 Dec | 631.0  | 82.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 62        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 476                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 358             |           |          | 1495                                     |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 209                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 2         | 2        |
| Subtotal   | 358             | 0         | 0        | 2180                                     | 67        | 2        |
| Total  |                 | 358       |          |  | 2249      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 12                                       |
| 14. Safety Systems                             |                 | 1  |
| 15. Reactor Cooling Systems                    |                 | 9  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 9  |
| 31. Turbine and auxiliaries                    |                 | 7  |
| 32. Feedwater and Main Steam System            |                 | 1  |
| 41. Main Generator Systems                     |                 | 3  |
| 42. Electrical Power Supply Systems            |                 | 14                                       |
| Total  | 0               | 56                                       |

## RU-35 LENINGRAD-4

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7232.2 GW(e).h  
**Energy Availability Factor:** 89.6%  
**Load Factor:** 89.0%  
**Operating Factor:** 93.8%  
**Energy Unavailability Factor:** 10.4%  
**Total Off-line Time:** 541 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 682.7 | 626.9 | 681.0 | 665.4 | 616.0 | 538.0 | 634.0 | 608.5 | 659.3 | 476.9 | 415.8 | 627.6 | 7232.2 |
| <b>EAF (%)</b>  | 99.2  | 97.7  | 99.1  | 99.9  | 90.0  | 82.2  | 93.2  | 89.8  | 99.1  | 69.1  | 63.9  | 91.7  | 89.6   |
| <b>UCF (%)</b>  | 99.5  | 99.2  | 100.0 | 100.0 | 90.1  | 82.5  | 100.0 | 90.3  | 99.1  | 69.2  | 77.6  | 99.9  | 92.3   |
| <b>LF (%)</b>   | 99.2  | 97.4  | 99.0  | 100.1 | 89.5  | 80.8  | 92.1  | 88.4  | 99.0  | 69.2  | 62.4  | 91.2  | 89.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 91.5  | 91.7  | 100.0 | 91.7  | 100.0 | 71.1  | 80.4  | 100.0 | 93.8   |
| <b>EUF (%)</b>  | 0.8   | 2.3   | 0.9   | 0.1   | 10.0  | 17.8  | 6.8   | 10.2  | 0.9   | 30.9  | 36.1  | 8.3   | 10.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 30.9  | 22.4  | 0.0   | 4.5    |
| <b>UCLF (%)</b> | 0.5   | 0.8   | 0.0   | 0.0   | 9.9   | 17.5  | 0.0   | 9.7   | 0.9   | 0.0   | 0.0   | 0.1   | 3.3    |
| <b>XUF (%)</b>  | 0.3   | 1.5   | 0.9   | 0.1   | 0.2   | 0.3   | 6.8   | 0.5   | 0.0   | 0.0   | 13.7  | 8.2   | 2.7    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, JULY, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 45932 MWH. ONE UNIT SHUTDOWN OCCURRED DUE TO PERSONNEL ERRORS. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Feb 1975      **Lifetime Generation:** 136057.7 GW(e).h  
**Date of First Criticality:** 29 Dec 1980      **Cumulative Energy Availability Factor:** 71.7%  
**Date of Grid Connection:** 09 Feb 1981      **Cumulative Load Factor:** 70.6%  
**Date of Commercial Operation:** 29 Aug 1981      **Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 28.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 7409.7         | 925.0          | 91.9   | 84.5   | 91.5                              | 84.0   | 91.4               | 83.7   | 8185               | 93.4   |
| 1990 | 7762.6         | 925.0          | 96.1   | 85.8   | 95.4                              | 85.3   | 95.8               | 85.1   | 8588               | 98.0   |
| 1991 | 6130.7         | 925.0          | 76.8   | 84.9   | 76.1                              | 84.4   | 75.7               | 84.1   | 6870               | 78.4   |
| 1992 | 5618.1         | 925.0          | 70.8   | 83.6   | 70.3                              | 83.1   | 69.2               | 82.8   | 6617               | 75.3   |
| 1993 | 6735.7         | 925.0          | 87.6   | 84.0   | 85.3                              | 83.3   | 83.1               | 82.8   | 7762               | 88.6   |
| 1994 | 6167.1         | 925.0          | 83.2   | 83.9   | 82.1                              | 83.2   | 76.1               | 82.3   | 7340               | 83.8   |
| 1995 | 6141.0         | 925.0          | 86.1   | 84.1   | 83.0                              | 83.2   | 75.8               | 81.8   | 7270               | 83.0   |
| 1996 | 7079.7         | 925.0          | 88.8   | 84.4   | 88.3                              | 83.5   | 87.1               | 82.2   | 8048               | 91.6   |
| 1997 | 7644.7         | 925.0          | 98.2   | 85.2   | 95.9                              | 84.3   | 94.3               | 82.9   | 8760               | 100.0  |
| 1998 | 3682.0         | 925.0          | 47.3   | 83.0   | 46.0                              | 82.0   | 45.4               | 80.7   | 4341               | 49.6   |
| 1999 | 0.0            | 925.0          | 0.0  | 78.4   | 0.0                               | 77.5   | 0.0                | 76.3   | 0                  | 0.0    |
| 2000 | 0.0            | 925.0          | 0.0  | 74.3   | 0.0                               | 73.4   | 0.0                | 72.3   | 0                  | 0.0    |
| 2001 | 3585.7         | 925.0          | 45.5   | 72.9   | 44.6                              | 72.0   | 44.3               | 70.9   | 4387               | 50.1   |
| 2002 | 7528.5         | 925.0          | 97.5   | 74.0   | 93.9                              | 73.0   | 92.9               | 71.9   | 8760               | 100.0  |
| 2003 | 1957.2         | 925.0          | 26.0   | 71.9   | 24.7                              | 70.9   | 24.2               | 69.8   | 2399               | 27.4   |
| 2004 | 7232.2         | 925.0          | 92.3   | 72.8   | 89.6                              | 71.7   | 89.0               | 70.6   | 8243               | 93.8   |



## RU-35 LENINGRAD-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Feb | 794.0 | 8.0     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 20 May | 63.0  | 67.8    | UF5  | A12  | UNIT SHUTDOWN OWING TO INADVERTENT ACTIVATION OF THE EMERGENCY PROTECTION SYSTEM KEY  |
| 11 Jun | 94.0  | 43.3    | UP1  | A41  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 2 TO ELIMINATE VIBRATION IN GENERATOR BEARING   |
| 24 Jun | 63.0  | 35.6    | UP1  | A41  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 1 BY THE PROTECTION SYSTEM FOR SHORT CIRCUIT TO EARTH IN THE STATOR CIRCUITS CAUSED BY AN OIL LEAK UNDERNEATH THE TRANSFORMER AND OVERHEATING THEREOF |
| 25 Jun | 60.0  | 33.9    | UF2  | A41  | UNIT SHUT DOWN OWING TO A REQUEST TO REPAIR THE TURBOGENERATOR NO. 1 TRANSFORMER  |
| 01 Jul | 26.0  | 5.7     | XP   | K    | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 2 OWING TO DISCONNECTION OF A POWER TRANSMISSION LINE   |
| 15 Jul | 110.0 | 38.6    | XP   | K    | UNIT POWER REDUCTION OWING TO MAINTENANCE OF A POWER TRANSMISSION LINE  |
| 01 Aug | 744.0 | 3.3     | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |
| 27 Aug | 62.0  | 66.6    | UF4  | A16  | UNIT SHUT DOWN BY THE EMERGENCY PROTECTION SYSTEM FOR A LEVEL INCREASE IN THE DRUM-TYPE STEAM SEPARATOR ON THE RIGHT SIDE OF THE REACTOR  |
| 07 Nov | 458.0 | 91.3    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 07 Dec | 356.0 | 361.6   | PF   | D    | ROUTINE UNIT MAINTENANCE  |
| 14 Dec | 432.0 | 56.2    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure  |                 | 185       |          |  | 39        |          |
| B. Refuelling without a maintenance   |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                                 |                 |           |          | 1440                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                                       | 356             |           |          | 297                                      |           |          |
| E. Testing of plant systems or components   |                 |           |          |  | 0         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling                  |                 |           |          | 265                                      |           |          |
| J. Grid failure or grid unavailability  |                 |           |          |  | 2         | 12       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)          |                 |           |          |  | 31        | 1        |
| S. Fuel management limitation (including high flux tilt, stretch out or coast-down operation) |                 |           |          |  | 0         |          |
| Subtotal  | 356             | 185       | 0        | 2002                                     | 73        | 13       |
| Total   |                 | 541       |          |  | 2088      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 1  |
| 12. Reactor I&C Systems                        | 63              |  |
| 15. Reactor Cooling Systems                    |                 | 23                                       |
| 16. Steam generation systems                   | 62              |  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 2  |
| 32. Feedwater and Main Steam System            |                 | 6  |
| 41. Main Generator Systems                     | 60              | 0  |
| 42. Electrical Power Supply Systems            |                 | 3  |
| Total  | 185             | 35                                       |

# RU-9 NOVOVORONEZH-3

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 385.0 MW(e)  
**Design Net RUP:** 385.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2313.6 GW(e).h  
**Energy Availability Factor:** 69.7%  
**Load Factor:** 68.4%  
**Operating Factor:** 82.9%  
**Energy Unavailability Factor:** 30.3%  
**Total Off-line Time:** 1502 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 240.5 | 222.6 | 231.9 | 207.5 | 206.5 | 0.0   | 5.7  | 212.2 | 237.5 | 245.6 | 247.1 | 256.7 | 2313.6 |
| <b>EAF (%)</b>  | 85.0  | 84.3  | 82.4  | 76.4  | 73.7  | 0.0   | 4.1  | 76.0  | 87.0  | 87.4  | 90.1  | 90.6  | 69.7   |
| <b>UCF (%)</b>  | 85.0  | 89.2  | 82.4  | 76.7  | 75.1  | 0.0   | 4.4  | 81.5  | 90.2  | 90.3  | 90.1  | 90.6  | 71.3   |
| <b>LF (%)</b>   | 84.0  | 83.1  | 81.0  | 75.0  | 72.1  | 0.0   | 2.0  | 74.1  | 85.7  | 85.6  | 89.1  | 89.6  | 68.4   |
| <b>OF (%)</b>   | 93.5  | 96.3  | 99.9  | 100.1 | 100.0 | 0.0   | 6.6  | 98.3  | 100.0 | 100.0 | 100.0 | 100.0 | 82.9   |
| <b>EUF (%)</b>  | 15.0  | 15.7  | 17.6  | 23.6  | 26.3  | 100.0 | 95.9 | 24.0  | 13.0  | 12.6  | 9.9   | 9.4   | 30.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 100.0 | 52.8 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.7   |
| <b>UCLF (%)</b> | 15.0  | 10.9  | 17.6  | 23.3  | 24.6  | 0.0   | 42.9 | 18.5  | 9.8   | 9.7   | 9.9   | 9.4   | 16.1   |
| <b>XUF (%)</b>  | 0.0   | 4.8   | 0.0   | 0.2   | 1.4   | 0.0   | 0.3  | 5.5   | 3.2   | 2.9   | 0.0   | 0.0   | 1.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1967      **Lifetime Generation:** 78488.6 GW(e).h  
**Date of First Criticality:** 22 Dec 1971      **Cumulative Energy Availability Factor:** 71.5%  
**Date of Grid Connection:** 27 Dec 1971      **Cumulative Load Factor:** 70.9%  
**Date of Commercial Operation:** 29 Jun 1972      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 28.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 2705.5         | 385.0          | 80.5   | 78.0   | 80.5                              | 77.9   | 80.2               | 77.7   | 8048               | 91.9   |
| 1987 | 2321.9         | 417.0          | 66.5   | 77.1   | 66.5                              | 77.1   | 63.6               | 76.7   | 6361               | 72.6   |
| 1988 | 2906.1         | 385.0          | 91.0   | 78.0   | 91.0                              | 78.0   | 85.9               | 77.3   | 8110               | 92.3   |
| 1989 | 1984.6         | 385.0          | 66.0   | 77.3   | 66.0                              | 77.3   | 58.8               | 76.2   | 6040               | 68.9   |
| 1990 | 2767.4         | 385.0          | 85.6   | 77.8   | 84.4                              | 77.7   | 82.1               | 76.5   | 8611               | 98.3   |
| 1991 | 1614.0         | 385.0          | 49.2   | 76.3   | 48.7                              | 76.2   | 47.9               | 75.0   | 5176               | 59.1   |
| 1992 | 2580.4         | 385.0          | 76.9   | 76.3   | 76.2                              | 76.2   | 76.3               | 75.1   | 6991               | 79.6   |
| 1993 | 1810.5         | 385.0          | 53.8   | 75.2   | 53.0                              | 75.1   | 53.7               | 74.1   | 4991               | 57.0   |
| 1994 | 2714.6         | 385.0          | 82.0   | 75.5   | 79.1                              | 75.2   | 80.5               | 74.3   | 7300               | 83.3   |
| 1995 | 1364.0         | 385.0          | 41.3   | 74.0   | 40.6                              | 73.7   | 40.4               | 72.9   | 3945               | 45.0   |
| 1996 | 1947.0         | 385.0          | 58.8   | 73.4   | 57.1                              | 73.1   | 57.6               | 72.2   | 5510               | 62.7   |
| 1997 | 2624.0         | 385.0          | 79.7   | 73.7   | 77.4                              | 73.2   | 77.8               | 72.5   | 7075               | 80.8   |
| 1998 | 2535.6         | 385.0          | 76.4   | 73.8   | 74.4                              | 73.3   | 75.2               | 72.6   | 6822               | 77.9   |
| 1999 | 1919.3         | 385.0          | 61.4   | 73.3   | 57.1                              | 72.7   | 56.9               | 72.0   | 5669               | 64.7   |
| 2000 | 2621.5         | 385.0          | 79.8   | 73.5   | 77.2                              | 72.8   | 77.5               | 72.2   | 7131               | 81.2   |
| 2001 | 1293.4         | 385.0          | 38.5   | 72.3   | 38.2                              | 71.6   | 38.3               | 71.0   | 3529               | 40.3   |
| 2002 | 2431.9         | 385.0          | 72.7   | 72.3   | 71.9                              | 71.7   | 72.1               | 71.1   | 6415               | 73.2   |
| 2003 | 2335.0         | 385.0          | 69.6   | 72.3   | 68.9                              | 71.6   | 69.2               | 71.0   | 6236               | 71.2   |
| 2004 | 2313.6         | 385.0          | 71.3   | 72.2   | 69.7                              | 71.5   | 68.4               | 70.9   | 7282               | 82.9   |

## RU-9 NOVovoronezh-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 686.0  | 22.9    | UP1  | H11  | UNIT POWER REDUCTION DURING REACTOR POWER LIMITATION OWING TO HEAT-UP IN THE FUEL ASSEMBLIES  |
| 30 Jan | 74.0   | 32.5    | UF1  | A31  | UNIT SHUTDOWN TO ELIMINATE STEAMING IN THE HIGH-PRESSURE CYLINDER   |
| 02 Feb | 244.0  | 13.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 12 Feb | 2618.0 | 202.0   | UP1  | H11  | UNIT POWER REDUCTION DURING REACTOR POWER LIMITATION OWING TO HEAT-UP IN THE FUEL ASSEMBLIES  |
| 01 Jun | 1081.0 | 428.0   | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 16 Jul | 117.0  | 35.9    | UF3  | Z    | EXTENSION OF UNIT OUTAGE FOR MEDIUM-SCALE MAINTENANCE   |
| 21 Jul | 1500.0 | 20.4    | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |
| 22 Jul | 230.0  | 99.6    | UF2  | A16  | UNIT SHUTDOWN TO ELIMINATE LEAK IN STEAM GENERATOR PIPING SYSTEM  |
| 03 Aug | 246.0  | 21.0    | UP1  | H    | UNIT POWER REDUCTION OWING TO REACTOR THERMAL POWER LIMITATION IN LINE WITH AN ORDER FROM THE DESIGN ORGANIZATION   |
| 03 Aug | 2196.0 | 13.7    | XP   | H    | UNIT POWER REDUCTION OWING TO HEAT TRANSFER ABOVE THE LEVEL STIPULATED IN THE TECHNICAL SPECIFICATIONS FOR PLANT AUXILIARY REQUIREMENTS AND OUTSIDE CONSUMERS |
| 03 Aug | 3600.0 | 127.0   | UP1  | H    | UNIT POWER REDUCTION BECAUSE OF REACTOR THERMAL POWER LIMITATION OWING TO HEAT-UP IN THE FUEL ASSEMBLIES  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 304       |          |  | 122       |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1081            |           |          | 1471                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 151                                      |           |          |
| Z. Others   |                 | 117       |          |  | 3         |          |
| Subtotal  | 1081            | 421       | 0        | 1622                                     | 125       | 0        |
| Total   |                 | 1502      |          |  | 1747      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             |                 | 15                                       |
| 15. Reactor Cooling Systems         |                 | 1  |
| 16. Steam generation systems        | 230             | 62                                       |
| 31. Turbine and auxiliaries         | 74              |  |
| 32. Feedwater and Main Steam System |                 | 12                                       |
| 35. All other I&C Systems           |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 1  |
| Total                               | 304             | 92                                       |

## RU-11 NOVORONEZH-4

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 385.0 MW(e)  
**Design Net RUP:** 385.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 2714.0 GW(e).h  
**Energy Availability Factor:** 80.8%  
**Load Factor:** 80.3%  
**Operating Factor:** 87.5%  
**Energy Unavailability Factor:** 19.2%  
**Total Off-line Time:** 1099 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 275.4 | 257.5 | 273.9 | 259.3 | 240.5 | 231.3 | 248.8 | 247.0 | 131.0 | 8.4  | 268.6 | 272.3 | 2714.0 |
| <b>EAF (%)</b>  | 95.8  | 96.0  | 95.6  | 93.5  | 84.4  | 84.6  | 88.9  | 87.0  | 47.7  | 4.6  | 96.9  | 95.3  | 80.8   |
| <b>UCF (%)</b>  | 99.4  | 98.0  | 96.5  | 94.7  | 86.0  | 95.6  | 95.0  | 94.2  | 49.8  | 4.6  | 96.9  | 95.4  | 83.8   |
| <b>LF (%)</b>   | 96.2  | 96.1  | 95.6  | 93.7  | 83.9  | 83.4  | 86.9  | 86.2  | 47.3  | 2.9  | 96.9  | 95.1  | 80.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 90.6  | 100.0 | 100.0 | 100.0 | 53.3  | 7.0  | 100.0 | 100.0 | 87.5   |
| <b>EUF (%)</b>  | 4.2   | 4.0   | 4.4   | 6.5   | 15.6  | 15.4  | 11.1  | 13.0  | 52.3  | 95.4 | 3.1   | 4.7   | 19.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 46.9  | 95.4 | 0.0   | 0.0   | 11.9   |
| <b>UCLF (%)</b> | 0.6   | 2.0   | 3.5   | 5.3   | 14.0  | 4.4   | 5.0   | 5.8   | 3.4   | 0.0  | 3.1   | 4.6   | 4.3    |
| <b>XUF (%)</b>  | 3.6   | 2.1   | 0.9   | 1.2   | 1.6   | 11.1  | 6.1   | 7.3   | 2.1   | 0.0  | 0.0   | 0.1   | 3.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 211 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Jul 1967      **Lifetime Generation:** 83504.1 GW(e).h  
**Date of First Criticality:** 25 Dec 1972      **Cumulative Energy Availability Factor:** 77.6%  
**Date of Grid Connection:** 28 Dec 1972      **Cumulative Load Factor:** 77.1%  
**Date of Commercial Operation:** 24 Mar 1973      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 22.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 3262.7         | 417.0          | 91.7   | 83.2   | 91.7                              | 83.2   | 89.3               | 83.4   | 8252               | 94.2   |
| 1988 | 2529.4         | 385.0          | 80.0   | 83.0   | 80.0                              | 83.0   | 74.8               | 82.8   | 7152               | 81.4   |
| 1989 | 2710.3         | 385.0          | 90.2   | 83.4   | 90.2                              | 83.4   | 80.4               | 82.7   | 8357               | 95.4   |
| 1990 | 2244.7         | 385.0          | 70.5   | 82.7   | 69.6                              | 82.6   | 66.6               | 81.7   | 6622               | 75.6   |
| 1991 | 1827.6         | 385.0          | 58.2   | 81.3   | 58.0                              | 81.3   | 54.2               | 80.2   | 5540               | 63.2   |
| 1992 | 2853.4         | 385.0          | 87.3   | 81.6   | 82.4                              | 81.3   | 84.4               | 80.4   | 8163               | 92.9   |
| 1993 | 2613.7         | 385.0          | 79.7   | 81.5   | 76.6                              | 81.1   | 77.5               | 80.3   | 7204               | 82.2   |
| 1994 | 1954.3         | 385.0          | 66.9   | 80.8   | 56.6                              | 79.9   | 57.9               | 79.2   | 6033               | 68.9   |
| 1995 | 2120.0         | 385.0          | 65.5   | 80.2   | 62.2                              | 79.1   | 62.9               | 78.5   | 5818               | 66.4   |
| 1996 | 3080.3         | 385.0          | 93.8   | 80.8   | 90.4                              | 79.6   | 91.1               | 79.0   | 8362               | 95.2   |
| 1997 | 2235.5         | 385.0          | 70.3   | 80.3   | 67.0                              | 79.1   | 66.3               | 78.5   | 6690               | 76.4   |
| 1998 | 2714.9         | 385.0          | 83.2   | 80.4   | 80.2                              | 79.1   | 80.5               | 78.6   | 7366               | 84.1   |
| 1999 | 1791.5         | 385.0          | 54.9   | 79.5   | 53.2                              | 78.1   | 53.1               | 77.6   | 4927               | 56.2   |
| 2000 | 2474.3         | 385.0          | 74.6   | 79.3   | 73.1                              | 77.9   | 73.2               | 77.4   | 6784               | 77.2   |
| 2001 | 2656.0         | 385.0          | 80.7   | 79.3   | 79.2                              | 78.0   | 78.8               | 77.5   | 7173               | 81.9   |
| 2002 | 2184.8         | 385.0          | 65.4   | 78.8   | 64.2                              | 77.5   | 64.8               | 77.1   | 5857               | 66.9   |
| 2003 | 2583.1         | 385.0          | 78.8   | 78.8   | 76.8                              | 77.5   | 76.6               | 77.0   | 6950               | 79.3   |
| 2004 | 2714.0         | 385.0          | 83.8   | 79.0   | 80.8                              | 77.6   | 80.3               | 77.1   | 7685               | 87.5   |

## RU-11 NOVovoronezh-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 7685.0 | 17.2    | XP   | H    | UNIT POWER REDUCTION OWING TO HEAT TRANSFER ABOVE THE LEVEL STIPULATED IN THE TECHNICAL SPECIFICATIONS FOR PLANT AUXILIARY REQUIREMENTS AND OUTSIDE CONSUMERS |
| 01 Jan | 238.0  | 10.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 08 Jan | 2436.0 | 30.4    | UP1  | H11  | UNIT POWER REDUCTION DURING REACTOR POWER LIMITATION OWING TO HEAT-UP IN THE FUEL ASSEMBLIES  |
| 01 Apr | 70.0   | 29.7    | UP1  | M    | UNIT SHUT DOWN TO IMPLEMENT A PROGRAMME TO REDUCE THE PRESSURE DIFFERENCE IN THE CORE   |
| 05 May | 3266.0 | 42.3    | XP   | N    | POWER REDUCTION DURING UNIT OPERATION OWING TO INCREASED CIRCULATING WATER TEMPERATURE  |
| 05 May | 3266.0 | 62.4    | UP1  | H11  | UNIT POWER REDUCTION BECAUSE OF REACTOR THERMAL POWER LIMITATION OWING TO HEAT-UP IN THE FUEL ASSEMBLIES  |
| 03 Jun | 577.0  | 20.4    | XP   | K    | UNIT POWER REDUCTION OWING TO ELECTRICITY GENERATION CONDITIONS IN THE FREE TRADE SECTOR  |
| 16 Sep | 1030.0 | 403.7   | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 26 Nov | 840.0  | 21.7    | UP1  | H11  | UNIT POWER REDUCTION OWING TO HEAT-UP IN THE FUEL ASSEMBLIES  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 55        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1030            |           |          | 1058  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 138   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 17  |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 84  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 3   | 20        |          |
| Subtotal   | 1030            | 0         | 0        | 1300  | 77        | 0        |
| Total  |                 | 1030      |          |   | 1377      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1973 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 16  |
| 15. Reactor Cooling Systems         |                    | 1   |
| 16. Steam generation systems        |                    | 24  |
| 32. Feedwater and Main Steam System |                    | 12  |
| Total                               | 0                  | 53  |

# RU-20 NOVORONEZH-5

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3610.6 GW(e).h  
**Energy Availability Factor:** 43.1%  
**Load Factor:** 43.3%  
**Operating Factor:** 45.9%  
**Energy Unavailability Factor:** 56.9%  
**Total Off-line Time:** 4752 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 685.3 | 440.7 | 604.1 | 690.1 | 706.0 | 484.4 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3610.6 |
| <b>EAF (%)</b>  | 96.0  | 67.2  | 85.1  | 100.0 | 99.6  | 71.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 43.1   |
| <b>UCF (%)</b>  | 99.4  | 67.2  | 86.0  | 100.0 | 100.0 | 72.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 43.6   |
| <b>LF (%)</b>   | 97.0  | 66.7  | 85.5  | 101.0 | 99.9  | 70.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 43.3   |
| <b>OF (%)</b>   | 100.0 | 87.1  | 92.6  | 100.1 | 100.0 | 73.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 45.9   |
| <b>EUF (%)</b>  | 4.0   | 32.8  | 14.9  | 0.0   | 0.4   | 28.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 56.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 27.3  | 100.0 | 100.0 | 33.3  | 0.0   | 0.0   | 0.0   | 21.9   |
| <b>UCLF (%)</b> | 0.6   | 32.8  | 14.0  | 0.0   | 0.0   | 0.3   | 0.0   | 0.0   | 66.7  | 100.0 | 100.0 | 100.0 | 34.5   |
| <b>XUF (%)</b>  | 3.4   | 0.0   | 0.9   | 0.0   | 0.4   | 1.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 20447 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1974      **Lifetime Generation:** 123572.0 GW(e).h  
**Date of First Criticality:** 30 Apr 1980      **Cumulative Energy Availability Factor:** 61.8%  
**Date of Grid Connection:** 31 May 1980      **Cumulative Load Factor:** 61.4%  
**Date of Commercial Operation:** 20 Feb 1981      **Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 38.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 3017.8         | 950.0          | 36.5   | 70.3   | 36.5                              | 70.2   | 36.2               | 70.0   | 3439               | 39.2   |
| 1989 | 3308.9         | 950.0          | 40.9   | 66.6   | 40.9                              | 66.6   | 39.8               | 66.3   | 3778               | 43.1   |
| 1990 | 3913.3         | 950.0          | 47.7   | 64.5   | 47.6                              | 64.5   | 47.0               | 64.1   | 4715               | 53.8   |
| 1991 | 5878.2         | 950.0          | 71.5   | 65.2   | 71.5                              | 65.2   | 70.6               | 64.8   | 6996               | 79.9   |
| 1992 | 3752.8         | 950.0          | 45.9   | 63.5   | 45.7                              | 63.4   | 45.0               | 63.0   | 5244               | 59.7   |
| 1993 | 5935.4         | 950.0          | 73.8   | 64.3   | 72.6                              | 64.2   | 71.3               | 63.7   | 7448               | 85.0   |
| 1994 | 2281.9         | 950.0          | 33.2   | 61.9   | 28.9                              | 61.5   | 27.4               | 60.9   | 4288               | 48.9   |
| 1995 | 4753.7         | 950.0          | 63.9   | 62.1   | 57.5                              | 61.2   | 57.1               | 60.6   | 6670               | 76.1   |
| 1996 | 3861.8         | 950.0          | 46.7   | 61.0   | 46.7                              | 60.2   | 46.3               | 59.7   | 4759               | 54.2   |
| 1997 | 5949.3         | 950.0          | 71.7   | 61.7   | 71.4                              | 60.9   | 71.5               | 60.4   | 6854               | 78.2   |
| 1998 | 3771.8         | 950.0          | 45.5   | 60.8   | 44.9                              | 60.0   | 45.3               | 59.5   | 4457               | 50.9   |
| 1999 | 4845.4         | 950.0          | 61.2   | 60.8   | 58.7                              | 59.9   | 58.2               | 59.5   | 6062               | 69.2   |
| 2000 | 5278.6         | 950.0          | 65.6   | 61.0   | 63.5                              | 60.1   | 63.3               | 59.7   | 6479               | 73.8   |
| 2001 | 5984.6         | 950.0          | 73.2   | 61.6   | 72.3                              | 60.7   | 71.9               | 60.3   | 7508               | 85.7   |
| 2002 | 6762.2         | 950.0          | 83.1   | 62.7   | 80.7                              | 61.7   | 81.3               | 61.3   | 7430               | 84.8   |
| 2003 | 6951.2         | 950.0          | 84.5   | 63.7   | 83.1                              | 62.6   | 83.5               | 62.3   | 7507               | 85.7   |
| 2004 | 3610.6         | 950.0          | 43.6   | 62.8   | 43.1                              | 61.8   | 43.3               | 61.4   | 4032               | 45.9   |

# RU-20 NOVOVORONEZH-5

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 102.0  | 9.7     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 07 Jan | 30.0   | 2.5     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 11 Jan | 32.0   | 4.9     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 11 Jan | 12.0   | 4.1     | UP1  | A31  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 1 TO REPLACE A BEARING IN THE CAM OF THE CONTROL VALVE B FEEDBACK   |
| 17 Jan | 51.0   | 5.7     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 20 Jan | 11.0   | 1.2     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 14 Feb | 44.0   | 44.9    | UF2  | A42  | UNIT SHUTDOWN OWING TO INTERNAL DAMAGE TO AUXILIARY POWER TRANSFORMER R-14T   |
| 16 Feb | 280.0  | 127.0   | UP1  | A42  | UNIT POWER REDUCTION DURING OPERATION WITH TURBOGENERATOR NO. 2 DISCONNECTED OWING TO SHUTDOWN OF AUXILIARY POWER TRANSFORMER R-14T   |
| 28 Feb | 101.0  | 100.3   | UF2  | A16  | UNIT SHUTDOWN IN ORDER TO ELIMINATE A LEAK IN THE CONTROL CIRCUIT PIPE COUPLING OF THE STEAM GENERATOR PULSED SAFETY MECHANISM  |
| 03 Mar | 79.0   | 36.0    | UP1  | A42  | UNIT POWER REDUCTION DURING OPERATION WITH TURBOGENERATOR NO. 2 DISCONNECTED OWING TO SHUTDOWN OF AUXILIARY TRANSFORMER R-14T   |
| 06 Mar | 11.0   | 5.4     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 07 Mar | 10.0   | 7.9     | UP2  | A31  | UNIT POWER REDUCTION AND SHUTDOWN OF TURBOGENERATOR NO. 1 WHEN TURBINE-DRIVEN FEED PUMP NO.1 CUT OUT OWING TO A FAULT IN THE TURBINE ELECTROHYDRAULIC CONTROL SYSTEM AND ERRONEOUS STAFF ACTION |
| 01 May | 1273.0 | 7.8     | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |
| 01 Jun | 529.0  | 2.3     | UP1  | A31  | UNIT POWER REDUCTION OWING TO FOULING OF THE TURBINE CONDENSERS   |
| 23 Jun | 1896.0 | 1801.2  | PF   | D    | MAJOR UNIT OVERHAUL   |
| 11 Sep | 2689.0 | 2554.6  | UF3  | A11  | EXTENSION OF UNIT OUTAGE FOR MAJOR OVERHAUL OWING TO MAINTENANCE WORK ON THE UPPER SECTION OF THE REACTOR   |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 2834      |          |  | 582       |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 1325                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       | 1896            |           |          | 564                                      |           |          |
| Subtotal  | 1896            | 2834      | 0        | 1889                                     | 583       | 0        |
| Total   |                 | 4730      |          |  | 2472      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         | 2689            | 49                                       |
| 12. Reactor I&C Systems             |                 | 20                                       |
| 13. Reactor Auxiliary Systems       |                 | 4  |
| 14. Safety Systems                  |                 | 3  |
| 15. Reactor Cooling Systems         |                 | 61                                       |
| 16. Steam generation systems        | 101             | 314                                      |
| 31. Turbine and auxiliaries         |                 | 6  |
| 32. Feedwater and Main Steam System |                 | 22                                       |
| 35. All other I&C Systems           |                 | 4  |
| 41. Main Generator Systems          |                 | 82                                       |
| 42. Electrical Power Supply Systems | 44              | 3  |
| XX. Miscellaneous Systems           |                 | 10                                       |
| Total                               | 2834            | 578                                      |

# RU-23 SMOLENSK-1

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)  
**Contractor:** FAEA (Federal Atomic Energy Agency)

## 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2337.1 GW(e).h  
**Energy Availability Factor:** 28.5%  
**Load Factor:** 28.8%  
**Operating Factor:** 29.5%  
**Energy Unavailability Factor:** 71.5%  
**Total Off-line Time:** 6192 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 682.1 | 645.3 | 678.6 | 331.1 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2337.1 |
| <b>EAF (%)</b>  | 97.6  | 98.7  | 97.5  | 50.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 28.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 51.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 29.1   |
| <b>LF (%)</b>   | 99.1  | 100.2 | 98.6  | 49.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 28.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 56.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 29.5   |
| <b>EUF (%)</b>  | 2.4   | 1.3   | 2.5   | 49.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 71.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 48.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 70.9   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 2.4   | 1.3   | 2.5   | 0.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 13126 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1975      **Lifetime Generation:** 123362.2 GW(e).h  
**Date of First Criticality:** 10 Sep 1982      **Cumulative Energy Availability Factor:** 69.5%  
**Date of Grid Connection:** 09 Dec 1982      **Cumulative Load Factor:** 69.3%  
**Date of Commercial Operation:** 30 Sep 1983      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 30.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6695.6         | 925.0          | 81.9   | 73.3   | 81.9                              | 72.8   | 82.4               | 72.7   | 7288               | 83.0   |
| 1989 | 6506.5         | 925.0          | 79.7   | 74.4   | 79.3                              | 73.9   | 80.3               | 73.9   | 7177               | 81.9   |
| 1990 | 6227.8         | 925.0          | 76.6   | 74.7   | 76.1                              | 74.2   | 76.9               | 74.3   | 6851               | 78.2   |
| 1991 | 6693.9         | 925.0          | 81.3   | 75.5   | 81.3                              | 75.1   | 82.6               | 75.4   | 7252               | 82.8   |
| 1992 | 6849.4         | 925.0          | 83.7   | 76.4   | 83.7                              | 76.0   | 84.3               | 76.3   | 7563               | 86.1   |
| 1993 | 6290.6         | 925.0          | 78.4   | 76.6   | 78.0                              | 76.2   | 77.6               | 76.5   | 6993               | 79.8   |
| 1994 | 4217.8         | 925.0          | 71.0   | 76.1   | 57.8                              | 74.6   | 52.1               | 74.3   | 6286               | 71.8   |
| 1995 | 5002.5         | 925.0          | 77.3   | 76.2   | 63.0                              | 73.6   | 61.7               | 73.2   | 6390               | 72.9   |
| 1996 | 5666.4         | 925.0          | 71.7   | 75.9   | 71.6                              | 73.5   | 69.7               | 73.0   | 6604               | 75.2   |
| 1997 | 4674.5         | 925.0          | 59.1   | 74.7   | 57.8                              | 72.3   | 57.7               | 71.9   | 5366               | 61.3   |
| 1998 | 3554.1         | 925.0          | 58.9   | 73.6   | 45.0                              | 70.5   | 43.9               | 70.0   | 5411               | 61.8   |
| 1999 | 6478.9         | 925.0          | 83.5   | 74.2   | 80.1                              | 71.1   | 80.0               | 70.6   | 7417               | 84.7   |
| 2000 | 5228.5         | 925.0          | 64.4   | 73.7   | 63.8                              | 70.7   | 64.3               | 70.3   | 5738               | 65.3   |
| 2001 | 5165.1         | 925.0          | 67.4   | 73.3   | 63.2                              | 70.3   | 63.7               | 69.9   | 5940               | 67.8   |
| 2002 | 6866.7         | 925.0          | 85.1   | 73.9   | 83.7                              | 71.0   | 84.7               | 70.7   | 7587               | 86.6   |
| 2003 | 6711.8         | 925.0          | 84.4   | 74.5   | 82.9                              | 71.6   | 82.8               | 71.3   | 7533               | 86.0   |
| 2004 | 2337.1         | 925.0          | 29.1   | 72.3   | 28.5                              | 69.5   | 28.8               | 69.3   | 2592               | 29.5   |



**RU-23 SMOLENSK-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 240.0  | 16.4    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER    |
| 01 Mar | 471.0  | 17.5    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER    |
| 18 Apr | 6192.0 | 5761.5  | PF   | G    | MAJOR UNIT OVERHAUL INCLUDING PARTIAL REPLACEMENT OF PROCESS CHANNELS |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure  |                 |           |          |   | 80        |          |
| B. Refuelling without a maintenance   |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                   |                 |           |          | 1166  |           |          |
| D. Inspection, maintenance or repair without refuelling                         |                 |           |          | 486   |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling | 6192            |           |          |   |           | 21       |
| Subtotal  | 6192            | 0         | 0        | 1652  | 80        | 21       |
| Total   |                 | 6192      |          |   | 1753      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 20  |
| 12. Reactor I&C Systems             |                    | 19  |
| 13. Reactor Auxiliary Systems       |                    | 14  |
| 14. Safety Systems                  |                    | 8   |
| 32. Feedwater and Main Steam System |                    | 14  |
| 42. Electrical Power Supply Systems |                    | 0   |
| Total                               | 0                  | 75  |

## RU-24 SMOLENSK-2

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7480.1 GW(e).h  
**Energy Availability Factor:** 90.9%  
**Load Factor:** 92.1%  
**Operating Factor:** 94.6%  
**Energy Unavailability Factor:** 9.1%  
**Total Off-line Time:** 472 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 691.3 | 655.0 | 655.8 | 664.2 | 689.5 | 621.1 | 617.9 | 632.9 | 205.9 | 676.6 | 671.1 | 698.8 | 7480.1 |
| <b>EAF (%)</b>  | 97.8  | 98.9  | 94.3  | 98.7  | 99.1  | 93.1  | 89.8  | 91.4  | 31.8  | 96.6  | 98.8  | 99.1  | 90.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 96.9  | 100.0 | 100.0 | 100.0 | 99.2  | 97.0  | 33.3  | 96.6  | 100.0 | 100.0 | 93.7   |
| <b>LF (%)</b>   | 100.4 | 101.7 | 95.3  | 99.9  | 100.2 | 93.3  | 89.8  | 92.0  | 30.9  | 98.2  | 100.8 | 101.5 | 92.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 34.4  | 100.0 | 100.0 | 100.0 | 94.6   |
| <b>EUF (%)</b>  | 2.2   | 1.1   | 5.7   | 1.3   | 0.9   | 6.9   | 10.2  | 8.6   | 68.2  | 3.4   | 1.2   | 0.9   | 9.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 66.7  | 3.4   | 0.0   | 0.0   | 5.8    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 3.1   | 0.0   | 0.0   | 0.0   | 0.8   | 3.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 2.2   | 1.1   | 2.6   | 1.3   | 0.9   | 6.9   | 9.4   | 5.6   | 1.5   | 0.0   | 1.2   | 0.9   | 2.8    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 46701 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Jun 1976      **Lifetime Generation:** 118662.8 GW(e).h  
**Date of First Criticality:** 09 Apr 1985      **Cumulative Energy Availability Factor:** 74.6%  
**Date of Grid Connection:** 31 May 1985      **Cumulative Load Factor:** 74.4%  
**Date of Commercial Operation:** 02 Jul 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 25.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6757.2         | 925.0          | 83.5   | 80.1   | 83.5                              | 80.0   | 83.2               | 79.2   | 7594               | 86.5   |
| 1989 | 6627.3         | 925.0          | 81.8   | 80.5   | 81.5                              | 80.4   | 81.8               | 79.8   | 7336               | 83.7   |
| 1990 | 6710.6         | 925.0          | 83.0   | 81.0   | 82.5                              | 80.8   | 82.8               | 80.4   | 7453               | 85.1   |
| 1991 | 5796.7         | 925.0          | 71.4   | 79.4   | 71.4                              | 79.3   | 71.5               | 79.0   | 6495               | 74.1   |
| 1992 | 6731.6         | 925.0          | 83.9   | 80.0   | 82.6                              | 79.7   | 82.9               | 79.5   | 7472               | 85.1   |
| 1993 | 6634.1         | 925.0          | 84.9   | 80.6   | 82.7                              | 80.1   | 81.9               | 79.8   | 7492               | 85.5   |
| 1994 | 5259.8         | 925.0          | 80.3   | 80.6   | 66.6                              | 78.6   | 64.9               | 78.2   | 7044               | 80.4   |
| 1995 | 5337.4         | 925.0          | 80.3   | 80.6   | 66.8                              | 77.4   | 65.9               | 76.9   | 6738               | 76.9   |
| 1996 | 6127.7         | 925.0          | 79.1   | 80.4   | 77.8                              | 77.5   | 75.4               | 76.8   | 7010               | 79.8   |
| 1997 | 4991.0         | 925.0          | 61.7   | 78.9   | 61.6                              | 76.2   | 61.6               | 75.5   | 5642               | 64.4   |
| 1998 | 5297.0         | 925.0          | 73.9   | 78.5   | 65.6                              | 75.4   | 65.4               | 74.8   | 6576               | 75.1   |
| 1999 | 5362.5         | 925.0          | 69.1   | 77.8   | 66.0                              | 74.7   | 66.2               | 74.2   | 6090               | 69.5   |
| 2000 | 6566.1         | 925.0          | 80.5   | 78.0   | 80.1                              | 75.1   | 80.8               | 74.6   | 7108               | 80.9   |
| 2001 | 6457.6         | 925.0          | 81.0   | 78.2   | 79.0                              | 75.3   | 79.7               | 74.9   | 7537               | 86.0   |
| 2002 | 3431.1         | 925.0          | 43.6   | 76.2   | 41.7                              | 73.3   | 42.3               | 73.0   | 3890               | 44.4   |
| 2003 | 6438.6         | 925.0          | 81.4   | 76.5   | 79.1                              | 73.6   | 79.5               | 73.4   | 7734               | 88.3   |
| 2004 | 7480.1         | 925.0          | 93.7   | 77.4   | 90.9                              | 74.6   | 92.1               | 74.4   | 8312               | 94.6   |

## RU-24 SMOLENSK-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 240.0  | 15.1    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Mar | 479.0  | 17.9    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 01 Mar | 39.0   | 21.2    | UP1  | A41  | UNIT POWER REDUCTION WHEN TURBOGENERATOR NO. 1 WAS SHUT DOWN FOR REPAIRS AS A RESULT OF A HYDROGEN LEAK FROM THE GENERATOR GAS COOLER CIRCUIT |
| 01 May | 2736.0 | 103.0   | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |
| 12 Jun | 777.0  | 62.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 31 Jul | 46.0   | 26.6    | UP1  | A41  | UNIT POWER REDUCTION AND DISCONNECTION OF TURBOGENERATOR NO. 1 TO ELIMINATE A HYDROGEN LEAK IN A BEARING                                      |
| 11 Sep | 472.0  | 444.1   | PF   | D    | ROUTINE UNIT MAINTENANCE  |
| 01 Oct | 14.0   | 23.4    | PP   | D    | UNIT POWER RAISE FOLLOWING ROUTINE MAINTENANCE  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 68        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 962                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 472             |           |          | 434                                      |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 240                                      |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 18       |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         |          |
| Subtotal   | 472             | 0         | 0        | 1636                                     | 75        | 20       |
| Total  |                 | 472       |          |  | 1731      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 13                                       |
| 15. Reactor Cooling Systems                    |                 | 24                                       |
| 16. Steam generation systems                   |                 | 2  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 31. Turbine and auxiliaries                    |                 | 1  |
| 42. Electrical Power Supply Systems            |                 | 18                                       |
| Total  | 0               | 61                                       |

## RU-67 SMOLENSK-3

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** LWGR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 925.0 MW(e)  
**Design Discharge Burnup:** 22200 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 7085.7 GW(e).h  
**Energy Availability Factor:** 86.9%  
**Load Factor:** 87.2%  
**Operating Factor:** 88.4%  
**Energy Unavailability Factor:** 13.1%  
**Total Off-line Time:** 1019 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 682.5 | 638.8 | 686.1 | 546.2 | 0.0   | 476.4 | 670.5 | 673.3 | 663.2 | 693.4 | 665.8 | 689.5 | 7085.7 |
| <b>EAF (%)</b>  | 98.2  | 98.0  | 99.2  | 81.8  | 0.0   | 72.5  | 97.7  | 98.5  | 99.7  | 100.0 | 98.8  | 99.0  | 86.9   |
| <b>UCF (%)</b>  | 100.0 | 98.9  | 100.0 | 82.2  | 0.0   | 74.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.9   |
| <b>LF (%)</b>   | 99.2  | 99.2  | 99.7  | 82.1  | 0.0   | 71.5  | 97.4  | 97.8  | 99.6  | 100.6 | 100.0 | 100.2 | 87.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 83.4  | 0.0   | 78.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.4   |
| <b>EUF (%)</b>  | 1.8   | 2.0   | 0.8   | 18.2  | 100.0 | 27.5  | 2.3   | 1.5   | 0.3   | 0.0   | 1.2   | 1.0   | 13.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 17.8  | 100.0 | 25.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.1   |
| <b>UCLF (%)</b> | 0.0   | 1.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>XUF (%)</b>  | 1.8   | 1.0   | 0.8   | 0.4   | 0.0   | 1.6   | 2.3   | 1.5   | 0.3   | 0.0   | 1.2   | 1.0   | 1.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 42423 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 May 1984      **Lifetime Generation:** 93493.6 GW(e).h  
**Date of First Criticality:** 01 Dec 1989      **Cumulative Energy Availability Factor:** 78.5%  
**Date of Grid Connection:** 17 Jan 1990      **Cumulative Load Factor:** 78.3%  
**Date of Commercial Operation:** 12 Oct 1990      **Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 21.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 4570.8         | 925.0          | 0.0  | 0.0    | 60.4                              | 100.0  | 59.1               | 0.0    | 6767               | 81.0   |
| 1991 | 6561.7         | 925.0          | 80.9   | 80.9   | 80.9                              | 80.9   | 81.0               | 81.0   | 7338               | 83.8   |
| 1992 | 6866.6         | 925.0          | 83.9   | 82.4   | 83.9                              | 82.4   | 84.5               | 82.8   | 7515               | 85.6   |
| 1993 | 6596.0         | 925.0          | 82.6   | 82.5   | 81.4                              | 82.1   | 81.4               | 82.3   | 7419               | 84.7   |
| 1994 | 5513.7         | 925.0          | 82.3   | 82.4   | 72.5                              | 79.7   | 68.0               | 78.7   | 6701               | 76.5   |
| 1995 | 5091.0         | 925.0          | 78.2   | 81.6   | 63.2                              | 76.4   | 62.8               | 75.6   | 5844               | 66.7   |
| 1996 | 6496.6         | 925.0          | 82.2   | 81.7   | 80.8                              | 77.1   | 80.0               | 76.3   | 7268               | 82.7   |
| 1997 | 5559.3         | 925.0          | 69.3   | 79.9   | 69.3                              | 76.0   | 68.6               | 75.2   | 6469               | 73.8   |
| 1998 | 4575.9         | 925.0          | 69.0   | 78.5   | 57.5                              | 73.7   | 56.5               | 72.9   | 6162               | 70.3   |
| 1999 | 6411.0         | 925.0          | 79.3   | 78.6   | 78.2                              | 74.2   | 79.1               | 73.6   | 7063               | 80.6   |
| 2000 | 6970.5         | 925.0          | 84.7   | 79.2   | 84.6                              | 75.2   | 85.8               | 74.8   | 7542               | 85.9   |
| 2001 | 6951.7         | 925.0          | 87.3   | 80.0   | 85.4                              | 76.2   | 85.8               | 75.8   | 7823               | 89.3   |
| 2002 | 7204.9         | 925.0          | 88.7   | 80.7   | 87.7                              | 77.1   | 88.9               | 76.9   | 7831               | 89.4   |
| 2003 | 7038.2         | 925.0          | 87.1   | 81.2   | 86.3                              | 77.8   | 86.9               | 77.6   | 7697               | 87.9   |
| 2004 | 7085.7         | 925.0          | 87.9   | 81.7   | 86.9                              | 78.5   | 87.2               | 78.3   | 7765               | 88.4   |

## RU-67 SMOLENSK-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 644.0  | 27.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER    |
| 25 Apr | 1019.0 | 979.2   | PF   | D    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 11 Jun | 432.0  | 11.0    | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER    |
| 01 Jul | 1752.0 | 27.8    | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 68        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 914                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 1019            |           |          | 395                                      |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 107      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 35        |          |
| Subtotal   | 1019            | 0         | 0        | 1309                                     | 103       | 107      |
| Total  |                 | 1019      |          |  | 1519      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1990 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 12                                       |
| 13. Reactor Auxiliary Systems            |                 | 7  |
| 21. Fuel Handling and Storage Facilities |                 | 24                                       |
| 35. All other I&C Systems                |                 | 7  |
| 41. Main Generator Systems               |                 | 3  |
| 42. Electrical Power Supply Systems      |                 | 3  |
| 99. No System Code                       |                 | 9  |
| Total                                    | 0               | 65                                       |

## RU-59 VOLGODONSK-1

**Operator:** REA (ROSENERGOATOM, CONSORTIUM)

**Contractor:** FAEA (Federal Atomic Energy Agency)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** —

### 2. Production Summary 2004

**Energy Production:** 7439.3 GW(e).h  
**Energy Availability Factor:** 87.8%  
**Load Factor:** 89.1%  
**Operating Factor:** 88.4%  
**Energy Unavailability Factor:** 12.2%  
**Total Off-line Time:** 1018 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 704.6 | 684.2 | 731.7 | 707.3 | 0.0   | 391.0 | 702.4 | 704.3 | 687.8 | 715.8 | 693.8 | 716.6 | 7439.3 |
| <b>EAF (%)</b>  | 97.5  | 100.0 | 99.8  | 99.9  | 0.0   | 58.3  | 99.2  | 99.4  | 99.9  | 100.0 | 100.0 | 100.0 | 87.8   |
| <b>UCF (%)</b>  | 98.2  | 100.0 | 99.8  | 99.9  | 0.0   | 58.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.0   |
| <b>LF (%)</b>   | 99.7  | 103.5 | 103.5 | 103.5 | 0.0   | 57.2  | 99.4  | 99.6  | 100.6 | 101.1 | 101.4 | 101.4 | 89.1   |
| <b>OF (%)</b>   | 98.3  | 100.0 | 99.9  | 100.1 | 0.0   | 63.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.4   |
| <b>EUF (%)</b>  | 2.5   | 0.0   | 0.2   | 0.1   | 100.0 | 41.7  | 0.8   | 0.6   | 0.1   | 0.0   | 0.0   | 0.0   | 12.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 100.0 | 41.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.9   |
| <b>UCLF (%)</b> | 1.8   | 0.0   | 0.2   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 0.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.8   | 0.6   | 0.1   | 0.0   | 0.0   | 0.0   | 0.2    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THE RUSSIAN NPPS ARE OPERATING IN THE BASELOAD MODE AGREED WITH THE RUSSIA'S FEDERAL ENERGY COMMISSION. UNIT OPERATION AT POWER LEVEL ABOVE INSTALLED CAPACITY TOOK PLACE IN JANUARY, FEBRUARY, MARCH, APRIL, JUNE, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER. ADDITIONAL ELECTRICITY GENERATION AMOUNTED TO 101052 MWH. RADIONUCLIDES CONTENT IN THE MONITORED ENVIRONMENTAL OBJECTS IN THE PLANT VICINITY WAS ON THE LEVEL OF AVERAGE BACKGROUND VALUES TYPICAL FOR THE EUROPEAN PART OF THE RUSSIAN FEDERATION.

### 5. Historical Summary

**Date of Construction Start:** 01 Sep 1981      **Lifetime Generation:** 21589.4 GW(e).h  
**Date of First Criticality:** 23 Feb 2001      **Cumulative Energy Availability Factor:** 84.4%  
**Date of Grid Connection:** 30 Mar 2001      **Cumulative Load Factor:** 86.4%  
**Date of Commercial Operation:** 25 Dec 2001      **Cumulative Unit Capability Factor:** 83.5%  
**Cumulative Energy Unavailability Factor:** 15.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2002 | 7176.2         | 950.0          | 85.5   | 85.5   | 84.1                              | 84.1   | 86.2               | 86.2   | 7543               | 86.1   |
| 2003 | 6973.9         | 950.0          | 82.6   | 84.0   | 81.3                              | 82.7   | 83.8               | 85.0   | 7154               | 81.7   |
| 2004 | 7439.3         | 950.0          | 88.0   | 85.3   | 87.8                              | 84.4   | 89.1               | 86.4   | 7766               | 88.4   |

## RU-59 VOLGODONSK-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 98.0   | 5.3     | XP   | K    | UNIT POWER REDUCTION OWING TO LIMITATION IMPOSED BY THE DISPATCHER  |
| 14 Jan | 13.0   | 12.6    | UF2  | A42  | UNIT SHUTDOWN OWING TO A SHORT CIRCUIT TO EARTH IN THE 24 KV GENERATOR VOLTAGE GRID   |
| 27 Mar | 10.0   | 1.4     | UP1  | A31  | UNIT POWER REDUCTION OWING TO REQUEST TO ELIMINATE LEAKS IN THE TURBINE CONDENSER PIPING SYSTEM                                       |
| 01 May | 1004.0 | 989.9   | PF   | C    | MEDIUM-SCALE UNIT MAINTENANCE   |
| 15 Jun | 8.0    | 0.3     | UP2  | A17  | UNIT POWER REDUCTION WHEN EMERGENCY PROTECTION SYSTEM 1 WAS TRIGGERED BY A SPURIOUS SIGNAL FOR A TEMPERATURE INCREASE IN THE HOT LOOP |
| 23 Jun | 1786.0 | 11.9    | XP   | N    | UNIT POWER REDUCTION OWING TO INCREASED CIRCULATING WATER TEMPERATURE   |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2002 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 13        |          |  | 89        |          |
| C. Inspection, maintenance or repair combined with refuelling | 1004            |           |          | 818                                      |           |          |
| Subtotal  | 1004            | 13        | 0        | 818                                      | 89        | 0        |
| Total   |                 | 1017      |          |  | 907       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 2002 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 11                                       |
| 41. Main Generator Systems                     |                 | 78                                       |
| 42. Electrical Power Supply Systems            | 13              |  |
| Total  | 13              | 89                                       |

**SK-2 BOHUNICE-1**

Operator: EBO (ELECTROSTATION BOHUNICE)

Contractor: AEE (ATOMENERGOEXPORT)

**1. Station Details**

Type: WWER  
 Net Reference Unit Power  
 at the beginning of 2004: 408.0 MW(e)  
 Design Net RUP: 381.0 MW(e)  
 Design Discharge Burnup: —

**2. Production Summary 2004**

Energy Production: 2775.8 GW(e).h  
 Energy Availability Factor: 83.3%  
 Load Factor: 77.5%  
 Operating Factor: 90.2%  
 Energy Unavailability Factor: 16.7%  
 Total Off-line Time: 857 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 276.7 | 232.4 | 0.0   | 202.2 | 245.6 | 253.3 | 260.2 | 268.2 | 256.4 | 265.1 | 269.8 | 245.7 | 2775.8 |
| EAF (%)  | 96.1  | 83.5  | 0.0   | 87.0  | 94.5  | 90.8  | 89.6  | 91.1  | 92.7  | 91.1  | 97.2  | 86.8  | 83.3   |
| UCF (%)  | 98.2  | 93.4  | 0.0   | 89.5  | 99.4  | 97.8  | 97.0  | 98.8  | 98.6  | 98.3  | 100.0 | 88.5  | 88.2   |
| LF (%)   | 91.2  | 81.8  | 0.0   | 68.8  | 80.9  | 86.2  | 85.7  | 88.4  | 87.3  | 87.2  | 91.8  | 81.0  | 77.5   |
| OF (%)   | 100.0 | 93.8  | 0.0   | 90.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.2   |
| EUF (%)  | 3.9   | 16.5  | 100.0 | 13.0  | 5.5   | 9.2   | 10.4  | 8.9   | 7.3   | 8.9   | 2.8   | 13.2  | 16.7   |
| PUF (%)  | 0.0   | 6.6   | 100.0 | 10.5  | 0.0   | 0.2   | 0.0   | 0.0   | 1.4   | 0.0   | 0.0   | 3.0   | 10.2   |
| UCLF (%) | 1.8   | 0.0   | 0.0   | 0.0   | 0.6   | 2.0   | 3.1   | 1.2   | 0.0   | 1.8   | 0.0   | 8.5   | 1.6    |
| XUF (%)  | 2.1   | 9.9   | 0.0   | 2.5   | 4.9   | 7.0   | 7.3   | 7.7   | 5.9   | 7.1   | 2.8   | 1.7   | 4.9    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 24 Apr 1972      Lifetime Generation: 66281.5 GW(e).h  
 Date of First Criticality: 27 Nov 1978      Cumulative Energy Availability Factor: 73.0%  
 Date of Grid Connection: 17 Dec 1978      Cumulative Load Factor: 72.1%  
 Date of Commercial Operation: 01 Apr 1980      Cumulative Unit Capability Factor: 77.7%  
    Cumulative Energy Unavailability Factor: 27.0%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 2754.1            | 398.0             | 78.9   | 74.0   | 78.9                                 | 74.0   | 79.0               | 73.8   | 7184                  | 82.0   |
| 1984 | 3229.6            | 408.0             | 89.8   | 78.0   | 89.8                                 | 78.1   | 90.1               | 78.0   | 8449                  | 96.2   |
| 1985 | 2445.7            | 408.0             | 72.0   | 76.8   | 72.0                                 | 76.8   | 68.4               | 76.0   | 6485                  | 74.0   |
| 1986 | 2486.0            | 408.0             | 70.5   | 75.8   | 70.5                                 | 75.8   | 69.6               | 74.9   | 6874                  | 78.5   |
| 1987 | 2701.7            | 408.0             | 78.1   | 76.1   | 77.3                                 | 76.0   | 75.6               | 75.0   | 7251                  | 82.8   |
| 1988 | 2061.6            | 408.0             | 56.5   | 73.6   | 56.4                                 | 73.5   | 57.5               | 72.8   | 5280                  | 60.1   |
| 1989 | 2846.6            | 408.0             | 80.2   | 74.3   | 80.1                                 | 74.2   | 79.6               | 73.6   | 7229                  | 82.5   |
| 1990 | 2776.5            | 408.0             | 80.7   | 75.0   | 80.0                                 | 74.8   | 77.7               | 74.0   | 7435                  | 84.9   |
| 1991 | 2839.5            | 408.0             | 82.3   | 75.7   | 81.4                                 | 75.4   | 79.4               | 74.5   | 7507                  | 85.7   |
| 1992 | 2491.9            | 408.0             | 66.2   | 74.9   | 64.4                                 | 74.5   | 69.5               | 74.1   | 6118                  | 69.6   |
| 1993 | 2307.7            | 408.0             | 67.1   | 74.3   | 64.6                                 | 73.7   | 64.6               | 73.3   | 6021                  | 68.7   |
| 1994 | 2852.0            | 405.0             | 84.6   | 75.0   | 79.2                                 | 74.1   | 80.4               | 73.8   | 7594                  | 86.7   |
| 1995 | 3002.2            | 408.0             | 82.7   | 75.5   | 81.3                                 | 74.6   | 84.0               | 74.5   | 7549                  | 86.2   |
| 1996 | 2667.9            | 436.0             | 80.3   | 75.8   | 72.0                                 | 74.4   | 69.7               | 74.2   | 7182                  | 81.8   |
| 1997 | 2426.0            | 408.0             | 73.7   | 75.7   | 63.2                                 | 73.8   | 67.9               | 73.8   | 6338                  | 72.4   |
| 1998 | 2088.1            | 408.0             | 65.6   | 75.2   | 60.5                                 | 73.0   | 58.4               | 73.0   | 6015                  | 68.7   |
| 1999 | 2268.9            | 408.0             | 86.2   | 75.7   | 63.4                                 | 72.5   | 63.5               | 72.5   | 6573                  | 75.0   |
| 2000 | 1949.2            | 408.0             | 59.5   | 74.9   | 54.8                                 | 71.6   | 54.4               | 71.6   | 5422                  | 61.7   |
| 2001 | 2397.2            | 408.0             | 77.4   | 75.0   | 68.0                                 | 71.5   | 67.1               | 71.3   | 7056                  | 80.5   |
| 2002 | 2752.5            | 408.0             | 86.6   | 75.6   | 82.9                                 | 72.0   | 77.0               | 71.6   | 7634                  | 87.1   |
| 2003 | 2765.3            | 408.0             | 88.1   | 76.1   | 84.1                                 | 72.5   | 77.4               | 71.9   | 7816                  | 89.2   |
| 2004 | 2775.8            | 408.0             | 88.2   | 76.6   | 83.3                                 | 73.0   | 77.5               | 72.1   | 7927                  | 90.2   |



## SK-2 BOHUNICE-1

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 1392.0 | 11.7    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE  |
| 24 Jan | 24.0   | 4.8     | UP   | A31  | LEAKAGE DUE TO EROSIONALLY CORROSION OF 6TH STEAM EXTRACTION LINE                                      |
| 28 Jan | 9.0    | 0.5     | UP   | Z    | XENON POISONING AFTER TG 11 SYNCHRONISATION TO SLOVAK ENERGY SYSTEM                                    |
| 06 Feb | 521.0  | 22.9    | XP   | S    | FUEL COAST-DOWN OPERATION  |
| 28 Feb | 5.0    | 1.1     | PP   | E    | REACTOR POWER REDUCTION BEFORE ANNUAL MAINTENANCE AND REFUELLING                                       |
| 28 Feb | 857.0  | 349.7   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING  |
| 05 Apr | 54.0   | 1.9     | PP   | E    | RUMP-UP OPERATION  |
| 06 Apr | 6480.0 | 131.2   | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE  |
| 26 May | 9.0    | 1.8     | UP2  | L31  | LEAK OIL FROM MAIN OIL TANK UNDER MINIMAL ALLOWABLE LEVEL  |
| 05 Jun | 1843.0 | 10.5    | UP   | A31  | WORSEN VACUUM SYSTEM BECAUSE OF HIGHER CIRCULATION COOLING WATER TEMPERATURE                           |
| 21 Jun | 3.0    | 0.6     | PP   | E31  | ALTERNATING SHUTDOWN OF TG FOR REGULAR TESTING OF PROTECTIONS  |
| 23 Jun | 15.0   | 3.3     | UP   | A33  | TG11 SHUTDOWN DUE TO CLEANING OF COOLING TOWERS NOZZLES  |
| 21 Jul | 20.0   | 4.0     | UP2  | A33  | LEAKAGE ON CIRCULATING WATER SYSTEM PIPE   |
| 11 Aug | 5.0    | 0.8     | UP   | A31  | TURBOGENERATOR TG12 DRAINAGE TANK LEAKAGE  |
| 24 Sep | 20.0   | 4.0     | PP   | E31  | ALTERNATING SHUTDOWN OF TG FOR REGULAR TESTING OF PROTECTIONS  |
| 06 Oct | 48.0   | 10.0    | XP   | J42  | TG11 PLANNED SHUTDOWN BECAUSE OF THE PLANNED WORKS IN EXTERNAL 220 KV GRID.                            |
| 22 Oct | 26.0   | 5.3     | UP1  | A31  | TG11 SHUTDOWN DUE TO LEAKAGE OF EXPANSION TANK OF CONDENSATE OF SEPARATOR REHEATER.                    |
| 10 Dec | 39.0   | 7.5     | PP   | E31  | TG11 SHUTDOWN FOR REGULAR TESTING OF SAFEGUARDS AND PROTECTIONS  |
| 13 Dec | 126.0  | 24.9    | UP   | A41  | HIGH TEMPERATURE OF GENERATOR BEARING SIGNAL DURING TG11 START-UP TIME AFTER PROTECTIONS REGULAR TESTS |
| 18 Dec | 8.0    | 1.5     | PP   | E31  | TG12 SHUTDOWN FOR REGULAR TESTING OF SAFEGUARDS AND PROTECTIONS  |
| 28 Dec | 13.0   | 0.8     | UP   | A31  | LEAK OF MAIN CONDENSER TUBES OF TURBOGENERATOR TG12  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 112       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 857             |           |          | 1353                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 150                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 8  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 2  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 42       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 27                                       |           | 5        |
| Subtotal   | 857             | 0         | 0        | 1540                                     | 115       | 47       |
| Total  |                 | 857       |          |  | 1702      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 23                                       |
| 12. Reactor I&C Systems                        |                 | 5  |
| 15. Reactor Cooling Systems                    |                 | 16                                       |
| 16. Steam generation systems                   |                 | 49                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 3  |
| 32. Feedwater and Main Steam System            |                 | 8  |
| 41. Main Generator Systems                     |                 | 0  |
| 42. Electrical Power Supply Systems            |                 | 3  |
| Total  | 0               | 108                                      |

**SK-3 BOHUNICE-2**

Operator: EBO (ELECTROSTATION BOHUNICE)

Contractor: AEE (ATOMENERGOEXPORT)

**1. Station Details**

Type: WWER  
 Net Reference Unit Power  
 at the beginning of 2004: 408.0 MW(e)  
 Design Net RUP: 381.0 MW(e)  
 Design Discharge Burnup: —

**2. Production Summary 2004**

Energy Production: 2861.8 GW(e).h  
 Energy Availability Factor: 84.5%  
 Load Factor: 79.9%  
 Operating Factor: 90.8%  
 Energy Unavailability Factor: 15.5%  
 Total Off-line Time: 807 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| GW(e).h  | 263.2 | 251.6 | 270.8 | 209.8 | 279.7 | 263.5 | 267.4 | 274.6 | 16.3 | 225.3 | 269.6 | 270.1 | 2861.8 |
| EAF (%)  | 96.7  | 96.5  | 93.9  | 76.4  | 95.0  | 91.5  | 90.5  | 92.2  | 7.7  | 78.2  | 96.9  | 96.7  | 84.5   |
| UCF (%)  | 98.4  | 99.3  | 96.3  | 79.0  | 100.0 | 98.0  | 97.2  | 100.0 | 8.4  | 81.0  | 99.1  | 98.2  | 88.0   |
| LF (%)   | 86.7  | 88.6  | 89.2  | 71.5  | 92.1  | 89.7  | 88.1  | 90.5  | 5.5  | 74.1  | 91.8  | 89.0  | 79.9   |
| OF (%)   | 100.0 | 99.1  | 98.1  | 97.2  | 100.0 | 100.0 | 100.0 | 100.0 | 8.5  | 85.5  | 100.0 | 100.0 | 90.8   |
| EUF (%)  | 3.3   | 3.5   | 6.1   | 23.6  | 5.0   | 8.5   | 9.5   | 7.8   | 92.3 | 21.8  | 3.1   | 3.3   | 15.5   |
| PUF (%)  | 0.9   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0   | 0.0   | 0.0   | 91.6 | 18.3  | 0.0   | 1.8   | 9.5    |
| UCLF (%) | 0.7   | 0.7   | 3.7   | 21.0  | 0.0   | 0.0   | 2.8   | 0.0   | 0.0  | 0.7   | 0.9   | 0.0   | 2.5    |
| XUF (%)  | 1.7   | 2.8   | 2.4   | 2.6   | 5.0   | 6.4   | 6.8   | 7.8   | 0.7  | 2.8   | 2.2   | 1.5   | 3.6    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 24 Apr 1972  
 Date of First Criticality: 15 Mar 1980  
 Date of Grid Connection: 26 Mar 1980  
 Date of Commercial Operation: 01 Jan 1981

Lifetime Generation: 65409.6 GW(e).h  
 Cumulative Energy Availability Factor: 74.4%  
 Cumulative Load Factor: 74.0%  
 Cumulative Unit Capability Factor: 77.7%  
 Cumulative Energy Unavailability Factor: 25.6%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 2946.6            | 398.0             | 84.8   | 78.4   | 84.9                                 | 78.4   | 84.5               | 78.8   | 7610                  | 86.9   |
| 1984 | 2782.6            | 408.0             | 76.2   | 77.9   | 76.2                                 | 77.9   | 77.6               | 78.5   | 7304                  | 83.2   |
| 1985 | 2444.7            | 408.0             | 72.6   | 76.8   | 72.3                                 | 76.7   | 68.4               | 76.4   | 6656                  | 76.0   |
| 1986 | 2833.0            | 408.0             | 80.3   | 77.4   | 80.3                                 | 77.3   | 79.3               | 76.9   | 7482                  | 85.4   |
| 1987 | 2902.4            | 408.0             | 86.8   | 78.7   | 82.9                                 | 78.1   | 81.2               | 77.5   | 7833                  | 89.4   |
| 1988 | 2947.5            | 408.0             | 84.2   | 79.4   | 84.0                                 | 78.9   | 82.2               | 78.1   | 7757                  | 88.3   |
| 1989 | 2637.8            | 408.0             | 73.8   | 78.8   | 73.6                                 | 78.3   | 73.8               | 77.6   | 6831                  | 78.0   |
| 1990 | 2683.0            | 408.0             | 76.7   | 78.6   | 76.1                                 | 78.1   | 75.1               | 77.4   | 6939                  | 79.2   |
| 1991 | 2583.5            | 408.0             | 72.6   | 78.0   | 72.1                                 | 77.5   | 72.3               | 76.9   | 6673                  | 76.2   |
| 1992 | 2704.5            | 408.0             | 73.8   | 77.7   | 70.3                                 | 76.9   | 75.5               | 76.8   | 6774                  | 77.1   |
| 1993 | 2057.4            | 408.0             | 59.3   | 76.2   | 57.6                                 | 75.4   | 57.6               | 75.3   | 5433                  | 62.0   |
| 1994 | 2761.8            | 405.0             | 80.8   | 76.6   | 77.7                                 | 75.6   | 77.8               | 75.5   | 7371                  | 84.1   |
| 1995 | 2989.5            | 408.0             | 83.7   | 77.0   | 79.8                                 | 75.9   | 83.6               | 76.0   | 6929                  | 79.1   |
| 1996 | 2712.6            | 436.0             | 74.7   | 76.9   | 72.3                                 | 75.6   | 70.8               | 75.7   | 6705                  | 76.3   |
| 1997 | 2321.0            | 408.0             | 62.8   | 76.0   | 60.4                                 | 74.7   | 64.9               | 75.0   | 5698                  | 65.0   |
| 1998 | 1839.2            | 408.0             | 53.9   | 74.8   | 52.3                                 | 73.5   | 51.5               | 73.7   | 4886                  | 55.8   |
| 1999 | 2278.3            | 408.0             | 68.0   | 74.5   | 63.9                                 | 73.0   | 63.7               | 73.2   | 6125                  | 69.9   |
| 2000 | 2527.5            | 408.0             | 76.3   | 74.5   | 71.1                                 | 72.9   | 70.5               | 73.1   | 6715                  | 76.4   |
| 2001 | 2899.3            | 408.0             | 88.3   | 75.2   | 81.8                                 | 73.3   | 81.1               | 73.5   | 7793                  | 89.0   |
| 2002 | 2855.1            | 408.0             | 87.7   | 75.8   | 84.2                                 | 73.8   | 79.9               | 73.7   | 7713                  | 88.0   |
| 2003 | 2614.9            | 408.0             | 80.0   | 76.0   | 76.6                                 | 73.9   | 73.2               | 73.7   | 7081                  | 80.8   |
| 2004 | 2861.8            | 408.0             | 88.0   | 76.5   | 84.5                                 | 74.4   | 79.9               | 74.0   | 7977                  | 90.8   |

## SK-3 BOHUNICE-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 2183.0 | 20.3    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE                  |
| 03 Jan | 12.0   | 2.0     | UP   | A32  | SUBSTITUTION OF PIPELINE SECTION   |
| 14 Jan | 15.0   | 2.8     | PP   | E31  | TG21 SHUTDOWN DUE TO REGULAR TESTING OF PROTECTIONS                      |
| 06 Feb | 10.0   | 2.1     | UP   | A32  | HAND VALVE EXCHANGE ON COOLING PIPELINE OF ELECTRO DRIVEN FEEDWATER PUMP |
| 21 Mar | 13.0   | 5.3     | UF   | A42  | TIME RELAY FAILURE OF OUTPUT BREAKER. TG22 FAIL AUTOMATICS               |
| 22 Mar | 29.0   | 1.1     | UP   | A42  | RUMP-UP OPERATION AFTER LOSS OF LOAD                                     |
| 24 Mar | 9.0    | 1.3     | UP   | A41  | CONTRACTOR EXCHANGE OF MAIN TRANSFORMER COOLING SYSTEM FAN               |
| 25 Mar | 19.0   | 3.5     | UP   | A31  | TG22 SHUTDOWN DUE TO EXCHANGE OF TURBINE LIFTING OIL PUMP                |
| 01 Apr | 3672.0 | 83.6    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE                  |
| 14 Apr | 188.0  | 36.7    | UP   | A42  | TG22 SHUTDOWN DUE TO MAIN TRANSFORMER FAILURE                            |
| 14 Apr | 21.0   | 8.6     | UF4  | A42  | MAIN TRANSFORMER FAILURE. SUDDEN 220 KV INSULATOR DESTRUCTION.           |
| 22 Apr | 39.0   | 7.2     | UP1  | A31  | TG21 SHUTDOWN DUE TO MAIN CONDENSER TUBES LEAK REPAIR.                   |
| 24 Apr | 15.0   | 2.7     | UP2  | A42  | MAIN TRANSFORMER OIL LEAK REPAIR - BUSHING 220 KV                        |
| 27 Apr | 27.0   | 4.8     | UP2  | A31  | STEAM EXTRACTION 6 LINE LEAK REPAIR-EROSIONALLY CORROSION                |
| 29 Apr | 8.0    | 1.6     | UP2  | A42  | TG22 SHUTDOWN DUE TO MAIN TRANSFORMER OIL COOLING REPAIR                 |
| 30 Jun | 13.0   | 4.5     | PP   | E31  | ALTERNATING SHUTDOWN OF TG FOR REGULAR TESTING OF PROTECTIONS            |
| 30 Jun | 13.0   | 1.5     | PP   | E15  | EXPERIMENTS DUE TO DIFFERENTIAL PRESSURE PULSATION IN REACTOR CORE       |
| 06 Jul | 21.0   | 3.6     | UP   | A42  | MAIN TRANSFORMER OIL LEAK REPAIR - BUSHING 220 KV                        |
| 20 Jul | 26.0   | 4.9     | UP2  | A33  | LEAKAGE ON CIRCULATING WATER SYSTEM PIPE DUE TO PIPE CORROSION           |
| 26 Aug | 174.0  | 3.5     | XP   | S    | FUEL COAST-DOWN OPERATION  |
| 27 Aug | 1.0    | 0.0     | UP2  | A12  | IN-CORE MONITORING SYSTEM FAILURE.                                       |
| 01 Sep | 61.0   | 1.0     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN SEPTEMBER     |
| 03 Sep | 659.0  | 269.0   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING  |
| 01 Oct | 108.0  | 44.1    | PF   | C    | ANNUAL MAINTENANCE   |
| 05 Oct | 33.0   | 11.4    | PP   | E    | RUMP-UP OPERATION  |
| 06 Oct | 2067.0 | 19.6    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE                  |
| 11 Oct | 12.0   | 2.2     | UP1  | A31  | LEAK REPAIR ON 7TH STEAM EXTRACTION LINE.                                |
| 08 Nov | 14.0   | 2.6     | UP   | A31  | TURBOGENERATOR TG21 TRIP DUE TO STOP VALVE CONTROL OIL FAILURE           |
| 05 Dec | 30.0   | 5.5     | PP   | E31  | ALTERNATING SHUTDOWN OF TG FOR REGULAR TESTING OF PROTECTIONS            |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 34        |          |  | 70        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 767             |           |          | 1326                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 306                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 4  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         |          |
| Subtotal   | 767             | 34        | 0        | 1636                                     | 71        | 1        |
| Total  |                 | 801       |          |  | 1708      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 13                                       |
| 12. Reactor I&C Systems                        |                 | 2  |
| 13. Reactor Auxiliary Systems                  |                 | 15                                       |
| 14. Safety Systems                             |                 | 1  |
| 15. Reactor Cooling Systems                    |                 | 1  |
| 16. Steam generation systems                   |                 | 5  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 14                                       |
| 31. Turbine and auxiliaries                    |                 | 1  |
| 32. Feedwater and Main Steam System            |                 | 5  |
| 35. All other I&C Systems                      |                 | 1  |
| 42. Electrical Power Supply Systems            | 34              | 7  |
| Total  | 34              | 65                                       |

# SK-13 BOHUNICE-3

**Operator:** EBO (ELECTROSTATION BOHUNICE)  
**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 408.0 MW(e)  
**Design Net RUP:** 420.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 2564.5 GW(e).h  
**Energy Availability Factor:** 79.0%  
**Load Factor:** 71.6%  
**Operating Factor:** 82.3%  
**Energy Unavailability Factor:** 21.0%  
**Total Off-line Time:** 1556 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 269.6 | 223.4 | 245.1 | 237.0 | 272.7 | 258.5 | 0.0   | 0.0   | 246.0 | 271.0 | 269.6 | 271.6 | 2564.5 |
| <b>EAF (%)</b>  | 97.9  | 96.8  | 97.5  | 93.4  | 96.1  | 90.6  | 0.0   | 0.0   | 88.7  | 95.8  | 97.7  | 96.6  | 79.0   |
| <b>UCF (%)</b>  | 100.0 | 98.4  | 100.0 | 97.7  | 100.0 | 96.7  | 0.0   | 0.0   | 93.8  | 100.0 | 100.0 | 100.0 | 82.0   |
| <b>LF (%)</b>   | 88.8  | 78.7  | 80.7  | 80.8  | 89.8  | 88.0  | 0.0   | 0.0   | 83.7  | 89.2  | 91.8  | 89.5  | 71.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 97.1  | 0.0   | 0.0   | 95.1  | 100.0 | 100.0 | 98.4  | 82.3   |
| <b>EUF (%)</b>  | 2.1   | 3.2   | 2.5   | 6.6   | 3.9   | 9.4   | 100.0 | 100.0 | 11.3  | 4.2   | 2.3   | 3.4   | 21.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.3   | 100.0 | 100.0 | 6.2   | 0.0   | 0.0   | 0.0   | 17.7   |
| <b>UCLF (%)</b> | 0.0   | 1.6   | 0.0   | 2.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| <b>XUF (%)</b>  | 2.1   | 1.6   | 2.5   | 4.3   | 3.9   | 6.1   | 0.0   | 0.0   | 5.0   | 4.2   | 2.3   | 3.4   | 2.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1976  
**Date of First Criticality:** 07 Aug 1984  
**Date of Grid Connection:** 20 Aug 1984  
**Date of Commercial Operation:** 14 Feb 1985

**Lifetime Generation:** 55459.1 GW(e).h  
**Cumulative Energy Availability Factor:** 77.5%  
**Cumulative Load Factor:** 76.0%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 22.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 685.6          | 408.0          | 0.0  | 0.0    | 81.8                              | 100.0  | 20.2               | 0.0    | 2219               | 26.7   |
| 1985 | 2721.6         | 408.0          | 0.0  | 0.0    | 78.7                              | 100.0  | 76.1               | 0.0    | 7057               | 80.6   |
| 1986 | 2674.1         | 408.0          | 75.4   | 75.4   | 75.4                              | 75.4   | 74.8               | 74.8   | 7089               | 80.9   |
| 1987 | 1997.4         | 408.0          | 55.5   | 65.5   | 53.7                              | 64.5   | 55.9               | 65.4   | 5181               | 59.1   |
| 1988 | 2866.9         | 408.0          | 80.2   | 70.4   | 79.9                              | 69.7   | 80.0               | 70.2   | 7329               | 83.4   |
| 1989 | 2992.3         | 408.0          | 85.0   | 74.1   | 84.1                              | 73.3   | 83.7               | 73.6   | 7633               | 87.1   |
| 1990 | 2829.1         | 408.0          | 80.5   | 75.3   | 79.2                              | 74.5   | 79.2               | 74.7   | 7376               | 84.2   |
| 1991 | 2585.6         | 408.0          | 74.2   | 75.2   | 71.9                              | 74.1   | 72.3               | 74.3   | 6717               | 76.7   |
| 1992 | 3140.7         | 408.0          | 83.9   | 76.4   | 82.8                              | 75.3   | 87.6               | 76.2   | 7528               | 85.7   |
| 1993 | 2973.1         | 408.0          | 86.5   | 77.7   | 83.2                              | 76.3   | 83.2               | 77.1   | 7721               | 88.1   |
| 1994 | 2806.8         | 405.0          | 84.0   | 78.4   | 79.1                              | 76.6   | 79.1               | 77.3   | 7423               | 84.7   |
| 1995 | 2536.7         | 408.0          | 78.1   | 78.3   | 70.1                              | 75.9   | 71.0               | 76.7   | 6440               | 73.5   |
| 1996 | 3045.9         | 436.0          | 85.6   | 79.0   | 82.5                              | 76.6   | 79.5               | 77.0   | 7504               | 85.4   |
| 1997 | 3096.4         | 440.0          | 87.7   | 79.8   | 84.0                              | 77.2   | 80.3               | 77.3   | 7711               | 88.0   |
| 1998 | 2804.6         | 408.0          | 85.3   | 80.2   | 81.8                              | 77.6   | 78.5               | 77.4   | 7571               | 86.4   |
| 1999 | 2468.5         | 408.0          | 76.5   | 80.0   | 69.7                              | 77.0   | 69.1               | 76.8   | 6620               | 75.6   |
| 2000 | 2806.7         | 408.0          | 87.9   | 80.5   | 79.8                              | 77.2   | 78.3               | 76.9   | 7776               | 88.5   |
| 2001 | 2687.0         | 408.0          | 86.6   | 80.9   | 76.5                              | 77.2   | 75.2               | 76.8   | 7680               | 87.7   |
| 2002 | 2690.7         | 408.0          | 87.4   | 81.3   | 83.9                              | 77.6   | 75.3               | 76.7   | 7711               | 88.0   |
| 2003 | 2485.0         | 408.0          | 78.3   | 81.1   | 75.5                              | 77.4   | 69.5               | 76.3   | 6908               | 78.9   |
| 2004 | 2564.5         | 408.0          | 82.0   | 81.1   | 79.0                              | 77.5   | 71.6               | 76.0   | 7228               | 82.3   |

# SK-13 BOHUNICE-3

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 744.0 | 6.3     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN JANUARY                                 |
| 19 Jan | 6.0   | 1.3     | XP   | J    | RUMP-UP AFTER GRID FAILURE   |
| 01 Feb | 696.0 | 4.5     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN FEBRUARY                                |
| 03 Feb | 15.0  | 3.0     | UP2  | A41  | TG32 SHUTDOWN DUE TO MAIN EXCITER FAILURE. THE DIRECT CAUSE WAS DEFECT UNIT OF VOLTAGE CONTROLLER  |
| 09 Feb | 9.0   | 1.6     | UP   | A31  | TG32 SHUTDOWN DUE TO LEAK REPAIR ON 7TH STEAM EXTRACTION LINE - EROSIONALLY CORROSION              |
| 01 Mar | 743.0 | 7.6     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN MARCH                                   |
| 01 Apr | 720.0 | 12.5    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN APRIL                                   |
| 03 Apr | 9.0   | 1.4     | UP   | A12  | EP3 LOW SPEED REVERSE ACTUATION - SPURIOUS SIGNAL  |
| 08 Apr | 9.0   | 1.7     | UP   | A32  | TG31 SHUTDOWN DUE TO PIPELINE LEAK REPAIR OF TURBINE STOP VALVE DRAINAGE                           |
| 30 Apr | 17.0  | 3.8     | UP   | A31  | STEAM EXTRACTION 7 LINE LEAK REPAIR-EROSIONALLY CORROSION  |
| 01 May | 744.0 | 11.7    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN MAY                                     |
| 01 Jun | 694.0 | 13.6    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN JUNE                                    |
| 17 Jun | 297.0 | 4.4     | XP   | S    | FUEL COAST-DOWN OPERATION  |
| 30 Jun | 5.0   | 1.0     | PP   | E    | REACTOR POWER REDUCTION BEFORE ANNUAL MAINTENANCE AND REFUELLING                                   |
| 30 Jun | 21.0  | 8.6     | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.REALIZATION OF WORKS ACCORDING TO NPP V-2 MODERNIZATION PROGRAM. |
| 01 Jul | 744.0 | 303.6   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.REALIZATION OF WORKS ACCORDING TO NPP V-2 MODERNIZATION PROGRAM. |
| 01 Aug | 744.0 | 303.6   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING.REALIZATION OF WORKS ACCORDING TO NPP V-2 MODERNIZATION PROGRAM. |
| 01 Sep | 35.0  | 14.3    | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING-PHASE OF REACTOR PHYSICAL TESTS                                  |
| 02 Sep | 21.0  | 3.9     | PP   | E    | RUMP-UP OPERATION  |
| 02 Sep | 685.0 | 14.8    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN SEPTEMBER                               |
| 01 Oct | 744.0 | 12.6    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN OCTOBER                                 |
| 01 Nov | 720.0 | 6.6     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN NOVEMBER                                |
| 01 Dec | 744.0 | 4.3     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN DECEMBER                                |
| 19 Dec | 12.0  | 4.9     | XF2  | J    | TG31 AND TG32 SHUTDOWN DUE TO GRID FAILURE - INSULATOR HOLDER REPAIR                               |
| 19 Dec | 6.0   | 1.3     | XP2  | J    | RUMP-UP AFTER GRID FAILURE   |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 73        |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1544            |           |          | 1201                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 163                                      |           |          |
| J. Grid failure or grid unavailability                        |                 |           | 12       |  |           | 8        |
| Subtotal  | 1544            | 0         | 12       | 1364                                     | 73        | 8        |
| Total   |                 | 1556      |          |  | 1445      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 3  |
| 13. Reactor Auxiliary Systems                  |                 | 6  |
| 14. Safety Systems                             |                 | 1  |
| 15. Reactor Cooling Systems                    |                 | 18                                       |
| 16. Steam generation systems                   |                 | 18                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 32. Feedwater and Main Steam System            |                 | 12                                       |
| 33. Circulating Water System                   |                 | 1  |
| 41. Main Generator Systems                     |                 | 0  |
| 42. Electrical Power Supply Systems            |                 | 8  |
| Total  | 0               | 68                                       |

# SK-14 BOHUNICE-4

**Operator:** EBO (ELECTROSTATION BOHUNICE)  
**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 408.0 MW(e)  
**Design Net RUP:** 398.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 2390.9 GW(e).h  
**Energy Availability Factor:** 74.4%  
**Load Factor:** 66.7%  
**Operating Factor:** 77.3%  
**Energy Unavailability Factor:** 25.6%  
**Total Off-line Time:** 1998 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 261.2 | 179.9 | 263.4 | 262.6 | 51.0 | 0.0   | 14.1 | 270.1 | 259.3 | 272.6 | 275.1 | 281.6 | 2390.9 |
| <b>EAF (%)</b>  | 98.8  | 98.2  | 97.6  | 95.4  | 17.4 | 0.0   | 6.9  | 94.8  | 94.8  | 95.2  | 97.1  | 98.3  | 74.4   |
| <b>UCF (%)</b>  | 100.0 | 99.0  | 100.0 | 100.0 | 19.4 | 0.0   | 7.4  | 99.4  | 100.0 | 99.7  | 100.0 | 99.7  | 77.0   |
| <b>LF (%)</b>   | 86.0  | 63.3  | 86.8  | 89.5  | 16.8 | 0.0   | 4.6  | 89.0  | 88.3  | 89.7  | 93.6  | 92.8  | 66.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 19.9 | 0.0   | 8.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.3   |
| <b>EUF (%)</b>  | 1.2   | 1.8   | 2.4   | 4.6   | 82.6 | 100.0 | 93.1 | 5.2   | 5.2   | 4.8   | 2.9   | 1.7   | 25.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 80.6 | 100.0 | 92.6 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.9   |
| <b>UCLF (%)</b> | 0.0   | 1.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.7   | 0.0   | 0.3   | 0.0   | 0.3   | 0.2    |
| <b>XUF (%)</b>  | 1.2   | 0.8   | 2.4   | 4.6   | 2.1  | 0.0   | 0.5  | 4.6   | 5.2   | 4.5   | 2.9   | 1.4   | 2.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1976  
**Date of First Criticality:** 02 Aug 1985  
**Date of Grid Connection:** 09 Aug 1985  
**Date of Commercial Operation:** 18 Dec 1985

**Lifetime Generation:** 54090.6 GW(e).h  
**Cumulative Energy Availability Factor:** 78.9%  
**Cumulative Load Factor:** 77.4%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 21.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 1083.5         | 408.0          | 0.0  | 0.0    | 99.4                              | 100.0  | 31.0               | 0.0    | 3177               | 37.1   |
| 1986 | 2887.9         | 408.0          | 81.0   | 81.0   | 81.0                              | 81.0   | 80.8               | 80.8   | 7294               | 83.3   |
| 1987 | 3084.7         | 408.0          | 86.6   | 83.8   | 86.1                              | 83.5   | 86.3               | 83.6   | 7783               | 88.8   |
| 1988 | 2786.5         | 408.0          | 78.0   | 81.9   | 77.8                              | 81.6   | 77.7               | 81.6   | 7248               | 82.5   |
| 1989 | 2827.7         | 408.0          | 80.0   | 81.4   | 79.2                              | 81.0   | 79.1               | 81.0   | 7548               | 86.2   |
| 1990 | 2873.8         | 408.0          | 82.0   | 81.5   | 80.7                              | 81.0   | 80.4               | 80.9   | 7427               | 84.8   |
| 1991 | 2850.5         | 408.0          | 82.9   | 81.7   | 80.4                              | 80.9   | 79.8               | 80.7   | 7438               | 84.9   |
| 1992 | 2711.9         | 408.0          | 73.3   | 80.5   | 70.4                              | 79.4   | 75.7               | 80.0   | 6714               | 76.4   |
| 1993 | 2847.6         | 408.0          | 82.6   | 80.8   | 79.7                              | 79.4   | 79.7               | 79.9   | 7341               | 83.8   |
| 1994 | 2791.4         | 405.0          | 83.9   | 81.1   | 78.7                              | 79.3   | 78.7               | 79.8   | 7389               | 84.3   |
| 1995 | 2823.7         | 408.0          | 88.5   | 81.9   | 79.3                              | 79.3   | 79.0               | 79.7   | 7211               | 82.3   |
| 1996 | 2834.9         | 436.0          | 79.2   | 81.6   | 76.1                              | 79.0   | 74.0               | 79.2   | 6953               | 79.2   |
| 1997 | 2953.5         | 440.0          | 84.7   | 81.9   | 80.2                              | 79.1   | 76.6               | 78.9   | 7469               | 85.3   |
| 1998 | 2822.4         | 408.0          | 85.7   | 82.2   | 82.4                              | 79.4   | 79.0               | 78.9   | 7525               | 85.9   |
| 1999 | 2656.5         | 408.0          | 81.7   | 82.1   | 75.1                              | 79.1   | 74.3               | 78.6   | 7283               | 83.1   |
| 2000 | 2431.9         | 408.0          | 76.3   | 81.8   | 68.9                              | 78.4   | 67.9               | 77.9   | 6791               | 77.3   |
| 2001 | 2793.3         | 408.0          | 86.7   | 82.1   | 79.2                              | 78.4   | 78.2               | 77.9   | 7721               | 88.1   |
| 2002 | 2823.2         | 408.0          | 87.9   | 82.4   | 85.0                              | 78.8   | 79.0               | 78.0   | 7742               | 88.4   |
| 2003 | 2814.9         | 408.0          | 87.8   | 82.7   | 84.4                              | 79.1   | 78.8               | 78.0   | 7737               | 88.3   |
| 2004 | 2390.9         | 408.0          | 77.0   | 82.4   | 74.4                              | 78.9   | 66.7               | 77.4   | 6786               | 77.3   |

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## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 744.0 | 3.6     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN JANUARY  |
| 01 Feb | 696.0 | 2.2     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN FEBRUARY   |
| 20 Feb | 16.0  | 2.8     | UP   | A31  | TG42 SHUTDOWN DUE TO LEAK REPAIR ON 7TH STEAM EXTRACTION LINE - EROSIONALLY CORROSION   |
| 01 Mar | 743.0 | 7.3     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN MARCH  |
| 01 Apr | 720.0 | 13.5    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN APRIL  |
| 01 May | 143.0 | 2.6     | XP   | S    | FUEL COAST-DOWN OPERATION   |
| 01 May | 143.0 | 3.7     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN MAY  |
| 06 May | 6.0   | 1.4     | PP   | E    | REACTOR POWER REDUCTION BEFORE ANNUAL MAINTENANCE AND REFUELLING  |
| 07 May | 596.0 | 243.2   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING WITH REACTOR PRESSURE VESSEL CHECK. REALIZATION OF WORKS ACCORDING TO NPP V-2 MODERNIZATION PROGRAM |
| 01 Jun | 720.0 | 293.8   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING WITH REACTOR PRESSURE VESSEL CHECK. REALIZATION OF WORKS ACCORDING TO NPP V-2 MODERNIZATION PROGRAM |
| 01 Jul | 682.0 | 278.3   | PF   | C    | ANNUAL MAINTENANCE AND REFUELLING WITH REACTOR PRESSURE VESSEL CHECK. REALIZATION OF WORKS ACCORDING TO NPP V-2 MODERNIZATION PROGRAM |
| 29 Jul | 72.0  | 2.8     | PP   | E    | RUMP-UP OPERATION   |
| 30 Jul | 48.0  | 1.4     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN JULY   |
| 01 Aug | 744.0 | 13.8    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN AUGUST   |
| 03 Aug | 10.0  | 2.0     | UP2  | A32  | TG41 CONTROLLED SHUTDOWN DUE TO CONDENSATE PUMPS PIPELINE LEAKAGE   |
| 01 Sep | 720.0 | 15.4    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN SEPTEMBER  |
| 01 Oct | 744.0 | 13.7    | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN OCTOBER  |
| 18 Oct | 5.0   | 0.8     | UP   | A35  | TG42 SHUTDOWN DUE TO ALL CONDENSATE PUMPS TRIP.   |
| 01 Nov | 720.0 | 8.6     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN NOVEMBER   |
| 01 Dec | 744.0 | 4.3     | XP   | N    | TG POWER REDUCTION DUE TO CIRCULATING WATER TEMPERATURE IN DECEMBER   |
| 08 Dec | 10.0  | 0.9     | UP   | A31  | LEAK OF MAIN CONDENSER TUBES OF TURBOGENERATOR TG42   |
| 21 Dec | 1.0   | 0.1     | UP   | A11  | CONTROL ROD 03-46 FALL DOWN. THE CAUSE OF THE DROP WAS INVALID LOW FREQUENCY CONVERTER.   |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |  | 49        |          |
| C. Inspection, maintenance or repair combined with refuelling | 1998            |           |          | 1095                                     |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 73                                       |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 1  |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |  |           | 0        |
| L. Human factor related                                       |                 |           |          |  | 0         |          |
| Subtotal  | 1998            | 0         | 0        | 1169                                     | 49        | 0        |
| Total   |                 | 1998      |          |  | 1218      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 6  |
| 15. Reactor Cooling Systems                    |                 | 0  |
| 16. Steam generation systems                   |                 | 28                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 5  |
| 32. Feedwater and Main Steam System            |                 | 5  |
| 33. Circulating Water System                   |                 | 0  |
| 42. Electrical Power Supply Systems            |                 | 0  |
| XX. Miscellaneous Systems                      |                 | 1  |
| Total  | 0               | 45                                       |

**SK-6 MOCHOVCE-1**

Operator: EMO (ELECTROSTATION MOCHOVCE)

Contractor: SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

**1. Station Details**

Type: WWER  
 Net Reference Unit Power  
 at the beginning of 2004: 405.0 MW(e)  
 Design Net RUP: 387.0 MW(e)  
 Design Discharge Burnup: —

**2. Production Summary 2004**

Energy Production: 2996.0 GW(e).h  
 Energy Availability Factor: 88.1%  
 Load Factor: 84.2%  
 Operating Factor: 88.8%  
 Energy Unavailability Factor: 11.9%  
 Total Off-line Time: 983 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 271.6 | 263.5 | 284.2 | 0.3  | 168.2 | 286.4 | 292.1 | 294.6 | 293.9 | 301.1 | 281.5 | 258.5 | 2996.0 |
| EAF (%)  | 100.0 | 100.0 | 94.8  | 6.6  | 57.1  | 100.0 | 98.9  | 99.5  | 100.0 | 99.6  | 100.0 | 100.0 | 88.1   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 6.6  | 57.1  | 100.0 | 99.3  | 99.6  | 100.0 | 99.6  | 100.0 | 100.0 | 88.6   |
| LF (%)   | 90.2  | 93.5  | 94.3  | 0.1  | 55.8  | 98.2  | 97.0  | 97.8  | 100.8 | 99.8  | 96.6  | 85.8  | 84.2   |
| OF (%)   | 100.0 | 100.0 | 99.9  | 3.1  | 61.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.8   |
| EUF (%)  | 0.0   | 0.0   | 5.2   | 93.4 | 42.9  | 0.0   | 1.1   | 0.5   | 0.0   | 0.4   | 0.0   | 0.0   | 11.9   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 93.4 | 42.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.3   |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.7   | 0.4   | 0.0   | 0.4   | 0.0   | 0.0   | 0.1    |
| XUF (%)  | 0.0   | 0.0   | 5.2   | 0.0  | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE GENERAL PERFORMANCE AND OPERATIONAL MODE OF THE UNIT OVER THE REPORTING PERIOD E.G. :  
 OPERATION WAS PERFORMED MORE OR LESS AT FULL POWER IN BASE LOAD MODE, LOAD-FOLLOWING FOR A  
 PERIOD - 158,6 GWH

**5. Historical Summary**

Date of Construction Start: 01 Oct 1983      Lifetime Generation: 17260.3 GW(e).h  
 Date of First Criticality: 09 Jun 1998      Cumulative Energy Availability Factor: 77.9%  
 Date of Grid Connection: 04 Jul 1998      Cumulative Load Factor: 76.7%  
 Date of Commercial Operation: 13 Oct 1998      Cumulative Unit Capability Factor: 83.3%  
    Cumulative Energy Unavailability Factor: 22.1%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1998 | 936.3             | 408.0             | 0.0  | 0.0    | 98.3                                 | 100.0  | 52.0               | 0.0    | 3343                  | 75.7   |
| 1999 | 2376.1            | 404.0             | 70.4   | 70.4   | 65.8                                 | 65.8   | 67.1               | 67.1   | 6397                  | 73.0   |
| 2000 | 2816.9            | 404.0             | 90.0   | 80.2   | 79.4                                 | 72.6   | 79.4               | 73.3   | 8311                  | 94.6   |
| 2001 | 2423.6            | 404.0             | 75.0   | 78.5   | 68.1                                 | 71.1   | 68.5               | 71.7   | 6648                  | 75.9   |
| 2002 | 2914.8            | 405.0             | 86.3   | 80.4   | 83.3                                 | 74.2   | 82.2               | 74.3   | 7628                  | 87.1   |
| 2003 | 2796.6            | 405.0             | 83.0   | 80.9   | 82.3                                 | 75.8   | 78.8               | 75.2   | 7324                  | 83.6   |
| 2004 | 2996.0            | 405.0             | 88.6   | 82.2   | 88.1                                 | 77.9   | 84.2               | 76.7   | 7801                  | 88.8   |



**SK-6 MOCHOVCE-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 409.0  | 13.9    | XP   | K    | LOAD FOLLOWING (20-40 MW)  |
| 13 Jan | 85.0   | 16.6    | XP   | K    | LOAD FOLLOWING TG12  |
| 01 Feb | 1439.0 | 0.0     | UP1  | A    | NON-ACHIEVEMENT OF EL.POWER DUE TO COOLING WATER.                                |
| 02 Feb | 299.0  | 11.6    | XP   | K    | LOAD FOLLOWING (40-70MW)   |
| 12 Feb | 218.0  | 7.7     | XP   | K    | LOAD FOLLOWING   |
| 01 Mar | 39.0   | 1.3     | XP   | K    | LOAD FOLLOWING 40 MW.  |
| 13 Mar | 445.0  | 15.8    | XP   | S    | COAST-DOWN OPERATION   |
| 31 Mar | 48.0   | 9.6     | XP   | K    | RESERVE SHUTDOWN OF TG 11DUE TO REDUCED DEMAND                                   |
| 01 Apr | 30.0   | 5.7     | XP   | K    | RESERVE SHUTDOWN OF TG12 DUE TO REDUCED DEMAND                                   |
| 01 Apr | 3.0    | 0.1     | XP   | K    | LOAD FOLLOWING 20 MW.  |
| 03 Apr | 971.0  | 391.1   | PF   | C    | GENERAL OVERHAUL OF EMO1 COMBINED WITH REFUELLING                                |
| 13 May | 111.0  | 10.3    | PP   | E    | RAMP-UP AFTER GENERAL OVEHAUL - TESTS OF SYSTEMS                                 |
| 22 May | 73.0   | 2.0     | XP   | K    | LOAD FOLLOWING (25-35 MW).   |
| 01 Jun | 290.0  | 8.7     | XP   | K    | LOAD FOLLOWING (15-35 MW).   |
| 01 Jun | 720.0  | 0.1     | XP   | N    | COOLING WATER TEMPERATURE LIMITS   |
| 01 Jul | 229.0  | 8.0     | XP   | K    | LOAD FOLLOWING (20-70 MW)  |
| 01 Jul | 744.0  | 1.1     | XP   | N    | COOLING WATER TEMPERATURE LIMITS.  |
| 22 Jul | 10.0   | 2.2     | UP2  | A32  | POWER DECREASED DUE TO FAILURE OF TWO FEEDWATER PUMPS.                           |
| 01 Aug | 255.0  | 8.4     | XP   | K    | LOAD FOLLOWING (20-70 MW)  |
| 01 Aug | 744.0  | 0.1     | XP   | N    | COOLING WATER TEMPERATURE LIMITS   |
| 30 Aug | 7.0    | 1.2     | UP2  | A31  | ACTUATION OF ELECTRICAL PROTECTION BOUND 2 (MEDZA 2).                            |
| 01 Sep | 129.0  | 4.2     | XP   | K    | LOAD FOLLOWING (30-65 MW)  |
| 01 Oct | 744.0  | 0.0     | XP   | N    | COOLING WATER TEMPERATURE LIMITS   |
| 02 Oct | 176.0  | 4.5     | XP   | K    | LOAD FOLLOWING (12-35 MW)  |
| 29 Oct | 7.0    | 1.2     | UP2  | A42  | PROBLEMS WITH 6 KV DISTRIBUTION POINT (1BBA) - FALSE FLASH PROTECTION ACTUATION. |
| 01 Nov | 399.0  | 11.2    | XP   | K    | LOAD FOLLOWING (20-35 MW).   |
| 01 Dec | 286.0  | 6.8     | XP   | K    | LOAD FOLLOWING (15-35 MW)  |
| 24 Dec | 190.0  | 38.1    | XP   | K    | RESERVE SHUT-DOWN OF TG11 DUE TO REDUCED DEMAND.                                 |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1998 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 83        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 971             |           |          | 868   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 59  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 40  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 10        |          |
| L. Human factor related  |                 |           |          |   | 1         |          |
| Subtotal   | 971             | 0         | 0        | 967   | 99        | 2        |
| Total  |                 | 971       |          |   | 1068      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1998 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 54  |
| 12. Reactor I&C Systems                        |                    | 9   |
| 16. Steam generation systems                   |                    | 1   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 6   |
| 42. Electrical Power Supply Systems            |                    | 11  |
| Total  | 0                  | 81  |

# SK-7 MOCHOVCE-2

**Operator:** EMO (ELECTROSTATION MOCHOVCE)  
**Contractor:** SKODA (SKODA CONCERN NUCLEAR POWER PLANT WORKS)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 405.0 MW(e)  
**Design Net RUP:** 387.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 2034.5 GW(e).h  
**Energy Availability Factor:** 81.4%  
**Load Factor:** 57.2%  
**Operating Factor:** 82.1%  
**Energy Unavailability Factor:** 18.6%  
**Total Off-line Time:** 1574 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|------|------|-------|--------|
| <b>GW(e).h</b>  | 241.4 | 228.7 | 225.3 | 38.2 | 209.4 | 155.2 | 281.8 | 137.0 | 138.1 | 31.2 | 60.4 | 287.8 | 2034.5 |
| <b>EAF (%)</b>  | 100.0 | 99.9  | 99.9  | 31.0 | 99.9  | 99.6  | 97.6  | 100.0 | 100.0 | 25.6 | 22.6 | 99.8  | 81.4   |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 100.0 | 31.0 | 100.0 | 99.8  | 99.6  | 100.0 | 100.0 | 25.6 | 22.6 | 99.8  | 81.6   |
| <b>LF (%)</b>   | 80.1  | 81.1  | 74.8  | 13.1 | 69.5  | 53.2  | 93.5  | 45.5  | 47.4  | 10.4 | 20.7 | 95.5  | 57.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 30.3 | 100.0 | 99.7  | 100.0 | 100.0 | 100.0 | 25.6 | 28.3 | 100.0 | 82.1   |
| <b>EUF (%)</b>  | 0.0   | 0.1   | 0.1   | 69.0 | 0.1   | 0.4   | 2.4   | 0.0   | 0.0   | 74.4 | 77.4 | 0.2   | 18.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 69.0 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 74.4 | 64.7 | 0.2   | 17.3   |
| <b>UCLF (%)</b> | 0.0   | 0.1   | 0.0   | 0.0  | 0.0   | 0.2   | 0.4   | 0.0   | 0.0   | 0.0  | 12.7 | 0.0   | 1.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.1   | 0.2   | 2.0   | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THE GENERAL PERFORMANCE AND OPERATIONAL MODE OF THE 2.ND UNIT MOCHOVCE NPP OVER THE REPORTING PERIOD E.G. OPERATION AT FULL POWER IN BASE LOAD MODE WAS FOR A SHORT TIME PERIOD (DUE TO OUTAGE START DATE REMOVAL)-LOAD-FOLLOWING FOR A PERIOD - 479 GWH (REDUCED POWER OR/AND ONE TURBINE SHUT-DOWN)-SHUT-DOWN FOR A PERIOD - PERFORMANCE OF INSPECTION AND MAINTENANCE OF BOTH UNITS COMMON SYSTEMS /COOLING WATER SYSTEMS.../ WITHOUT REFUELING OF THE REACTOR - 9.4.2004-29.4.2004- GENERAL OVERHAUL 9.10.2004 -21.11.2004 (UNPLANNED EXTENSION OF PLANNED OUTAGE DURING 19.11.-21.11.2004)THE SIGNIFICANT FACTORS AFFECTING ENERGY GENERATION OVER THE REPORTING PERIOD, E.G. -LIMITATIONS DUE TO OUTAGE START DATE REMOVAL FROM 7.7.2004 TO 9.10.2004 FOR SMOOTHING OF THE PRODUCED POWER IN THE SLOVAK GRID. THE AMOUNT OF 352,7 GWH WAS UNDELIVERED. ONE TURBINE WAS TEMPORARY SHUT-DOWN DUE TO FUEL LIMITATIONS AND IT WAS NOT AVAILABLE FOR DISPATCHER CALL. PERSONNEL FACTORS - 1,1 GWH LOSS CAUSED (6H LONG TURBINE TRIP CAUSED BY MAINTENANCE PERSONAL)-EQUIPMENT PERFORMANCE - 38,8 GWH LOSS CAUSED BY THE EQUIPMENT FAILURE-ENVIRONMENTAL CONDITIONS - COOLING WATER TEMPERATURE LIMITATION - 2,2 GWH LOSS CAUSED DURING THE SUMMER PERIOD

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1983      **Lifetime Generation:** 12690.0 GW(e).h  
**Date of First Criticality:** 01 Dec 1999      **Cumulative Energy Availability Factor:** 78.1%  
**Date of Grid Connection:** 20 Dec 1999      **Cumulative Load Factor:** 70.7%  
**Date of Commercial Operation:** 11 Apr 2000      **Cumulative Unit Capability Factor:** 83.7%  
**Cumulative Energy Unavailability Factor:** 21.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2000 | 2641.4         | 404.0          | 0.0  | 0.0    | 90.9                              | 100.0  | 74.4               | 0.0    | 7513               | 85.5   |
| 2001 | 2540.9         | 404.0          | 78.2   | 78.2   | 72.1                              | 72.1   | 71.8               | 71.8   | 6967               | 79.5   |
| 2002 | 2498.4         | 405.0          | 76.0   | 77.1   | 71.7                              | 71.9   | 70.4               | 71.1   | 6862               | 78.3   |
| 2003 | 2964.9         | 405.0          | 87.8   | 80.7   | 87.4                              | 77.1   | 83.6               | 75.3   | 7729               | 88.2   |
| 2004 | 2034.5         | 405.0          | 81.6   | 80.9   | 81.4                              | 78.1   | 57.2               | 70.7   | 7210               | 82.1   |

# SK-7 MOCHOVCE-2

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 419.0  | 16.1    | XP   | K    | LOAD FOLLOWING (20-70 MW)   |
| 01 Jan | 2183.0 | 0.6     | UP1  | A    | NON-ACHIEVEMENT OF EL.POWER DUE TO COOLING WATER                        |
| 01 Jan | 147.0  | 29.4    | XP   | K    | LOAD FOLLOWING TG22 - CONTINUATION FROM PREVIOUS YEAR                   |
| 16 Jan | 83.0   | 16.5    | XP   | K    | LOAD FOLLOWING TG22   |
| 01 Feb | 413.0  | 13.0    | XP   | K    | LOAD FOLLOWING (20-45 MW)   |
| 03 Feb | 168.0  | 33.6    | XP   | K    | LOAD FOLLOWING TG22   |
| 18 Feb | 43.0   | 8.3     | XP   | K    | LOAD FOLLOWING TG22   |
| 01 Mar | 261.0  | 6.8     | XP   | K    | LOAD FOLLOWING (20-65 MW)   |
| 01 Mar | 743.0  | 0.1     | XP   | N    | COOLING WATER TEMPERATURE LIMITS  |
| 13 Mar | 109.0  | 4.2     | XP   | K    | LOAD FOLLOWING  |
| 18 Mar | 511.0  | 102.9   | XP   | K    | LOAD FOLLOWING TG22   |
| 01 Apr | 86.0   | 3.2     | XP   | K    | LOAD FOLLOWING 20 MW OR RESERVE SHUTDOWN - 220 MW.                      |
| 09 Apr | 499.0  | 201.1   | PF   | D    | MAINTENANCE OF BOTH UNITS COMMON SYSTEMS /COOLING WATER SYSTEMS.../     |
| 29 Apr | 32.0   | 6.4     | XP   | K    | RESERVE SHUTDOWN OF TG21 DUE TO REDUCED DEMAND                          |
| 01 May | 2208.0 | 7.0     | XP   | N    | HIGH COOLING WATER TEMPERATURE  |
| 01 May | 178.0  | 4.5     | XP   | K    | LOAD FOLLOWING (20-55 MW).  |
| 14 May | 420.0  | 83.7    | XP   | K    | LOAD FOLLOWING TG21   |
| 01 Jun | 236.0  | 9.7     | XP   | K    | LOAD FOLLOWING (5-45 MW) OR RESERVE SHUTDOWN - 220 MW                   |
| 05 Jun | 426.0  | 85.5    | XP   | K    | LOAD FOLLOWING TG21   |
| 22 Jun | 173.0  | 34.4    | XP   | K    | LOAD FOLLOWING TG21   |
| 22 Jun | 5.0    | 0.6     | UP2  | A41  | MAXIMUM VALUE OF EXCENTRICITY OF GENERATOR'S ROTOR                      |
| 01 Jul | 273.0  | 9.5     | XP   | K    | LOAD FOLLOWING (20-45 MW).  |
| 23 Jul | 6.0    | 1.1     | UP2  | L31  | MAINTENANCE WORKMAN MANIPULATION WITH DUPLEX FILTER OF TURBINE OIL      |
| 23 Jul | 2.0    | 0.1     | XP   | S    | XE POISONING IN THE END OF FUEL CYCLE AFTER POWER CHANGING (50% N NOM)  |
| 31 Jul | 1678.0 | 337.1   | XP   | K    | LOAD FOLLOWING AND RESERVE SHUTDOWN OF TG211 OR TG22                    |
| 01 Aug | 362.0  | 7.2     | XP   | K    | LOAD FOLLOWING (15-40 MW)   |
| 02 Aug | 1.0    | 0.0     | UP1  | A16  | VISUAL INSPECTION OF SG - BLOWDOWN SYSTEM LEAKAGE.                      |
| 01 Sep | 110.0  | 2.4     | XP   | K    | LOAD FOLLOWING (20-40 MW).  |
| 02 Oct | 61.0   | 1.6     | XP   | K    | LOAD FOLLOWING (25-40 MW).  |
| 08 Oct | 5.0    | 0.6     | PP   | C    | SHUTDOWN FOR PLANNED OUTAGE WITH REFUELLING.                            |
| 09 Oct | 985.0  | 398.8   | PF   | C    | PLANNED SHUTDOWN FOR MAINTENANCE AND PARTIAL REFUELLING                 |
| 19 Nov | 67.0   | 26.9    | UF3  | A13  | UNPLANNED EXTENTION RESEALING OF AN UNTIGHTNESS OF PRESURISER'S FLANGE. |
| 21 Nov | 185.0  | 13.8    | PP   | E    | RAMP-UP AFTER GENERAL OVERHAUL  |
| 24 Nov | 7.0    | 1.3     | UP1  | A41  | CONTROLLED POWER REDUCTION FOR REPAIR OF GENERATOR EXCITER.             |
| 24 Nov | 13.0   | 2.4     | UP1  | A32  | UNPLANNED POWER REDUCTION FOR RAPAIR OF STEAM VALVE UNTIGHTNESS         |
| 26 Nov | 23.0   | 6.6     | UF4  | A41  | FAILURE OF GENERATOR POWER-SWITCH                                       |
| 02 Dec | 262.0  | 9.4     | XP   | K    | LOAD FOLLOWING AND RESERVE SHUTDOWN.                                    |
| 03 Dec | 33.0   | 6.2     | XP   | K    | RESERVE SHUT-DOWN OF TG22 DUE TO REDUCED DEMAND.                        |
| 09 Dec | 4.0    | 0.5     | PP   | E    | PLANNED TEST BOUND 2 (MEDZA2) - N RE = 38% N NOM                        |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 2000 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 90        |          |  | 81        |          |
| B. Refuelling without a maintenance                           |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 985             |           |          | 855                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       | 499             |           |          | 91                                       |           |          |
| L. Human factor related                                       |                 |           |          |  | 6         |          |
| Subtotal  | 1484            | 90        | 0        | 946                                      | 87        | 0        |
| Total   |                 | 1574      |          |  | 1033      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                        | 2004 Hours Lost | 2000 to 2004 Average Hours Lost Per Year |
|-------------------------------|-----------------|--|
| 13. Reactor Auxiliary Systems | 67              |  |
| 15. Reactor Cooling Systems   |                 | 66                                       |
| 16. Steam generation systems  |                 | 8  |
| 41. Main Generator Systems    | 23              | 6  |
| Total                         | 90              | 80                                       |

# SI-1 KRSKO

**Operator:** NEK (NUKLEARNA ELEKTRARNA KRSKO)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 676.0 MW(e)  
**Design Net RUP:** 632.0 MW(e)  
**Design Discharge Burnup:** 38-40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5212.2 GW(e).h  
**Energy Availability Factor:** 89.6%  
**Load Factor:** 90.5%  
**Operating Factor:** 92.0%  
**Energy Unavailability Factor:** 10.4%  
**Total Off-line Time:** 703 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 501.0 | 467.5 | 499.4 | 463.0 | 490.1 | 459.3 | 472.4 | 432.4 | 45.1 | 423.5 | 481.8 | 476.5 | 5212.2 |
| <b>EAFF (%)</b> | 100.0 | 100.0 | 100.0 | 98.1  | 100.0 | 97.3  | 96.9  | 88.9  | 12.2 | 86.4  | 100.0 | 97.7  | 89.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.7  | 12.7 | 86.4  | 100.0 | 100.0 | 91.2   |
| <b>LF (%)</b>   | 99.6  | 99.4  | 99.3  | 95.1  | 97.5  | 94.4  | 93.9  | 86.0  | 9.3  | 84.2  | 99.0  | 94.7  | 90.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.7  | 10.3 | 93.7  | 100.0 | 100.0 | 92.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 1.9   | 0.0   | 2.7   | 3.1   | 11.1  | 87.8 | 13.6  | 0.0   | 2.3   | 10.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 87.3 | 6.5   | 0.0   | 0.1   | 7.9    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.3   | 0.0  | 7.1   | 0.0   | 0.0   | 0.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 1.9   | 0.0   | 2.7   | 3.1   | 7.8   | 0.5  | 0.0   | 0.0   | 2.2   | 1.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THERE WAS ONE AUTOMATIC TRIP DURING THE YEAR 2004.ON AUGUST 10TH ROD CONTROL NON-URGENT ALARM WAS ACTIVATED. THE SHIFT STAFF CONTACTED THE COORDINATOR OF INSTRUMENTATION MAINTENANCE ON DUTY, WHICH EXAMINED THE POWER SUPPLY OF ROD INSERTION SYSTEM. AN ERROR WAS FOUND ON POWER SUPPLY UNIT PS1 IN 1AC CABINET OF ROD INSERTION SYSTEM. A DECISION WAS MADE TO REPLACE THE BAD POWER SUPPLY UNIT. DURING THE REPLACEMENT OF SUPPLY UNIT, A LOSS OF POWER SUPPLY OCCURED AND THE CONTROL RODS FELL INTO THE REACTOR, THUS CAUSING THE REACTOR TRIP DUE TO POWER RANGE NEGATIVE RATE TRIP SIGNAL. ALL SAFETY, CONTROL SYSTEMS AND PLANT EQUIPMENT RESPONDED IN ACCORDANCE WITH DESIGN REQUIREMENTS. THERE WAS NO IMPACT ON THE ENVIRONMENT OR PLANT PERSONNEL.THERE WERE ALSO POWER REDUCTIONS DUE TO EXTENSION OF THE FUEL CYCLE (COAST-DOWN), REDUCED ENERGY DEMANDS AND TESTING OF TURBINE VALVES.

## 5. Historical Summary

**Date of Construction Start:** 30 Mar 1975      **Lifetime Generation:** 100075.3 GW(e).h  
**Date of First Criticality:** 11 Sep 1981      **Cumulative Energy Availability Factor:** 81.4%  
**Date of Grid Connection:** 02 Oct 1981      **Cumulative Load Factor:** 79.9%  
**Date of Commercial Operation:** 01 Jan 1983      **Cumulative Unit Capability Factor:** 77.9%  
**Cumulative Energy Unavailability Factor:** 18.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1992 | 3767.2         | 632.0          | 73.9   | 79.9   | 68.5                              | 78.4   | 68.0               | 75.0   | 6699               | 76.5   |
| 1993 | 3762.8         | 620.0          | 72.5   | 79.2   | 69.3                              | 77.6   | 69.3               | 74.5   | 6493               | 74.1   |
| 1994 | 4403.5         | 620.0          | 82.1   | 79.5   | 81.1                              | 77.9   | 81.1               | 75.0   | 7402               | 84.5   |
| 1995 | 4568.5         | 620.0          | 85.1   | 79.9   | 84.1                              | 78.4   | 84.1               | 75.7   | 7606               | 86.8   |
| 1996 | 4361.6         | 620.0          | 79.6   | 79.9   | 79.6                              | 78.4   | 80.1               | 76.0   | 7143               | 81.3   |
| 1997 | 4794.0         | 620.0          | 88.3   | 80.4   | 87.8                              | 79.1   | 88.3               | 76.8   | 7824               | 89.3   |
| 1998 | 4793.6         | 620.0          | 89.5   | 81.0   | 88.0                              | 79.6   | 88.3               | 77.5   | 7913               | 90.3   |
| 1999 | 4492.4         | 620.0          | 84.7   | 81.2   | 82.4                              | 79.8   | 82.7               | 77.8   | 7480               | 85.4   |
| 2000 | 4548.8         | 646.0          | 82.6   | 81.3   | 80.5                              | 79.8   | 80.2               | 78.0   | 7295               | 83.0   |
| 2001 | 5036.3         | 656.0          | 88.5   | 81.7   | 86.2                              | 80.2   | 87.6               | 78.5   | 7790               | 88.9   |
| 2002 | 5308.8         | 676.0          | 92.0   | 82.2   | 91.1                              | 80.8   | 89.6               | 79.1   | 8111               | 92.6   |
| 2003 | 4963.3         | 676.0          | 91.6   | 82.7   | 86.2                              | 81.0   | 83.8               | 79.3   | 8084               | 92.3   |
| 2004 | 5212.2         | 656.0          | 91.4   | 83.1   | 89.6                              | 81.4   | 90.5               | 79.9   | 8081               | 92.0   |

# SI-1 KRSKO

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 24 Apr | 168.0  | 9.3     | XP   | K    | POWER REDUCTION DUE TO REDUCED ENERGY DEMANDS   |
| 30 May | 1744.0 | 41.3    | XP   | S11  | REDUCED POWER DUE TO EXTENSION OF FUEL CYCLE (COAST-DOWN)   |
| 10 Aug | 9.0    | 16.4    | UF4  | A12  | AN AUTOMATIC REACTOR TRIP, WHICH FOLLOWED THE REPLACEMENT OF BAD POWER SUPPLY UNIT OF ROD INSERTION SYSTEM. |
| 11 Aug | 570.0  | 28.8    | XP   | S11  | REDUCED POWER DUE TO EXTENSION OF FUEL CYCLE (COAST-DOWN)   |
| 04 Sep | 646.0  | 425.0   | PF   | F    | ANNUAL OUTAGE   |
| 01 Oct | 48.0   | 68.5    | PF   | F    | ANNUAL OUTAGE   |
| 05 Dec | 11.0   | 0.3     | PP   | E31  | REDUCED POWER DUE TO TURBINE VALVES TESTING   |
| 24 Dec | 169.0  | 11.3    | XP   | K    | REDUCED POWER DUE TO REDUCED ENERGY DEMANDS   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 9         |          |  | 144       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 998                                      |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 201                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 62                                       | 1         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling   | 694             |           |          |  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  |           | 0        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  | 1         |          |
| Subtotal   | 694             | 9         | 0        | 1261                                     | 146       | 0        |
| Total  |                 | 703       |          |  | 1407      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 9               | 2  |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 18                                       |
| 16. Steam generation systems        |                 | 14                                       |
| 31. Turbine and auxiliaries         |                 | 31                                       |
| 32. Feedwater and Main Steam System |                 | 49                                       |
| 33. Circulating Water System        |                 | 1  |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 5  |
| 42. Electrical Power Supply Systems |                 | 17                                       |
| Total                               | 9               | 139                                      |

**ZA-1 KOEBERG-1**

Operator: ESKOM (ESKOM)  
Contractor: FRAM (FRAMATOME)

**1. Station Details**

Type: PWR  
Net Reference Unit Power  
at the beginning of 2004: 900.0 MW(e)  
Design Net RUP: 921.0 MW(e)  
Design Discharge Burnup: 33000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6388.0 GW(e).h  
Energy Availability Factor: 81.1%  
Load Factor: 80.8%  
Operating Factor: 83.8%  
Energy Unavailability Factor: 18.9%  
Total Off-line Time: 1426 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 666.9 | 623.2 | 295.6 | 0.0   | 557.3 | 616.1 | 638.1 | 637.4 | 535.5 | 506.0 | 644.1 | 667.8 | 6388.0 |
| EAF (%)  | 99.9  | 100.0 | 45.1  | 0.0   | 83.6  | 95.0  | 95.2  | 95.3  | 82.9  | 76.7  | 99.9  | 99.7  | 81.1   |
| UCF (%)  | 100.0 | 100.0 | 45.1  | 0.0   | 88.4  | 95.0  | 95.2  | 95.3  | 82.9  | 77.5  | 100.0 | 100.0 | 81.7   |
| LF (%)   | 99.6  | 99.5  | 44.1  | 0.0   | 83.2  | 95.1  | 95.3  | 95.2  | 82.6  | 75.6  | 99.4  | 99.7  | 80.8   |
| OF (%)   | 100.0 | 100.0 | 45.4  | 0.0   | 94.4  | 100.0 | 100.0 | 100.0 | 86.9  | 78.0  | 100.0 | 100.0 | 83.8   |
| EUF (%)  | 0.1   | 0.0   | 54.9  | 100.0 | 16.4  | 5.0   | 4.8   | 4.7   | 17.1  | 23.3  | 0.1   | 0.3   | 18.9   |
| PUF (%)  | 0.0   | 0.0   | 54.5  | 93.6  | 0.1   | 0.0   | 0.0   | 0.0   | 13.1  | 22.5  | 0.0   | 0.0   | 15.3   |
| UCLF (%) | 0.0   | 0.0   | 0.4   | 6.4   | 11.5  | 5.0   | 4.8   | 4.7   | 4.0   | 0.0   | 0.0   | 0.0   | 3.1    |
| XUF (%)  | 0.1   | 0.0   | 0.0   | 0.0   | 4.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7   | 0.1   | 0.3   | 0.5    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Jul 1976  
Date of First Criticality: 14 Mar 1984  
Date of Grid Connection: 04 Apr 1984  
Date of Commercial Operation: 21 Jul 1984

Lifetime Generation: 111515.1 GW(e).h  
Cumulative Energy Availability Factor: 69.8%  
Cumulative Load Factor: 66.9%  
Cumulative Unit Capability Factor: 78.1%  
Cumulative Energy Unavailability Factor: 30.2%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1984 | 3949.5            | 920.0             | 0.0  | 0.0    | 86.2                                 | 100.0  | 49.3               | 0.0    | 5063                  | 58.1   |
| 1985 | 4004.3            | 920.0             | 53.5   | 53.5   | 53.5                                 | 53.5   | 49.7               | 49.7   | 4986                  | 56.9   |
| 1986 | 3419.0            | 922.0             | 53.6   | 53.5   | 53.6                                 | 53.5   | 42.3               | 46.0   | 4575                  | 52.2   |
| 1987 | 2864.5            | 920.0             | 61.6   | 56.2   | 61.6                                 | 56.2   | 35.5               | 42.5   | 4337                  | 49.5   |
| 1988 | 5964.4            | 920.0             | 76.0   | 61.2   | 76.0                                 | 61.2   | 73.8               | 50.4   | 6791                  | 77.3   |
| 1989 | 4498.1            | 922.0             | 63.2   | 61.6   | 63.2                                 | 61.6   | 55.2               | 51.3   | 5655                  | 64.0   |
| 1990 | 3852.1            | 920.0             | 61.7   | 61.6   | 52.7                                 | 60.1   | 47.8               | 50.7   | 5360                  | 61.2   |
| 1991 | 5976.8            | 920.0             | 76.3   | 63.7   | 74.6                                 | 62.2   | 74.2               | 54.1   | 6886                  | 78.6   |
| 1992 | 3992.5            | 920.0             | 63.6   | 63.7   | 50.3                                 | 60.7   | 49.4               | 53.5   | 5697                  | 64.9   |
| 1993 | 4097.9            | 920.0             | 66.4   | 64.0   | 50.5                                 | 59.6   | 50.8               | 53.2   | 6010                  | 68.6   |
| 1994 | 5933.9            | 920.0             | 95.6   | 67.2   | 74.9                                 | 61.1   | 73.6               | 55.2   | 8422                  | 96.1   |
| 1995 | 4576.9            | 920.0             | 65.7   | 67.0   | 56.8                                 | 60.7   | 56.8               | 55.4   | 5853                  | 66.8   |
| 1996 | 5672.8            | 920.0             | 81.8   | 68.3   | 70.4                                 | 61.5   | 70.2               | 56.6   | 7260                  | 82.7   |
| 1997 | 6610.7            | 920.0             | 87.4   | 69.7   | 82.3                                 | 63.1   | 82.0               | 58.6   | 7676                  | 87.6   |
| 1998 | 7248.3            | 920.0             | 97.6   | 71.7   | 90.1                                 | 65.0   | 89.9               | 60.8   | 8552                  | 97.6   |
| 1999 | 7051.7            | 920.0             | 88.1   | 72.8   | 83.3                                 | 66.2   | 87.5               | 62.6   | 7848                  | 89.6   |
| 2000 | 5629.2            | 920.0             | 73.4   | 72.8   | 70.2                                 | 66.5   | 69.8               | 63.0   | 7250                  | 82.7   |
| 2001 | 6042.5            | 920.0             | 83.0   | 73.4   | 77.1                                 | 67.1   | 75.0               | 63.7   | 7303                  | 83.4   |
| 2002 | 7328.6            | 900.0             | 95.2   | 74.6   | 93.1                                 | 68.5   | 93.0               | 65.3   | 8417                  | 96.1   |
| 2003 | 6413.4            | 900.0             | 84.1   | 75.1   | 81.9                                 | 69.2   | 81.3               | 66.2   | 7398                  | 84.5   |
| 2004 | 6388.0            | 900.0             | 81.7   | 75.4   | 81.1                                 | 69.8   | 80.8               | 66.9   | 7358                  | 83.8   |

**ZA-1 KOEBERG-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 15 Mar | 1080.0 | 972.0   | PF   | C11  | REFUELLING OUTAGE 114   |
| 29 Apr | 83.3   | 75.0    | UF3  | Z    | UNPLANNED OUTAGE EXTENTION ON REFUELLING OUTAGE   |
| 07 May | 3414.0 | 148.3   | UP   | A31  | OPERATED AT REDUCED OUTPUT DUE TO CLOSED GOVERNOR VALVE                                       |
| 27 Sep | 252.5  | 227.3   | PF   | D11  | UNIT TAKEN OFF LOAD FOR A PLANNED VESSEL HEAD INSPECTION.RETURNED TO SERVICE WITH NO DEFECTS. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 243       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1080            |           |          | 1193  | 14        |          |
| D. Inspection, maintenance or repair without refuelling                              | 252             |           |          | 193   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 5   | 0         | 17       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 76  | 37        |          |
| Z. Others  |                 | 83        |          |   |           |          |
| Subtotal   | 1332            | 83        | 0        | 1467  | 305       | 17       |
| Total  |                 | 1415      |          |   | 1789      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 0   |
| 12. Reactor I&C Systems             |                    | 5   |
| 13. Reactor Auxiliary Systems       |                    | 1   |
| 14. Safety Systems                  |                    | 4   |
| 15. Reactor Cooling Systems         |                    | 67  |
| 16. Steam generation systems        |                    | 0   |
| 31. Turbine and auxiliaries         |                    | 45  |
| 32. Feedwater and Main Steam System |                    | 28  |
| 33. Circulating Water System        |                    | 2   |
| 41. Main Generator Systems          |                    | 30  |
| 42. Electrical Power Supply Systems |                    | 56  |
| Total                               | 0                  | 238   |

**ZA-2 KOEBERG-2**

**Operator:** ESKOM (ESKOM)  
**Contractor:** AA (ALSTHOM ATLANTIQUE)

**1. Station Details**

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 900.0 MW(e)  
**Design Net RUP:** 921.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 7896.7 GW(e).h  
**Energy Availability Factor:** 99.8%  
**Load Factor:** 99.9%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.2%  
**Total Off-line Time:** 0 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 662.4 | 626.9 | 670.7 | 648.4 | 662.9 | 648.7 | 671.0 | 669.9 | 649.9 | 670.0 | 648.1 | 667.8 | 7896.7 |
| <b>EAF (%)</b>  | 98.8  | 100.0 | 100.0 | 100.0 | 99.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.8  | 99.8   |
| <b>UCF (%)</b>  | 98.8  | 100.0 | 100.0 | 100.0 | 99.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.8   |
| <b>LF (%)</b>   | 98.9  | 100.1 | 100.2 | 100.2 | 99.0  | 100.1 | 100.2 | 100.0 | 100.3 | 99.9  | 100.0 | 99.7  | 99.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 1.2   | 0.0   | 0.0   | 0.0   | 1.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 1.2   | 0.0   | 0.0   | 0.0   | 1.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE KOEBERG U2 WAS SYNCHRONIZED TO THE NATIONAL GRID FOR THE CALENDER YEAR AND WAS ON LINE FOR 410 DAYS WHEN IT WAS TAKEN OFF LOAD ON 24 JANUARY 2005 FOR REFUELLING OUTAGE

**5. Historical Summary**

**Date of Construction Start:** 01 Jul 1976      **Lifetime Generation:** 103835.5 GW(e).h  
**Date of First Criticality:** 07 Jul 1985      **Cumulative Energy Availability Factor:** 68.5%  
**Date of Grid Connection:** 25 Jul 1985      **Cumulative Load Factor:** 67.0%  
**Date of Commercial Operation:** 09 Nov 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 31.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 1389.8         | 920.0          | 0.0  | 0.0    | 76.8                              | 100.0  | 18.5               | 0.0    | 2006               | 24.5   |
| 1986 | 5409.0         | 922.0          | 67.4   | 67.4   | 67.3                              | 67.3   | 67.0               | 67.0   | 5969               | 68.1   |
| 1987 | 3352.8         | 920.0          | 48.6   | 58.0   | 48.6                              | 58.0   | 41.6               | 54.3   | 4193               | 47.9   |
| 1988 | 4552.7         | 920.0          | 63.1   | 59.7   | 63.1                              | 59.7   | 56.3               | 55.0   | 5626               | 64.0   |
| 1989 | 6620.2         | 922.0          | 89.2   | 67.1   | 89.2                              | 67.1   | 81.3               | 61.6   | 8115               | 91.9   |
| 1990 | 4614.3         | 920.0          | 64.8   | 66.7   | 58.4                              | 65.4   | 57.3               | 60.7   | 5933               | 67.7   |
| 1991 | 3191.9         | 920.0          | 56.3   | 64.9   | 40.3                              | 61.2   | 39.6               | 57.2   | 5067               | 57.8   |
| 1992 | 5308.1         | 920.0          | 94.9   | 69.2   | 66.3                              | 61.9   | 65.7               | 58.4   | 8439               | 96.1   |
| 1993 | 3212.3         | 920.0          | 52.6   | 67.2   | 40.4                              | 59.2   | 39.9               | 56.1   | 4654               | 53.1   |
| 1994 | 3755.9         | 920.0          | 69.2   | 67.4   | 49.5                              | 58.2   | 46.6               | 55.1   | 5944               | 67.9   |
| 1995 | 6710.5         | 920.0          | 98.6   | 70.5   | 83.2                              | 60.7   | 83.3               | 57.9   | 8640               | 98.6   |
| 1996 | 6084.9         | 920.0          | 81.5   | 71.5   | 75.8                              | 62.0   | 75.3               | 59.5   | 7177               | 81.7   |
| 1997 | 6016.4         | 920.0          | 83.8   | 72.5   | 75.2                              | 63.1   | 74.7               | 60.7   | 7409               | 84.6   |
| 1998 | 6333.0         | 920.0          | 81.3   | 73.2   | 79.0                              | 64.3   | 78.6               | 62.1   | 7194               | 82.1   |
| 1999 | 6413.9         | 920.0          | 86.2   | 74.1   | 75.7                              | 65.2   | 79.6               | 63.3   | 7509               | 85.7   |
| 2000 | 7365.9         | 920.0          | 98.1   | 75.7   | 91.2                              | 66.9   | 91.1               | 65.2   | 8687               | 98.9   |
| 2001 | 4662.8         | 920.0          | 66.5   | 75.1   | 60.1                              | 66.5   | 57.9               | 64.7   | 5461               | 62.3   |
| 2002 | 4688.8         | 900.0          | 60.6   | 74.3   | 59.6                              | 66.1   | 59.5               | 64.4   | 5439               | 62.1   |
| 2003 | 6255.5         | 900.0          | 82.9   | 74.8   | 79.4                              | 66.8   | 79.3               | 65.2   | 7150               | 81.6   |
| 2004 | 7896.7         | 900.0          | 99.8   | 76.1   | 99.8                              | 68.5   | 99.9               | 67.0   | 8784               | 100.0  |



**ZA-2 KOEBERG-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                                     |
|--------|-------|---------|------|------|---|
| 10 Jan | 25.0  | 8.1     | UP   | A31  | LOAD REDUCED TO REPAIR A CONDENSER TUBE LEAK    |
| 23 May | 26.0  | 6.8     | UP   | A33  | LOAD REDUCED TO REPAIR ONE OF THE COOLING PUMPS |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 364       | 15       |
| B. Refuelling without a maintenance  |                 |           |          |   | 7         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 856   | 25        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 40  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 49  | 0         |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |   |           | 0        |
| H. Nuclear regulatory requirements   |                 |           |          |   | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 0         | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 89        | 3        |
| Subtotal   | 0               | 0         | 0        | 945   | 486       | 19       |
| Total  |                 | 0         |          |   | 1450      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1978 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 11  |
| 14. Safety Systems                  |                    | 54  |
| 15. Reactor Cooling Systems         |                    | 14  |
| 16. Steam generation systems        |                    | 53  |
| 31. Turbine and auxiliaries         |                    | 19  |
| 32. Feedwater and Main Steam System |                    | 20  |
| 33. Circulating Water System        |                    | 3   |
| 41. Main Generator Systems          |                    | 14  |
| 42. Electrical Power Supply Systems |                    | 188   |
| Total                               | 0                  | 376   |

# ES-6 ALMARAZ-1

**Operator:** CNAT (CENTRALES NUCLEARES ALMARAZ-TRILLO(ID/UFG/ENDESA/HC/NUCLENOR ))  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 944.0 MW(e)  
**Design Net RUP:** 900.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8185.7 GW(e).h  
**Energy Availability Factor:** 99.2%  
**Load Factor:** 98.7%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.8%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 701.3 | 656.0 | 699.3 | 676.0 | 695.3 | 662.7 | 674.4 | 682.6 | 662.2 | 698.1 | 676.4 | 701.4 | 8185.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 99.7  | 98.3  | 96.9  | 98.0  | 98.2  | 99.8  | 100.0 | 100.0 | 99.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9   |
| <b>LF (%)</b>   | 99.9  | 99.9  | 99.6  | 99.6  | 99.0  | 97.5  | 96.0  | 97.2  | 97.4  | 99.3  | 99.5  | 99.9  | 98.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 1.7   | 3.1   | 2.0   | 1.8   | 0.2   | 0.0   | 0.0   | 0.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 1.7   | 2.0   | 2.0   | 1.8   | 0.2   | 0.0   | 0.0   | 0.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 02 Jul 1973  
**Date of First Criticality:** 05 Apr 1981  
**Date of Grid Connection:** 01 May 1981  
**Date of Commercial Operation:** 01 Sep 1983

**Lifetime Generation:** 149821.7 GW(e).h  
**Cumulative Energy Availability Factor:** 84.5%  
**Cumulative Load Factor:** 84.7%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 15.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3713.9         | 930.0          | 0.0  | 0.0    | 45.6                              | 100.0  | 45.6               | 0.0    | 5925               | 67.6   |
| 1984 | 4820.5         | 893.0          | 65.0   | 65.0   | 65.0                              | 65.0   | 61.5               | 61.5   | 6062               | 69.0   |
| 1985 | 4825.2         | 900.0          | 61.6   | 63.3   | 61.6                              | 63.3   | 61.2               | 61.3   | 5705               | 65.1   |
| 1986 | 5425.0         | 900.0          | 69.3   | 65.3   | 69.3                              | 65.3   | 68.8               | 63.8   | 6418               | 73.3   |
| 1987 | 7193.7         | 900.0          | 92.5   | 72.1   | 92.5                              | 72.1   | 91.2               | 70.7   | 8346               | 95.3   |
| 1988 | 5879.6         | 900.0          | 74.6   | 72.6   | 74.6                              | 72.6   | 74.4               | 71.4   | 6899               | 78.5   |
| 1989 | 6562.2         | 895.0          | 83.2   | 74.4   | 83.2                              | 74.4   | 83.7               | 73.5   | 7640               | 87.2   |
| 1990 | 6460.7         | 895.0          | 82.2   | 75.5   | 82.2                              | 75.5   | 82.4               | 74.7   | 7451               | 85.1   |
| 1991 | 7481.7         | 895.0          | 96.2   | 78.1   | 96.2                              | 78.1   | 95.4               | 77.3   | 8589               | 98.0   |
| 1992 | 6379.1         | 895.0          | 80.8   | 78.4   | 80.8                              | 78.4   | 81.1               | 77.7   | 7387               | 84.1   |
| 1993 | 6530.9         | 895.0          | 85.0   | 79.0   | 83.2                              | 78.9   | 83.3               | 78.3   | 7663               | 87.5   |
| 1994 | 7448.6         | 895.0          | 95.9   | 80.6   | 95.1                              | 80.3   | 95.0               | 79.8   | 8495               | 97.0   |
| 1995 | 6588.5         | 895.0          | 86.2   | 81.0   | 83.7                              | 80.6   | 84.0               | 80.2   | 7709               | 88.0   |
| 1996 | 5904.3         | 895.0          | 73.8   | 80.5   | 72.5                              | 80.0   | 75.1               | 79.8   | 6789               | 77.3   |
| 1997 | 6642.8         | 895.0          | 83.0   | 80.7   | 79.6                              | 80.0   | 84.7               | 80.1   | 7371               | 84.1   |
| 1998 | 8032.5         | 944.0          | 98.8   | 81.9   | 97.1                              | 81.2   | 97.1               | 81.3   | 8760               | 100.0  |
| 1999 | 6988.6         | 927.0          | 85.4   | 82.2   | 84.7                              | 81.4   | 86.1               | 81.6   | 7613               | 86.9   |
| 2000 | 7471.6         | 927.0          | 91.1   | 82.7   | 90.3                              | 81.9   | 91.8               | 82.2   | 8014               | 91.2   |
| 2001 | 8151.4         | 927.0          | 99.6   | 83.7   | 99.0                              | 82.9   | 100.4              | 83.3   | 8749               | 99.9   |
| 2002 | 7428.0         | 944.0          | 92.2   | 84.1   | 90.4                              | 83.3   | 89.8               | 83.6   | 8100               | 92.5   |
| 2003 | 7499.1         | 944.0          | 93.8   | 84.6   | 91.6                              | 83.7   | 90.7               | 84.0   | 8233               | 94.0   |
| 2004 | 8185.7         | 944.0          | 99.9   | 85.4   | 99.2                              | 84.5   | 98.7               | 84.7   | 8784               | 100.0  |

## ES-6 ALMARAZ-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 07 Jul | 48.0  | 8.2     | UP   | A32  | REDUCTION OF POWER TO 76% FOR REPAIR BEARINGS VAPOR PUMP FEEDING WATER. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          | 5   | 140       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 780   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 246   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 73  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 2         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 1         |          |
| L. Human factor related  |                 |           |          |   | 2         |          |
| Subtotal   | 0               | 0         | 0        | 1104  | 147       | 0        |
| Total  | 0               |           |          | 1251  |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1982 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 15  |
| 13. Reactor Auxiliary Systems                  |                    | 40  |
| 15. Reactor Cooling Systems                    |                    | 20  |
| 16. Steam generation systems                   |                    | 0   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 0   |
| 31. Turbine and auxiliaries                    |                    | 6   |
| 32. Feedwater and Main Steam System            |                    | 27  |
| 33. Circulating Water System                   |                    | 1   |
| 41. Main Generator Systems                     |                    | 4   |
| 42. Electrical Power Supply Systems            |                    | 28  |
| Total  | 0                  | 141   |

# ES-7 ALMARAZ-2

**Operator:** CNAT (CENTRALES NUCLEARES ALMARAZ-TRILLO(ID/UFG/ENDESA/HC/NUCLENOR ))  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 953.0 MW(e)  
**Design Net RUP:** 900.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7563.2 GW(e).h  
**Energy Availability Factor:** 90.9%  
**Load Factor:** 90.5%  
**Operating Factor:** 92.0%  
**Energy Unavailability Factor:** 9.1%  
**Total Off-line Time:** 701 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 627.1 | 662.2 | 706.8 | 683.1 | 704.1 | 671.3 | 691.3 | 688.7 | 667.9 | 72.9 | 678.5 | 709.3 | 7563.2 |
| <b>EAF (%)</b>  | 89.2  | 100.0 | 100.0 | 100.0 | 99.9  | 98.5  | 98.2  | 97.9  | 98.0  | 12.1 | 99.2  | 100.0 | 90.9   |
| <b>UCF (%)</b>  | 89.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 13.0 | 99.2  | 100.0 | 91.6   |
| <b>LF (%)</b>   | 88.4  | 99.8  | 99.7  | 99.7  | 99.3  | 97.8  | 97.5  | 97.1  | 97.3  | 10.3 | 98.9  | 100.0 | 90.5   |
| <b>OF (%)</b>   | 91.0  | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 14.9 | 100.0 | 100.0 | 92.0   |
| <b>EUF (%)</b>  | 10.8  | 0.0   | 0.0   | 0.0   | 0.1   | 1.5   | 1.8   | 2.1   | 2.0   | 87.9 | 0.8   | 0.0   | 9.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 87.0 | 0.8   | 0.0   | 7.5    |
| <b>UCLF (%)</b> | 10.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 1.4   | 1.8   | 2.1   | 2.0   | 0.9  | 0.0   | 0.0   | 0.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 02 Jul 1973  
**Date of First Criticality:** 19 Sep 1983  
**Date of Grid Connection:** 08 Oct 1983  
**Date of Commercial Operation:** 01 Jul 1984

**Lifetime Generation:** 145439.4 GW(e).h  
**Cumulative Energy Availability Factor:** 86.1%  
**Cumulative Load Factor:** 86.6%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 13.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 712.8          | 969.0          | 0.0  | 0.0    | 85.8                              | 100.0  | 8.6                | 0.0    | 1320               | 15.4   |
| 1984 | 6012.9         | 893.0          | 0.0  | 0.0    | 82.0                              | 100.0  | 76.7               | 0.0    | 7502               | 85.4   |
| 1985 | 6236.1         | 900.0          | 79.8   | 79.8   | 79.8                              | 79.8   | 79.1               | 79.1   | 7297               | 83.3   |
| 1986 | 5825.2         | 900.0          | 75.2   | 77.5   | 75.2                              | 77.5   | 73.9               | 76.5   | 7136               | 81.5   |
| 1987 | 6402.5         | 900.0          | 81.8   | 79.0   | 81.8                              | 78.9   | 81.2               | 78.1   | 7351               | 83.9   |
| 1988 | 6809.4         | 900.0          | 86.3   | 80.8   | 86.3                              | 80.8   | 86.1               | 80.1   | 7838               | 89.2   |
| 1989 | 6545.7         | 895.0          | 82.8   | 81.2   | 82.8                              | 81.2   | 83.5               | 80.8   | 7638               | 87.2   |
| 1990 | 7649.3         | 895.0          | 97.4   | 83.9   | 97.4                              | 83.9   | 97.6               | 83.6   | 8652               | 98.8   |
| 1991 | 6812.9         | 895.0          | 85.3   | 84.1   | 85.4                              | 84.1   | 86.9               | 84.0   | 7712               | 88.0   |
| 1992 | 6892.7         | 895.0          | 87.3   | 84.5   | 87.3                              | 84.5   | 87.7               | 84.5   | 7997               | 91.0   |
| 1993 | 7710.1         | 895.0          | 99.0   | 86.1   | 98.5                              | 86.0   | 98.3               | 86.0   | 8760               | 100.0  |
| 1994 | 6384.6         | 895.0          | 84.3   | 85.9   | 80.9                              | 85.5   | 81.4               | 85.6   | 7562               | 86.3   |
| 1995 | 6814.7         | 895.0          | 89.0   | 86.2   | 86.2                              | 85.6   | 86.9               | 85.7   | 7952               | 90.8   |
| 1996 | 7273.3         | 895.0          | 91.6   | 86.7   | 91.5                              | 86.1   | 92.5               | 86.3   | 8108               | 92.3   |
| 1997 | 6042.5         | 895.0          | 76.6   | 85.9   | 72.6                              | 85.0   | 77.1               | 85.5   | 6811               | 77.8   |
| 1998 | 5892.4         | 953.0          | 75.9   | 85.1   | 70.2                              | 83.9   | 70.6               | 84.4   | 6810               | 77.7   |
| 1999 | 8126.6         | 936.0          | 98.0   | 86.0   | 97.4                              | 84.9   | 99.1               | 85.4   | 8743               | 99.8   |
| 2000 | 7401.8         | 936.0          | 90.6   | 86.3   | 88.5                              | 85.1   | 90.0               | 85.7   | 8160               | 92.9   |
| 2001 | 7601.5         | 936.0          | 92.1   | 86.7   | 91.3                              | 85.5   | 92.7               | 86.2   | 8189               | 93.5   |
| 2002 | 8154.9         | 953.0          | 98.8   | 87.4   | 98.1                              | 86.2   | 97.7               | 86.8   | 8760               | 100.0  |
| 2003 | 6627.9         | 953.0          | 81.9   | 87.1   | 79.9                              | 85.9   | 79.4               | 86.4   | 7391               | 84.4   |
| 2004 | 7563.2         | 951.0          | 91.6   | 87.3   | 90.9                              | 86.1   | 90.5               | 86.6   | 8083               | 92.0   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 17 Jan | 67.5  | 76.9    | UF1  | A42  | STOP OF THE UNIT FOR S PHASE SUBSTITUTION OF THE MAIN TRANSFORMER FOR PRESENCE OF GASES IN THE OIL. |
| 29 Sep | 36.5  | 1.0     | PP   | S21  | POWER REDUCTION DUE TO STRETCH OUT  |
| 03 Oct | 634.0 | 617.9   | PF   | C21  | FIFTEENTH REFUELLING  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 67        |          |  | 136       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 634             |           |          | 650                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 28                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 39                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 8         |          |
| L. Human factor related  |                 |           |          |  | 0         |          |
| Subtotal   | 634             | 67        | 0        | 717                                      | 153       | 0        |
| Total  |                 | 701       |          |  | 870       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 11                                       |
| 13. Reactor Auxiliary Systems       |                 | 4  |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 5  |
| 16. Steam generation systems        |                 | 26                                       |
| 31. Turbine and auxiliaries         |                 | 37                                       |
| 32. Feedwater and Main Steam System |                 | 9  |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 1  |
| 42. Electrical Power Supply Systems | 67              | 36                                       |
| Total                               | 67              | 131                                      |

# ES-8 ASCO-1

**Operator:** ANAV (ASOCIACION NUCLEAR ASCO-VANDELLOS A.I.E. (ENDESA/ID))

**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 995.0 MW(e)  
**Design Net RUP:** 888.0 MW(e)  
**Design Discharge Burnup:** 45000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7734.3 GW(e).h  
**Energy Availability Factor:** 88.6%  
**Load Factor:** 88.5%  
**Operating Factor:** 90.5%  
**Energy Unavailability Factor:** 11.4%  
**Total Off-line Time:** 835 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 737.5 | 689.5 | 736.1 | 712.6 | 705.6 | 702.5 | 722.4 | 704.4 | 52.9 | 539.4 | 708.0 | 723.4 | 7734.3 |
| <b>EAF (%)</b>  | 99.7  | 99.7  | 99.7  | 99.5  | 95.4  | 98.6  | 98.5  | 96.1  | 4.7  | 72.9  | 99.5  | 98.1  | 88.6   |
| <b>UCF (%)</b>  | 99.8  | 99.9  | 99.9  | 99.8  | 96.1  | 99.9  | 99.8  | 97.5  | 4.8  | 73.5  | 99.8  | 98.2  | 89.2   |
| <b>LF (%)</b>   | 99.6  | 99.6  | 99.4  | 99.6  | 95.3  | 98.1  | 97.6  | 95.1  | 7.4  | 72.8  | 98.8  | 97.7  | 88.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 96.2  | 100.0 | 100.0 | 100.0 | 10.0 | 78.7  | 100.0 | 100.0 | 90.5   |
| <b>EUF (%)</b>  | 0.3   | 0.3   | 0.3   | 0.5   | 4.6   | 1.4   | 1.5   | 3.9   | 95.3 | 27.1  | 0.5   | 1.9   | 11.4   |
| <b>PUF (%)</b>  | 0.2   | 0.1   | 0.1   | 0.2   | 0.1   | 0.1   | 0.1   | 2.5   | 95.2 | 21.0  | 0.2   | 1.8   | 10.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 3.8   | 0.0   | 0.0   | 0.0   | 0.0  | 5.5   | 0.0   | 0.0   | 0.8    |
| <b>XUF (%)</b>  | 0.1   | 0.2   | 0.2   | 0.3   | 0.7   | 1.2   | 1.4   | 1.5   | 0.0  | 0.6   | 0.3   | 0.2   | 0.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 16 May 1974  
**Date of First Criticality:** 16 Jun 1983  
**Date of Grid Connection:** 13 Aug 1983  
**Date of Commercial Operation:** 10 Dec 1984

**Lifetime Generation:** 142077.0 GW(e).h  
**Cumulative Energy Availability Factor:** 85.1%  
**Cumulative Load Factor:** 84.0%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 14.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 360.8          | 919.0          | 0.0  | 0.0    | 69.0                              | 100.0  | 4.9                | 0.0    | 1294               | 16.0   |
| 1984 | 4038.4         | 887.0          | 0.0  | 0.0    | 72.9                              | 100.0  | 51.8               | 0.0    | 5771               | 65.7   |
| 1985 | 4429.4         | 898.0          | 60.3   | 60.3   | 60.3                              | 60.3   | 56.3               | 56.3   | 5342               | 61.0   |
| 1986 | 5129.0         | 898.0          | 68.2   | 64.2   | 68.2                              | 64.2   | 65.2               | 60.8   | 6208               | 70.9   |
| 1987 | 6392.0         | 898.0          | 84.3   | 70.9   | 83.7                              | 70.7   | 81.3               | 67.6   | 7569               | 86.4   |
| 1988 | 6669.0         | 898.0          | 84.1   | 74.2   | 84.1                              | 74.1   | 84.5               | 71.8   | 7599               | 86.5   |
| 1989 | 6750.0         | 930.0          | 86.0   | 76.7   | 86.0                              | 76.5   | 82.9               | 74.1   | 7771               | 88.7   |
| 1990 | 6642.0         | 930.0          | 84.5   | 78.0   | 84.5                              | 77.9   | 81.5               | 75.4   | 7699               | 87.9   |
| 1991 | 6836.0         | 930.0          | 87.2   | 79.3   | 87.0                              | 79.2   | 83.9               | 76.6   | 7810               | 89.2   |
| 1992 | 6875.0         | 887.0          | 86.5   | 80.2   | 86.5                              | 80.1   | 88.2               | 78.0   | 7898               | 89.9   |
| 1993 | 6599.0         | 930.0          | 83.3   | 80.6   | 83.2                              | 80.5   | 81.0               | 78.4   | 7401               | 84.5   |
| 1994 | 6868.0         | 930.0          | 87.1   | 81.2   | 86.8                              | 81.1   | 84.3               | 79.0   | 7758               | 88.6   |
| 1995 | 5708.0         | 900.0          | 70.8   | 80.3   | 70.4                              | 80.2   | 72.4               | 78.4   | 6387               | 72.9   |
| 1996 | 7972.0         | 947.0          | 99.0   | 81.9   | 99.0                              | 81.8   | 95.8               | 79.9   | 8755               | 99.7   |
| 1997 | 6411.0         | 915.0          | 80.5   | 81.8   | 77.6                              | 81.5   | 80.0               | 79.9   | 7198               | 82.2   |
| 1998 | 7349.0         | 949.0          | 89.3   | 82.4   | 89.1                              | 82.0   | 88.4               | 80.5   | 7943               | 90.7   |
| 1999 | 8147.0         | 945.0          | 99.0   | 83.5   | 98.7                              | 83.2   | 98.4               | 81.8   | 8741               | 99.8   |
| 2000 | 7681.0         | 979.0          | 89.8   | 83.9   | 89.5                              | 83.6   | 89.3               | 82.3   | 8008               | 91.2   |
| 2001 | 7798.0         | 991.0          | 90.3   | 84.3   | 89.8                              | 84.0   | 89.8               | 82.7   | 8056               | 92.0   |
| 2002 | 8397.0         | 998.0          | 98.2   | 85.2   | 97.6                              | 84.8   | 96.0               | 83.5   | 8737               | 99.7   |
| 2003 | 7581.1         | 996.0          | 88.0   | 85.3   | 87.3                              | 84.9   | 86.9               | 83.7   | 7900               | 90.2   |
| 2004 | 7734.3         | 995.0          | 89.2   | 85.5   | 88.6                              | 85.1   | 88.5               | 84.0   | 7949               | 90.5   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 2904.0 | 4.0     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN.  |
| 01 Jan | 2904.0 | 5.6     | XP   | N33  | ENERGY LOSS DUE TO LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER. |
| 14 Jan | 4.8    | 0.2     | PP   | E31  | POWER REDUCTION TO PERFORM PV-97 (TURBINE VALVES OPERABILITY).                 |
| 21 Jan | 3.5    | 0.1     | PP   | E31  | POWER REDUCTION TO PERFORM PV-97 (TURBINE VALVES OPERABILITY).                 |
| 15 Apr | 4.9    | 0.2     | PP   | E31  | POWER REDUCTION TO PERFORM PV-97 (TURBINE VALVES OPERABILITY).                 |
| 01 May | 336.0  | 1.0     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN.  |
| 01 May | 336.0  | 5.1     | XP   | N33  | ENERGY LOSS DUE TO LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER. |
| 14 May | 28.0   | 27.8    | UF4  | L34  | TURBINE RUNBACK DUE TO LOW COOLING FLOW TO THE ALTERNATOR COILS.               |
| 01 Jun | 2928.0 | 22.1    | XP   | N33  | ENERGY LOSS DUE TO LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER. |
| 01 Jun | 2928.0 | 10.9    | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN.  |
| 02 Jul | 3.5    | 0.1     | PP   | D33  | POWER REDUCTION IN ORDER TO CARRY OUT A TREATMENT AGAINST ZEBRA MUSSEL         |
| 02 Jul | 3.5    | 0.1     | UP3  | Z33  | EXTENSION OF THE OUTAGE  |
| 18 Aug | 398.5  | 24.6    | PP   | S11  | POWER REDUCTION BECAUSE CORE STRETCH-OUT.                                      |
| 03 Sep | 9.6    | 5.8     | PP   | D31  | POWER REDUCTION IN ORDER TO INITIATE THE REFUELLING OUTAGE.                    |
| 04 Sep | 768.0  | 793.0   | PF   | C21  | REFUELLING OUTAGE.   |
| 06 Oct | 39.4   | 40.7    | UF3  | Z21  | UNAVAILABILITY DUE TO UNPLANNED EXTENSION OF THE REFUELLING OUTAGE.            |
| 07 Oct | 62.0   | 30.6    | PP   | E31  | LOAD INCREASE RAMP AFTER REFUELLING OUTAGE.                                    |
| 01 Nov | 1464.0 | 2.0     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN.  |
| 01 Nov | 1464.0 | 3.1     | XP   | N33  | ENERGY LOSS DUE TO LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER. |
| 04 Nov | 624.0  | 0.1     | PP   | D33  | POWER REDUCTION IN ORDER TO CARRY OUT A TREATMENT AGAINST ZEBRA MUSSEL         |
| 29 Nov | 781.4  | 12.5    | PP   | Z42  | POWER REDUCTION IN ORDER TO REDUCE THE CURRENT THROUGH TRANSFORMERS.           |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 241       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 768             |           |          | 848   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 21  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 76  | 6         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 6        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 8         | 0        |
| L. Human factor related  |                 | 28        |          | 8   |           |          |
| Z. Others  |                 | 39        |          |   |           |          |
| Subtotal   | 768             | 67        | 0        | 953   | 259       | 6        |
| Total  |                 | 835       |          |   | 1218      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 3  |
| 13. Reactor Auxiliary Systems                  |                 | 0  |
| 15. Reactor Cooling Systems                    |                 | 14                                       |
| 16. Steam generation systems                   |                 | 12                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 21. Fuel Handling and Storage Facilities       |                 | 8  |
| 31. Turbine and auxiliaries                    |                 | 13                                       |
| 32. Feedwater and Main Steam System            |                 | 15                                       |
| 35. All other I&C Systems                      |                 | 1  |
| 41. Main Generator Systems                     |                 | 103                                      |
| 42. Electrical Power Supply Systems            |                 | 63                                       |
| XX. Miscellaneous Systems                      |                 | 3  |
| Total  | 0               | 235                                      |

# ES-9 ASCO-2

**Operator:** ANAV (ASOCIACION NUCLEAR ASCO-VANDELLOS A.I.E. (ENDESA/ID))  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 997.0 MW(e)  
**Design Net RUP:** 888.0 MW(e)  
**Design Discharge Burnup:** 45000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6909.3 GW(e).h  
**Energy Availability Factor:** 79.6%  
**Load Factor:** 78.9%  
**Operating Factor:** 83.0%  
**Energy Unavailability Factor:** 20.4%  
**Total Off-line Time:** 1497 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 733.2 | 614.3 | 209.3 | 429.0 | 729.6 | 660.9 | 719.4 | 717.2 | 697.5 | 494.7 | 525.2 | 378.9 | 6909.3 |
| <b>EAF (%)</b>  | 99.6  | 89.3  | 27.1  | 59.7  | 99.2  | 93.3  | 98.5  | 98.4  | 98.3  | 67.5  | 74.0  | 51.3  | 79.6   |
| <b>UCF (%)</b>  | 99.8  | 89.4  | 27.1  | 59.9  | 99.8  | 94.3  | 99.8  | 99.9  | 99.8  | 68.2  | 74.2  | 51.5  | 80.2   |
| <b>LF (%)</b>   | 98.8  | 88.5  | 28.2  | 59.9  | 98.4  | 92.1  | 97.0  | 96.7  | 97.2  | 66.6  | 73.2  | 51.1  | 78.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 38.7  | 66.9  | 100.0 | 94.6  | 100.0 | 100.0 | 100.0 | 68.5  | 73.5  | 54.6  | 83.0   |
| <b>EUF (%)</b>  | 0.4   | 10.7  | 72.9  | 40.3  | 0.8   | 6.7   | 1.5   | 1.6   | 1.7   | 32.5  | 26.0  | 48.7  | 20.4   |
| <b>PUF (%)</b>  | 0.2   | 10.6  | 72.9  | 33.3  | 0.2   | 0.2   | 0.2   | 0.1   | 0.2   | 0.1   | 0.1   | 0.9   | 9.9    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 6.8   | 0.0   | 5.5   | 0.0   | 0.0   | 0.0   | 31.7  | 25.7  | 47.6  | 9.8    |
| <b>XUF (%)</b>  | 0.2   | 0.1   | 0.0   | 0.2   | 0.6   | 1.0   | 1.3   | 1.5   | 1.5   | 0.7   | 0.2   | 0.2   | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 07 Mar 1975      **Lifetime Generation:** 134804.0 GW(e).h  
**Date of First Criticality:** 11 Sep 1985      **Cumulative Energy Availability Factor:** 88.1%  
**Date of Grid Connection:** 23 Oct 1985      **Cumulative Load Factor:** 86.9%  
**Date of Commercial Operation:** 31 Mar 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 11.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 261.8          | 926.0          | 0.0  | 0.0    | 95.1                              | 100.0  | 3.4                | 0.0    | 991                | 12.0   |
| 1986 | 5368.0         | 898.0          | 0.0  | 0.0    | 74.2                              | 100.0  | 68.2               | 0.0    | 6639               | 75.8   |
| 1987 | 5954.0         | 898.0          | 78.1   | 78.1   | 77.3                              | 77.3   | 75.7               | 75.7   | 7035               | 80.3   |
| 1988 | 6865.0         | 898.0          | 88.2   | 83.2   | 86.8                              | 82.0   | 87.0               | 81.4   | 7874               | 89.6   |
| 1989 | 6732.0         | 930.0          | 86.3   | 84.3   | 85.7                              | 83.3   | 82.6               | 81.8   | 7729               | 88.2   |
| 1990 | 6933.0         | 930.0          | 90.4   | 85.8   | 90.4                              | 85.1   | 85.1               | 82.6   | 7916               | 90.4   |
| 1991 | 6820.0         | 930.0          | 86.7   | 86.0   | 86.5                              | 85.4   | 83.7               | 82.9   | 7799               | 89.0   |
| 1992 | 7077.0         | 953.0          | 89.9   | 86.7   | 89.9                              | 86.2   | 84.5               | 83.1   | 8042               | 91.6   |
| 1993 | 7052.0         | 930.0          | 90.0   | 87.2   | 88.6                              | 86.5   | 86.6               | 83.6   | 7897               | 90.1   |
| 1994 | 7085.0         | 930.0          | 89.8   | 87.5   | 89.5                              | 86.9   | 87.0               | 84.1   | 7962               | 90.9   |
| 1995 | 6977.0         | 900.0          | 86.4   | 87.4   | 86.3                              | 86.8   | 88.5               | 84.5   | 7674               | 87.6   |
| 1996 | 6011.0         | 963.0          | 75.6   | 86.1   | 75.1                              | 85.6   | 71.1               | 83.1   | 6825               | 77.7   |
| 1997 | 7916.0         | 900.0          | 98.2   | 87.2   | 96.2                              | 86.5   | 100.4              | 84.7   | 8725               | 99.6   |
| 1998 | 7399.0         | 946.0          | 90.6   | 87.5   | 89.9                              | 86.8   | 89.3               | 85.1   | 8050               | 91.9   |
| 1999 | 7215.0         | 946.0          | 87.2   | 87.5   | 86.4                              | 86.8   | 87.1               | 85.2   | 7854               | 89.7   |
| 2000 | 8451.0         | 983.0          | 98.6   | 88.3   | 98.6                              | 87.7   | 97.9               | 86.2   | 8734               | 99.4   |
| 2001 | 7829.0         | 983.0          | 91.0   | 88.5   | 90.6                              | 87.9   | 90.9               | 86.5   | 8102               | 92.5   |
| 2002 | 7780.0         | 997.0          | 90.8   | 88.7   | 89.4                              | 88.0   | 89.1               | 86.7   | 8127               | 92.8   |
| 2003 | 8521.2         | 997.0          | 99.6   | 89.3   | 98.7                              | 88.7   | 97.6               | 87.4   | 8738               | 99.7   |
| 2004 | 6909.3         | 997.0          | 80.2   | 88.8   | 79.6                              | 88.1   | 78.9               | 86.9   | 7287               | 83.0   |



## ES-9 ASCO-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 2184.0 | 2.0     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN   |
| 01 Jan | 2184.0 | 2.3     | XP   | N33  | LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER               |
| 04 Jan | 3.5    | 0.1     | PP   | D33  | POWER REDUCTION IN ORDER TO CARRY OUT A TREATMENT AGAINST ZEBRA MUSSEL   |
| 04 Feb | 969.5  | 140.1   | PP   | S11  | POWER REDUCTION BECAUSE CORE STRECH-OUT                                  |
| 12 Mar | 8.0    | 5.3     | PP   | D31  | POWER REDUCTION IN ORDER TO INITIATE THE REFUELLING OUTAGE               |
| 13 Mar | 647.0  | 664.6   | PF   | C21  | REFUELLING OUTAGE  |
| 01 Apr | 240.0  | 0.7     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN   |
| 01 Apr | 240.0  | 1.2     | XP   | N33  | LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER               |
| 09 Apr | 47.3   | 48.6    | UF3  | Z21  | UNAVAILABILITY DUE TO UNPLANNED EXTENSION OF THE REFUELLING OUTAGE       |
| 10 Apr | 81.4   | 40.8    | PP   | E31  | LOAD INCREASE RAMP AFTER REFUELLING OUTAGE                               |
| 01 May | 2208.0 | 3.9     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN   |
| 01 May | 1464.0 | 11.5    | XP   | N33  | LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER               |
| 19 May | 1.8    | 0.2     | UP3  | A31  | POWER REDUCTION BECAUSE DISTURBANCES AT THE SECONDARY CIRCUIT            |
| 06 Jun | 39.0   | 39.7    | XF4  | J42  | TURBINE TRIP DUE TO DISTURBANCES AT THE 400 KV NET                       |
| 01 Jul | 3672.0 | 38.0    | XP   | N33  | LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER               |
| 01 Jul | 3.5    | 0.1     | PP   | D33  | POWER REDUCTION IN ORDER TO CARRY OUT A TREATMENT AGAINST ZEBRA MUSSEL   |
| 01 Aug | 2208.0 | 3.1     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN   |
| 08 Sep | 3.8    | 0.4     | PP   | E31  | POWER REDUCTION TO PERFORM PV-97 (TURBINE VALVES OPERABILITY)            |
| 16 Oct | 236.0  | 235.5   | UF4  | A42  | THE ELECTRICAL PROTECTION ACTIVATION OF PHASE-T OF THE MAIN TRANSFORMER  |
| 01 Nov | 552.0  | 0.8     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN   |
| 04 Nov | 4.0    | 0.1     | PP   | D33  | POWER REDUCTION IN ORDER TO CARRY OUT A TREATMENT AGAINST ZEBRA MUSSEL   |
| 23 Nov | 528.3  | 537.0   | UF4  | A42  | THE ELECTRICAL PROTECTION ACTIVATION OF PHASE -S OF THE MAIN TRANSFORMER |
| 01 Dec | 744.0  | 0.7     | PP   | Z32  | ENERGY LOSS DUE TO SG BLOWDOWN   |
| 01 Dec | 744.0  | 1.5     | XP   | N33  | LOW VACUUM BECAUSE WATER FLOW AND TEMPERATURE OF THE RIVER               |
| 15 Dec | 395.0  | 6.1     | PP   | Z42  | POWER REDUCTION IN ORDER TO REDUCE THE CURRENT THROUGH TRANSFORMERS      |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 764       |          |  | 135       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 647             |           |          | 626                                      |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 37                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 25                                       | 4         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling   |                 |           |          | 25                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           | 39       |  | 3         | 6        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 18                                       | 6         | 4        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  |           | 3        |
| Z. Others  |                 | 47        |          |  |           |          |
| Subtotal   | 647             | 811       | 39       | 731                                      | 149       | 13       |
| Total  |                 | 1497      |          |  | 893       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 4  |
| 12. Reactor I&C Systems             |                 | 1  |
| 15. Reactor Cooling Systems         |                 | 1  |
| 16. Steam generation systems        |                 | 11                                       |
| 31. Turbine and auxiliaries         |                 | 16                                       |
| 32. Feedwater and Main Steam System |                 | 75                                       |
| 33. Circulating Water System        |                 | 3  |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems | 764             | 10                                       |
| XX. Miscellaneous Systems           |                 | 9  |
| Total                               | 764             | 130                                      |

# ES-10 COFRENTES

**Operator:** ID (IBERDROLA, S.A.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1062.0 MW(e)  
**Design Net RUP:** 930.0 MW(e)  
**Design Discharge Burnup:** 28750 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8813.9 GW(e).h  
**Energy Availability Factor:** 94.3%  
**Load Factor:** 94.4%  
**Operating Factor:** 96.3%  
**Energy Unavailability Factor:** 5.7%  
**Total Off-line Time:** 327 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 773.1 | 732.4 | 787.7 | 765.0 | 484.2 | 758.2 | 776.7 | 775.9 | 759.5 | 718.8 | 719.5 | 762.8 | 8813.9 |
| <b>EAFF (%)</b> | 97.8  | 98.9  | 99.6  | 99.9  | 60.8  | 99.0  | 98.1  | 98.0  | 99.2  | 90.7  | 93.9  | 96.4  | 94.3   |
| <b>UCF (%)</b>  | 99.4  | 100.0 | 99.8  | 100.0 | 61.0  | 99.7  | 99.0  | 98.9  | 100.0 | 91.3  | 94.2  | 96.8  | 94.9   |
| <b>LF (%)</b>   | 97.8  | 98.9  | 99.5  | 100.0 | 61.2  | 99.0  | 98.1  | 98.0  | 99.1  | 90.7  | 93.9  | 96.4  | 94.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 67.1  | 100.0 | 100.0 | 100.0 | 100.0 | 93.8  | 96.8  | 98.3  | 96.3   |
| <b>EUF (%)</b>  | 2.2   | 1.1   | 0.4   | 0.1   | 39.2  | 1.0   | 1.9   | 2.0   | 0.8   | 9.3   | 6.1   | 3.6   | 5.7    |
| <b>PUF (%)</b>  | 0.5   | 0.0   | 0.2   | 0.0   | 34.5  | 0.3   | 0.0   | 0.6   | 0.0   | 0.4   | 0.0   | 0.0   | 3.1    |
| <b>UCLF (%)</b> | 0.1   | 0.0   | 0.0   | 0.0   | 4.6   | 0.0   | 1.0   | 0.5   | 0.0   | 8.3   | 5.8   | 3.2   | 2.0    |
| <b>XUF (%)</b>  | 1.7   | 1.1   | 0.2   | 0.1   | 0.2   | 0.7   | 0.8   | 0.9   | 0.8   | 0.6   | 0.3   | 0.4   | 0.7    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

REFERENCE UNIT POWER REVISIONS DURING THE YEAR: 10/FEB/2004 1063.94 MW

## 5. Historical Summary

**Date of Construction Start:** 09 Sep 1975      **Lifetime Generation:** 148822.2 GW(e).h  
**Date of First Criticality:** 23 Aug 1984      **Cumulative Energy Availability Factor:** 87.9%  
**Date of Grid Connection:** 14 Oct 1984      **Cumulative Load Factor:** 88.0%  
**Date of Commercial Operation:** 11 Mar 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 12.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 350.2          | 948.0          | 0.0  | 0.0    | 91.3                              | 100.0  | 4.2                | 0.0    | 1190               | 13.5   |
| 1985 | 6142.5         | 939.0          | 0.0  | 0.0    | 75.1                              | 100.0  | 74.7               | 0.0    | 7300               | 83.3   |
| 1986 | 6668.3         | 939.0          | 82.0   | 82.0   | 81.1                              | 81.1   | 81.1               | 81.1   | 7487               | 85.5   |
| 1987 | 6883.1         | 930.0          | 83.4   | 82.7   | 83.4                              | 82.2   | 84.5               | 82.8   | 7615               | 86.9   |
| 1988 | 7142.2         | 930.0          | 85.7   | 83.7   | 85.5                              | 83.3   | 87.4               | 84.3   | 7850               | 89.4   |
| 1989 | 7052.2         | 939.0          | 83.9   | 83.8   | 83.9                              | 83.5   | 85.7               | 84.7   | 7732               | 88.3   |
| 1990 | 7070.3         | 939.0          | 85.1   | 84.0   | 85.1                              | 83.8   | 86.0               | 84.9   | 7560               | 86.3   |
| 1991 | 6999.6         | 953.0          | 83.7   | 84.0   | 83.7                              | 83.8   | 83.8               | 84.7   | 7660               | 87.4   |
| 1992 | 7712.1         | 939.0          | 91.9   | 85.1   | 91.9                              | 84.9   | 93.5               | 86.0   | 8376               | 95.4   |
| 1993 | 7016.2         | 953.0          | 84.8   | 85.1   | 83.6                              | 84.8   | 84.0               | 85.8   | 7579               | 86.5   |
| 1994 | 6990.9         | 953.0          | 85.1   | 85.1   | 83.5                              | 84.6   | 83.7               | 85.5   | 7553               | 86.2   |
| 1995 | 8187.0         | 953.0          | 97.8   | 86.3   | 97.5                              | 85.9   | 98.1               | 86.8   | 8683               | 99.1   |
| 1996 | 7687.5         | 953.0          | 91.9   | 86.8   | 90.9                              | 86.4   | 91.8               | 87.3   | 8215               | 93.5   |
| 1997 | 6893.7         | 953.0          | 86.2   | 86.8   | 83.7                              | 86.2   | 82.6               | 86.9   | 7668               | 87.5   |
| 1998 | 8174.1         | 993.0          | 96.6   | 87.6   | 96.6                              | 87.0   | 94.0               | 87.4   | 8546               | 97.6   |
| 1999 | 7491.6         | 989.0          | 89.8   | 87.8   | 86.4                              | 87.0   | 86.5               | 87.4   | 8004               | 91.4   |
| 2000 | 7348.1         | 989.0          | 86.9   | 87.7   | 84.6                              | 86.8   | 84.6               | 87.2   | 7808               | 88.9   |
| 2001 | 8278.1         | 989.0          | 95.5   | 88.2   | 95.5                              | 87.4   | 95.6               | 87.7   | 8424               | 96.2   |
| 2002 | 7918.1         | 1043.0         | 89.2   | 88.3   | 88.2                              | 87.4   | 86.7               | 87.6   | 7875               | 89.9   |
| 2003 | 8002.5         | 1056.0         | 88.2   | 88.3   | 88.2                              | 87.5   | 86.5               | 87.6   | 7742               | 88.4   |
| 2004 | 8813.9         | 1063.0         | 94.9   | 88.6   | 94.3                              | 87.9   | 94.4               | 88.0   | 8457               | 96.3   |

# ES-10 COFRENTES

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 31 Jan | 50.0  | 17.1    | XP   | S11  | FLUX-TILT TESTS  |
| 01 May | 240.6 | 255.9   | PF   | C    | REFUELLING OUTAGE  |
| 01 May | 0.8   | 0.8     | UF4  | A41  | AUTOMATIC SCRAM FOR GENERATOR TRIP DUE TO MALFUNCTION GENERATOR EXCITATION SYSTEM. |
| 12 May | 33.0  | 13.7    | PP   | E    | START-UP AND START-UP TESTS AFTER REFUELLING OUTAGE                                |
| 12 May | 61.4  | 18.7    | UP1  | A32  | SEVERAL FAILURES IN HEATERS ALONG THE START-UP AFTER THE SCRAM                     |
| 23 May | 30.3  | 11.2    | UP2  | A12  | RECIRCULATION PUMP TRIP DUE TO A SPURIOUS SIGNAL                                   |
| 24 Oct | 30.9  | 32.9    | UF4  | A41  | REACTOR SCRAM DUE TO ALTERNATOR TRIP BECAUSE LOSS OF EXCITATION.                   |
| 25 Oct | 15.3  | 16.2    | UF4  | L32  | REACTOR SCRAM DUE TO ERROR WHEN PUTTING THE HEATERS IN SERVICE                     |
| 25 Oct | 9.9   | 8.8     | UP1  | L41  | START-UP AFTER SCRAM   |
| 26 Oct | 8.9   | 7.5     | UP1  | L32  | START-UP AFTER SCRAM   |
| 12 Nov | 54.8  | 20.2    | UP1  | A32  | POWER REDUCTION TO REPAIR THE CHECK VALVE N21FF274                                 |
| 30 Nov | 35.2  | 37.4    | UF4  | L12  | REACTOR SCRAM DUE TO RECIRCULATION CONTROL RUNBACK AND PUMP A TRIP                 |
| 01 Dec | 24.4  | 11.7    | UP1  | A12  | START-UP AFTER SCRAM   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 31        |          |  | 203       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 240             |           |          | 584                                      | 3         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 20                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 27                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 4        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 8         | 1        |
| L. Human factor related  |                 | 50        |          |  |           |          |
| Z. Others  |                 |           |          |  | 8         |          |
| Subtotal   | 240             | 81        | 0        | 631                                      | 227       | 5        |
| Total  |                 | 321       |          |  | 863       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 0  |
| 12. Reactor I&C Systems                  |                 | 17                                       |
| 13. Reactor Auxiliary Systems            |                 | 5  |
| 15. Reactor Cooling Systems              |                 | 11                                       |
| 21. Fuel Handling and Storage Facilities |                 | 30                                       |
| 31. Turbine and auxiliaries              |                 | 85                                       |
| 32. Feedwater and Main Steam System      |                 | 6  |
| 41. Main Generator Systems               | 31              | 34                                       |
| 42. Electrical Power Supply Systems      |                 | 10                                       |
| Total                                    | 31              | 198                                      |

## ES-1 JOSE CABRERA-1(ZORITA)

**Operator:** UFG (UNION FENOSA GENERATION S.A.)

**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

### 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 153.0 MW(e)  
**Design Net RUP:** 153.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 1172.9 GW(e).h  
**Energy Availability Factor:** 94.4%  
**Load Factor:** 87.3%  
**Operating Factor:** 96.6%  
**Energy Unavailability Factor:** 5.6%  
**Total Off-line Time:** 296 hours

### 3. 2004 Monthly Performance Data

|                 | Jan  | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 56.9 | 97.7  | 104.2 | 99.8  | 104.3 | 99.9  | 99.7  | 104.5 | 100.3 | 102.4 | 100.5 | 102.6 | 1172.9 |
| <b>EAF (%)</b>  | 56.3 | 94.1  | 99.9  | 97.7  | 99.2  | 98.1  | 95.5  | 99.2  | 98.6  | 97.5  | 98.9  | 97.8  | 94.4   |
| <b>UCF (%)</b>  | 56.3 | 94.1  | 99.9  | 97.7  | 99.3  | 98.1  | 95.5  | 99.2  | 98.6  | 97.5  | 98.9  | 97.8  | 94.4   |
| <b>LF (%)</b>   | 49.9 | 91.8  | 91.5  | 90.6  | 91.7  | 90.7  | 87.6  | 91.8  | 91.1  | 89.8  | 91.3  | 90.1  | 87.3   |
| <b>OF (%)</b>   | 60.3 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.6   |
| <b>EUF (%)</b>  | 43.7 | 5.9   | 0.1   | 2.3   | 0.8   | 1.9   | 4.5   | 0.8   | 1.4   | 2.5   | 1.1   | 2.2   | 5.6    |
| <b>PUF (%)</b>  | 4.3  | 0.0   | 0.1   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2   | 0.0   | 0.0   | 0.5    |
| <b>UCLF (%)</b> | 39.4 | 5.9   | 0.1   | 2.3   | 0.7   | 1.9   | 4.5   | 0.8   | 1.4   | 1.3   | 1.0   | 2.2   | 5.2    |
| <b>XUF (%)</b>  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

OPERATION AT FULL POWER IN BASE LOAD MODE.THERE HAVE NOT BEEN SIGNIFICANT FACTORS AFFECTING ENERGY GENERATION. THE OUTAGE LASTED TILL JANUARY 2004, LONGER AS PROGRAMMED, CAUSED, AMONG OTHER MINOR REASONS, BY THE LOOSENING OF A PART FROM A FUEL ELEMENT TOOL DURING THE CORE LOADING. THE PLANT WENT INTO OPERATION IN 1968, AND IT SHALL BEGIN THE PERMANENT SHUTDOWN ON APRIL 2006 FOLLOWING A DISPOSITION OF THE SPANISH GOVERNMENT.

### 5. Historical Summary

**Date of Construction Start:** 24 Jun 1964      **Lifetime Generation:** 33320.6 GW(e).h  
**Date of First Criticality:** 30 Jun 1968      **Cumulative Energy Availability Factor:** 71.6%  
**Date of Grid Connection:** 14 Jul 1968      **Cumulative Load Factor:** 68.7%  
**Date of Commercial Operation:** 13 Aug 1969      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 28.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 1097.1         | 153.0          | 82.8   | 73.4   | 82.8                              | 67.9   | 81.9               | 67.2   | 7834               | 89.4   |
| 1988 | 1142.2         | 153.0          | 85.2   | 74.0   | 85.2                              | 68.8   | 85.0               | 68.2   | 7839               | 89.2   |
| 1989 | 1132.9         | 153.0          | 84.8   | 74.6   | 84.8                              | 69.6   | 84.8               | 69.0   | 8059               | 92.3   |
| 1990 | 957.4          | 153.0          | 72.3   | 74.5   | 72.3                              | 69.7   | 71.4               | 69.1   | 7281               | 83.1   |
| 1991 | 1048.4         | 153.0          | 79.1   | 74.7   | 79.1                              | 70.1   | 78.2               | 69.5   | 7230               | 82.5   |
| 1992 | 1123.8         | 153.0          | 84.7   | 75.1   | 84.0                              | 70.7   | 83.6               | 70.1   | 7743               | 88.1   |
| 1993 | 913.0          | 153.0          | 93.5   | 75.9   | 81.7                              | 71.2   | 68.1               | 70.0   | 8496               | 97.0   |
| 1994 | 21.0           | 153.0          | 2.4  | 73.0   | 2.4                               | 68.5   | 1.6                | 67.3   | 216                | 2.5    |
| 1995 | 348.7          | 153.0          | 51.2   | 72.1   | 51.2                              | 67.8   | 26.0               | 65.7   | 4853               | 55.4   |
| 1996 | 979.8          | 153.0          | 90.1   | 72.8   | 90.1                              | 68.6   | 72.9               | 66.0   | 8099               | 92.2   |
| 1997 | 815.6          | 153.0          | 63.3   | 72.5   | 63.3                              | 68.4   | 60.9               | 65.8   | 6088               | 69.5   |
| 1998 | 1100.3         | 153.0          | 84.0   | 72.8   | 84.0                              | 69.0   | 82.1               | 66.4   | 8004               | 91.4   |
| 1999 | 1109.6         | 153.0          | 84.2   | 73.2   | 84.2                              | 69.5   | 82.8               | 66.9   | 7969               | 91.0   |
| 2000 | 1098.7         | 153.0          | 83.8   | 73.6   | 83.8                              | 69.9   | 81.8               | 67.4   | 7898               | 89.9   |
| 2001 | 1057.9         | 153.0          | 82.1   | 73.8   | 82.1                              | 70.3   | 78.9               | 67.8   | 7698               | 87.9   |
| 2002 | 947.4          | 153.0          | 79.1   | 74.0   | 79.1                              | 70.6   | 70.7               | 67.8   | 6912               | 78.9   |
| 2003 | 1071.0         | 153.0          | 84.5   | 74.3   | 84.5                              | 71.0   | 79.9               | 68.2   | 7632               | 87.1   |
| 2004 | 1172.9         | 153.0          | 94.4   | 74.9   | 94.4                              | 71.6   | 87.3               | 68.7   | 8489               | 96.6   |

## ES-1 JOSE CABRERA-1(ZORITA)

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 325.0 | 49.8    | PF   | C    | DURING 2004, THE JOSE CABRERA NUCLEAR POWER PLANT OPERATED WITHOUT ANY INCIDENTS INVOLVING A RISK TO THE POPULATION OR ENVIRONMENT. REFUELING OUTAGE NUMBER 27 WAS BEGUN ON NOVEMBER 15 (2003) AND LASTED ON JANUARY 14 (2004). 49752 MW(E)H IS THE ENERGY LOSS (NET) DURING THE DAYS 1 TO 14 JANUARY 2004 OF NOTE IS THE LOW RADIOLOGICAL DOSE RECEIVED DURING THIS REFUELING. IN ADDITION TO REPLACING 16 FUEL ASSEMBLIES, 4290 PREVIOUSLY PLANNED ACTIVITIES WERE CARRIED OUT BY PLANT PERSONNEL IN CONJUNCTION WITH 390 CONTRACT PERSONNEL FROM 38 COMPANIES. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 395       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 325             |           |          | 1112                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 273                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 7  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 12                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         | 2        |
| Z. Others  |                 |           |          |  | 9         |          |
| Subtotal   | 325             | 0         | 0        | 1404                                     | 406       | 4        |
| Total  |                 | 325       |          |  | 1814      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 271                                      |
| 12. Reactor I&C Systems                        |                 | 4  |
| 13. Reactor Auxiliary Systems                  |                 | 3  |
| 14. Safety Systems                             |                 | 1  |
| 15. Reactor Cooling Systems                    |                 | 12                                       |
| 16. Steam generation systems                   |                 | 29                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 9  |
| 32. Feedwater and Main Steam System            |                 | 4  |
| 41. Main Generator Systems                     |                 | 52                                       |
| 42. Electrical Power Supply Systems            |                 | 6  |
| Total  | 0               | 391                                      |

**ES-2 SANTA MARIA DE GARONA**

**Operator:** NUCLENOR (NUCLENOR, S.A.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 446.0 MW(e)  
**Design Net RUP:** 440.0 MW(e)  
**Design Discharge Burnup:** 30-35000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 3873.8 GW(e).h  
**Energy Availability Factor:** 98.7%  
**Load Factor:** 98.9%  
**Operating Factor:** 99.0%  
**Energy Unavailability Factor:** 1.3%  
**Total Off-line Time:** 85 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 330.5 | 310.0 | 327.5 | 280.7 | 331.1 | 321.1 | 333.2 | 330.9 | 320.7 | 333.1 | 321.7 | 333.3 | 3873.8 |
| <b>EAF (%)</b>  | 99.6  | 99.9  | 98.8  | 87.4  | 99.8  | 100.0 | 100.0 | 99.5  | 99.9  | 100.0 | 99.6  | 100.0 | 98.7   |
| <b>UCF (%)</b>  | 99.6  | 100.0 | 98.9  | 87.4  | 100.0 | 100.0 | 100.0 | 99.5  | 100.0 | 100.0 | 99.6  | 100.0 | 98.8   |
| <b>LF (%)</b>   | 99.6  | 99.9  | 98.7  | 87.5  | 99.8  | 100.0 | 100.4 | 99.7  | 99.9  | 100.3 | 100.2 | 100.4 | 98.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 88.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.0   |
| <b>EUF (%)</b>  | 0.4   | 0.1   | 1.2   | 12.6  | 0.2   | 0.0   | 0.0   | 0.5   | 0.1   | 0.0   | 0.4   | 0.0   | 1.3    |
| <b>PUF (%)</b>  | 0.3   | 0.0   | 0.0   | 10.3  | 0.0   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 0.4   | 0.0   | 0.9    |
| <b>UCLF (%)</b> | 0.1   | 0.0   | 1.1   | 2.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.1   | 0.1   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

OPERATION AT FULL POWER IN BASE LOAD MODE. NO REFUELING OUTAGE DURING THE YEAR.

**5. Historical Summary**

**Date of Construction Start:** 02 May 1966  
**Date of First Criticality:** 05 Nov 1970  
**Date of Grid Connection:** 02 Mar 1971  
**Date of Commercial Operation:** 11 May 1971

**Lifetime Generation:** 98284.8 GW(e).h  
**Cumulative Energy Availability Factor:** 76.3%  
**Cumulative Load Factor:** 75.7%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 23.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2322.1         | 440.0          | 60.2   | 65.3   | 60.2                              | 62.1   | 60.2               | 61.2   | 5630               | 64.3   |
| 1984 | 2873.5         | 440.0          | 85.6   | 66.8   | 74.2                              | 63.1   | 74.3               | 62.3   | 6853               | 78.0   |
| 1985 | 1731.0         | 440.0          | 46.6   | 65.4   | 44.1                              | 61.7   | 44.9               | 61.0   | 4285               | 48.9   |
| 1986 | 3413.6         | 440.0          | 91.8   | 67.2   | 88.6                              | 63.5   | 88.6               | 62.9   | 8173               | 93.3   |
| 1987 | 2565.1         | 440.0          | 67.6   | 67.2   | 66.6                              | 63.7   | 66.6               | 63.1   | 6205               | 70.8   |
| 1988 | 2693.3         | 440.0          | 70.0   | 67.3   | 70.0                              | 64.1   | 69.7               | 63.5   | 6639               | 75.6   |
| 1989 | 3515.8         | 440.0          | 92.2   | 68.7   | 91.3                              | 65.6   | 91.2               | 65.0   | 8324               | 95.0   |
| 1990 | 2558.6         | 440.0          | 66.4   | 68.6   | 66.4                              | 65.6   | 66.4               | 65.1   | 6297               | 71.9   |
| 1991 | 3678.3         | 440.0          | 95.4   | 69.9   | 95.4                              | 67.1   | 95.4               | 66.6   | 8528               | 97.4   |
| 1992 | 2377.3         | 440.0          | 69.7   | 69.9   | 69.2                              | 67.2   | 61.5               | 66.3   | 6360               | 72.4   |
| 1993 | 3671.9         | 440.0          | 95.1   | 71.1   | 95.1                              | 68.5   | 95.3               | 67.7   | 8444               | 96.4   |
| 1994 | 3134.1         | 440.0          | 82.0   | 71.5   | 81.2                              | 69.0   | 81.3               | 68.3   | 7271               | 83.0   |
| 1995 | 3826.0         | 440.0          | 99.3   | 72.7   | 99.1                              | 70.3   | 99.3               | 69.5   | 8760               | 100.0  |
| 1996 | 3203.8         | 440.0          | 83.2   | 73.1   | 82.5                              | 70.8   | 82.9               | 70.1   | 7450               | 84.8   |
| 1997 | 3363.7         | 440.0          | 89.2   | 73.7   | 89.1                              | 71.5   | 87.3               | 70.7   | 7853               | 89.7   |
| 1998 | 3792.5         | 446.0          | 98.0   | 74.6   | 97.5                              | 72.4   | 97.1               | 71.7   | 8735               | 99.7   |
| 1999 | 3330.8         | 448.0          | 86.1   | 75.0   | 84.9                              | 72.9   | 84.9               | 72.2   | 7639               | 87.2   |
| 2000 | 3854.6         | 446.0          | 98.8   | 75.9   | 98.4                              | 73.8   | 98.4               | 73.1   | 8699               | 99.0   |
| 2001 | 3435.0         | 446.0          | 88.0   | 76.3   | 87.9                              | 74.3   | 87.9               | 73.6   | 7737               | 88.3   |
| 2002 | 3841.4         | 446.0          | 98.8   | 77.0   | 98.3                              | 75.0   | 98.3               | 74.4   | 8679               | 99.1   |
| 2003 | 3577.7         | 446.0          | 92.0   | 77.5   | 91.6                              | 75.6   | 91.6               | 75.0   | 8085               | 92.3   |
| 2004 | 3873.8         | 446.0          | 98.8   | 78.2   | 98.7                              | 76.3   | 98.9               | 75.7   | 8699               | 99.0   |

## ES-2 SANTA MARIA DE GARONA

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 17 Apr | 74.0  | 33.0    | PF   | D31  | REACTOR SHUTDOWN TO PERFORM SEVERAL MAINTENANCE WORKS. IT IS INCLUDED THE POWER DECREASE AND POWER RISE PERIODS. |
| 20 Apr | 11.0  | 4.8     | UF3  | Z32  | UNPLANNED EXTENSION OF MAINTENANCE WORKS OUTAGE.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 467       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1101                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 74              |           |          | 47                                       | 1         |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 5         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 22                                       | 39        | 19       |
| J. Grid failure or grid unavailability   |                 |           |          |  | 2         | 11       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 7  | 16        | 22       |
| Z. Others  |                 | 11        |          |  | 1         |          |
| Subtotal   | 74              | 11        | 0        | 1179                                     | 544       | 52       |
| Total  |                 | 85        |          |  | 1775      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 32                                       |
| 12. Reactor I&C Systems                        |                 | 41                                       |
| 13. Reactor Auxiliary Systems                  |                 | 11                                       |
| 14. Safety Systems                             |                 | 37                                       |
| 15. Reactor Cooling Systems                    |                 | 200                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 21                                       |
| 32. Feedwater and Main Steam System            |                 | 27                                       |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     |                 | 4  |
| 42. Electrical Power Supply Systems            |                 | 42                                       |
| Total  | 0               | 415                                      |

# ES-11 TRILLO-1

**Operator:** CNAT (CENTRALES NUCLEARES ALMARAZ-TRILLO(ID/UFG/ENDESA/HC/NUCLENOR ))  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1003.0 MW(e)  
**Design Net RUP:** 990.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7980.1 GW(e).h  
**Energy Availability Factor:** 90.5%  
**Load Factor:** 90.6%  
**Operating Factor:** 92.2%  
**Energy Unavailability Factor:** 9.5%  
**Total Off-line Time:** 682 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 736.1 | 654.6 | 740.6 | 716.2 | 305.4 | 509.3 | 737.4 | 738.2 | 713.7 | 739.3 | 717.0 | 672.3 | 7980.1 |
| <b>EAF (%)</b>  | 98.6  | 93.7  | 99.3  | 99.1  | 40.9  | 70.5  | 98.8  | 98.9  | 98.8  | 98.9  | 99.2  | 90.0  | 90.5   |
| <b>UCF (%)</b>  | 99.3  | 94.3  | 100.0 | 100.0 | 42.1  | 72.0  | 100.0 | 100.0 | 99.9  | 99.9  | 99.9  | 91.0  | 91.5   |
| <b>LF (%)</b>   | 98.6  | 93.8  | 99.2  | 99.3  | 40.9  | 70.5  | 98.8  | 98.9  | 98.8  | 98.9  | 99.3  | 90.1  | 90.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 43.5  | 73.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.9  | 92.2   |
| <b>EUF (%)</b>  | 1.4   | 6.3   | 0.7   | 0.9   | 59.1  | 29.5  | 1.2   | 1.1   | 1.2   | 1.1   | 0.8   | 10.0  | 9.5    |
| <b>PUF (%)</b>  | 0.7   | 0.0   | 0.0   | 0.0   | 55.6  | 11.0  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 5.7    |
| <b>UCLF (%)</b> | 0.0   | 5.7   | 0.0   | 0.0   | 2.3   | 17.0  | 0.0   | 0.0   | 0.0   | 0.2   | 0.1   | 9.0   | 2.8    |
| <b>XUF (%)</b>  | 0.7   | 0.6   | 0.7   | 0.9   | 1.2   | 1.5   | 1.2   | 1.1   | 1.1   | 1.0   | 0.6   | 0.9   | 1.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 17 Aug 1979      **Lifetime Generation:** 117352.1 GW(e).h  
**Date of First Criticality:** 14 May 1988      **Cumulative Energy Availability Factor:** 87.4%  
**Date of Grid Connection:** 23 May 1988      **Cumulative Load Factor:** 82.7%  
**Date of Commercial Operation:** 06 Aug 1988      **Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 12.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 1571.7         | 997.0          | 0.0  | 0.0    | 93.3                              | 100.0  | 17.9               | 0.0    | 1704               | 19.4   |
| 1989 | 7147.8         | 990.0          | 83.7   | 83.7   | 83.7                              | 83.7   | 82.4               | 82.4   | 7665               | 87.5   |
| 1990 | 6372.2         | 990.0          | 75.0   | 79.3   | 75.0                              | 79.3   | 73.5               | 77.9   | 7596               | 86.7   |
| 1991 | 6410.8         | 972.0          | 79.7   | 79.4   | 79.7                              | 79.4   | 75.3               | 77.1   | 6929               | 79.1   |
| 1992 | 6408.0         | 1000.0         | 98.3   | 84.2   | 98.3                              | 84.2   | 73.0               | 76.0   | 6467               | 73.6   |
| 1993 | 7395.9         | 1001.0         | 85.5   | 84.5   | 85.5                              | 84.5   | 84.3               | 77.7   | 7513               | 85.8   |
| 1994 | 7927.8         | 1001.0         | 91.0   | 85.6   | 91.0                              | 85.6   | 90.4               | 79.8   | 8010               | 91.4   |
| 1995 | 7472.6         | 1001.0         | 86.4   | 85.7   | 86.4                              | 85.7   | 85.2               | 80.6   | 7570               | 86.4   |
| 1996 | 7626.3         | 1001.0         | 87.4   | 85.9   | 87.4                              | 85.9   | 86.7               | 81.4   | 7707               | 87.7   |
| 1997 | 7765.5         | 1001.0         | 91.9   | 86.6   | 91.1                              | 86.5   | 88.6               | 82.2   | 8066               | 92.1   |
| 1998 | 4389.0         | 1000.0         | 84.7   | 86.4   | 84.6                              | 86.3   | 50.1               | 79.0   | 4477               | 51.1   |
| 1999 | 6828.8         | 1001.0         | 78.0   | 85.6   | 78.0                              | 85.5   | 77.9               | 78.9   | 6853               | 78.2   |
| 2000 | 8206.5         | 1001.0         | 93.7   | 86.3   | 93.7                              | 86.2   | 93.3               | 80.1   | 8251               | 93.9   |
| 2001 | 7907.4         | 1001.0         | 90.7   | 86.6   | 90.7                              | 86.6   | 90.2               | 80.9   | 7958               | 90.8   |
| 2002 | 7827.0         | 1000.0         | 89.6   | 86.8   | 89.6                              | 86.8   | 89.3               | 81.5   | 7852               | 89.6   |
| 2003 | 8114.7         | 1003.0         | 93.1   | 87.3   | 92.5                              | 87.2   | 92.4               | 82.2   | 8210               | 93.7   |
| 2004 | 7980.1         | 1003.0         | 91.5   | 87.5   | 90.5                              | 87.4   | 90.6               | 82.7   | 8102               | 92.2   |



# ES-11 TRILLO-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 07 Jan | 42.0  | 0.6     | PP   | D31  | CONDENSATOR ISOLATION FOR CLEANING (SD 11B001).                             |
| 12 Jan | 92.0  | 1.4     | PP   | D31  | CONDENSATOR ISOLATION FOR CLEANING (SD 13B001).                             |
| 18 Jan | 121.0 | 3.1     | PP   | D31  | CONDENSATOR ISOLATION FOR CLEANING AND LEAKAGE SEARCHING (SD 12B001).       |
| 08 Feb | 110.0 | 39.9    | UP   | A31  | CONDENSATOR ISOLATION FOR CLEANING AND LEAKAGE SEARCHING (SD 11B001).       |
| 07 May | 69.0  | 17.0    | UP   | A31  | CONDENSATOR ISOLATION FOR LEAKAGE SEARCHING (SD 11B001).                    |
| 14 May | 492.0 | 494.2   | PF   | C    | REFUELLING OUTAGE.  |
| 03 Jun | 80.0  | 80.6    | UF3  | A11  | EXTENSION OF THE REFUELLING OUTAGE FOR FUEL GUIDE PINS INSPECTION.          |
| 27 Jun | 42.0  | 42.4    | UF   | A42  | OIL LEAKAGE FROM MAIN TRANSFORMER AND TURBINE.                              |
| 27 Sep | 2.0   | 0.4     | PP   | E31  | TURBINE VALVES TEST.  |
| 24 Oct | 56.0  | 1.1     | UP   | A31  | CONDENSATOR ISOLATION FOR LEAKAGE SEARCHING.                                |
| 07 Nov | 57.0  | 0.8     | UP   | A31  | CONDENSATOR ISOLATION FOR LEAKAGE SEARCHING.                                |
| 13 Dec | 2.0   | 0.4     | PP   | E31  | TURBINE VALVES TEST.  |
| 18 Dec | 68.0  | 66.8    | UF   | A17  | ERRONEOUS ACTUATION OF THE MAIN STEAM SYSTEM'S MINIMUM PRESSURE CONTROLLER. |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1990 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 190       |          | 1  | 131       |          |
| C. Inspection, maintenance or repair combined with refuelling | 492             |           |          | 715                                      |           |          |
| Subtotal  | 492             | 190       | 0        | 716                                      | 131       | 0        |
| Total   |                 | 682       |          |  | 847       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1990 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    | 80              |  |
| 12. Reactor I&C Systems                        |                 | 6  |
| 15. Reactor Cooling Systems                    |                 | 6  |
| 16. Steam generation systems                   |                 | 36                                       |
| 17. Safety I&C Systems (excluding reactor I&C) | 68              |  |
| 31. Turbine and auxiliaries                    |                 | 25                                       |
| 32. Feedwater and Main Steam System            |                 | 7  |
| 33. Circulating Water System                   |                 | 4  |
| 41. Main Generator Systems                     |                 | 9  |
| 42. Electrical Power Supply Systems            | 42              | 10                                       |
| Total  | 190             | 103                                      |

# ES-16 VANDELLOS-2

**Operator:** ANAV (ASOCIACION NUCLEAR ASCO-VANDELLOS A.I.E. (ENDESA/ID))  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1045.0 MW(e)  
**Design Net RUP:** 930.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8677.0 GW(e).h  
**Energy Availability Factor:** 94.5%  
**Load Factor:** 94.5%  
**Operating Factor:** 96.0%  
**Energy Unavailability Factor:** 5.5%  
**Total Off-line Time:** 355 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 774.5 | 715.3 | 626.1 | 749.2 | 771.2 | 737.8 | 756.7 | 654.7 | 727.6 | 760.0 | 628.9 | 775.0 | 8677.0 |
| <b>EAF (%)</b>  | 99.7  | 98.3  | 80.0  | 99.6  | 99.2  | 98.1  | 97.5  | 84.0  | 96.9  | 97.8  | 83.2  | 99.9  | 94.5   |
| <b>UCF (%)</b>  | 100.0 | 98.7  | 80.4  | 100.0 | 100.0 | 99.9  | 100.0 | 86.9  | 100.0 | 100.0 | 83.9  | 100.0 | 95.8   |
| <b>LF (%)</b>   | 99.6  | 98.3  | 80.6  | 99.6  | 99.2  | 98.1  | 97.3  | 84.2  | 96.7  | 97.6  | 83.6  | 99.7  | 94.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 80.9  | 100.0 | 100.0 | 100.0 | 100.0 | 87.0  | 100.0 | 100.0 | 83.9  | 100.0 | 96.0   |
| <b>EUF (%)</b>  | 0.3   | 1.7   | 20.0  | 0.4   | 0.8   | 1.9   | 2.5   | 16.0  | 3.1   | 2.2   | 16.8  | 0.1   | 5.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 1.3   | 19.6  | 0.0   | 0.0   | 0.1   | 0.0   | 13.1  | 0.0   | 0.0   | 16.2  | 0.0   | 4.2    |
| <b>XUF (%)</b>  | 0.3   | 0.4   | 0.4   | 0.4   | 0.8   | 1.8   | 2.5   | 2.9   | 3.1   | 2.2   | 0.7   | 0.1   | 1.3    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING THE YEAR 2004 HAVEN'T HAD REFUELING.

## 5. Historical Summary

**Date of Construction Start:** 29 Dec 1980  
**Date of First Criticality:** 14 Nov 1987  
**Date of Grid Connection:** 12 Dec 1987  
**Date of Commercial Operation:** 08 Mar 1988

**Lifetime Generation:** 126200.1 GW(e).h  
**Cumulative Energy Availability Factor:** 87.4%  
**Cumulative Load Factor:** 87.4%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 12.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 40.3           | 963.0          | 0.0  | 0.0    | 0.5                               | 100.0  | 0.5                | 0.0    | 318                | 3.7    |
| 1988 | 5101.9         | 930.0          | 0.0  | 0.0    | 72.7                              | 100.0  | 62.5               | 0.0    | 6262               | 71.3   |
| 1989 | 5868.8         | 943.0          | 70.6   | 70.6   | 70.6                              | 70.6   | 71.0               | 71.0   | 6357               | 72.6   |
| 1990 | 7334.3         | 943.0          | 87.8   | 79.2   | 87.8                              | 79.2   | 88.8               | 79.9   | 7925               | 90.5   |
| 1991 | 7214.9         | 953.0          | 88.5   | 82.3   | 86.3                              | 81.6   | 86.4               | 82.1   | 7825               | 89.3   |
| 1992 | 6718.2         | 953.0          | 79.6   | 81.7   | 79.6                              | 81.1   | 80.3               | 81.6   | 7249               | 82.5   |
| 1993 | 6910.4         | 961.0          | 84.3   | 82.2   | 82.4                              | 81.4   | 82.1               | 81.7   | 7377               | 84.2   |
| 1994 | 7208.4         | 961.0          | 85.6   | 82.8   | 85.6                              | 82.1   | 85.6               | 82.4   | 7676               | 87.6   |
| 1995 | 7571.3         | 961.0          | 89.5   | 83.7   | 89.5                              | 83.1   | 89.9               | 83.5   | 7957               | 90.8   |
| 1996 | 7511.4         | 961.0          | 89.1   | 84.4   | 89.0                              | 83.9   | 89.0               | 84.2   | 7942               | 90.4   |
| 1997 | 7243.1         | 961.0          | 88.7   | 84.9   | 85.5                              | 84.1   | 86.0               | 84.4   | 7961               | 90.9   |
| 1998 | 8359.0         | 966.0          | 99.3   | 86.3   | 99.0                              | 85.6   | 98.8               | 85.8   | 8760               | 100.0  |
| 1999 | 7224.4         | 1024.0         | 83.4   | 86.0   | 82.5                              | 85.3   | 80.5               | 85.3   | 7430               | 84.8   |
| 2000 | 7976.9         | 1043.0         | 87.9   | 86.2   | 87.6                              | 85.5   | 87.1               | 85.5   | 7852               | 89.4   |
| 2001 | 9010.3         | 1043.0         | 99.4   | 87.3   | 99.4                              | 86.6   | 98.6               | 86.6   | 8727               | 99.6   |
| 2002 | 8010.1         | 1040.0         | 89.3   | 87.5   | 88.1                              | 86.7   | 87.9               | 86.7   | 7881               | 90.0   |
| 2003 | 8219.3         | 1040.0         | 90.9   | 87.7   | 89.5                              | 86.9   | 90.2               | 86.9   | 8067               | 92.1   |
| 2004 | 8677.0         | 1045.0         | 95.8   | 88.2   | 94.5                              | 87.4   | 94.5               | 87.4   | 8429               | 96.0   |

**ES-16 VANDELLOS-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 22 Feb | 35.0  | 9.3     | UP1  | A32  | REPARATION FC-K01B  |
| 16 Mar | 142.0 | 149.2   | UF1  | A31  | OUTAGE FOR STEAM EXTRACTION REPARATION                                      |
| 03 Jun | 25.0  | 0.8     | UP1  | A32  | CHANGING PUMP CONDENSATE MOTOR  |
| 03 Jun | 242.0 | 3.3     | UP1  | A31  | LOSS OF TURBINE PERFORMANCE. FAILURE IN THE STEAM EXTRACTION, HEATER N° 4A. |
| 25 Aug | 97.0  | 101.8   | UF2  | A33  | OUTAGE FOR PIPPING REPARATION   |
| 14 Nov | 116.0 | 121.5   | UF4  | A42  | LOSS OF EXTERNAL ENERGY   |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 355       |          |   | 179       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 581             |           |          | 581   | 1         |          |
| D. Inspection, maintenance or repair without refuelling                              | 30              |           |          | 30  |           |          |
| E. Testing of plant systems or components  | 6               |           |          | 6   | 1         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 5         | 16       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 7        |
| Subtotal   | 0               | 355       | 0        | 617   | 197       | 23       |
| Total  |                 | 355       |          |   | 837       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 16  |
| 13. Reactor Auxiliary Systems       |                    | 1   |
| 15. Reactor Cooling Systems         |                    | 39  |
| 31. Turbine and auxiliaries         | 142                | 8   |
| 32. Feedwater and Main Steam System |                    | 11  |
| 33. Circulating Water System        | 97                 |   |
| 41. Main Generator Systems          |                    | 12  |
| 42. Electrical Power Supply Systems | 116                | 82  |
| XX. Miscellaneous Systems           |                    | 5   |
| Total                               | 355                | 174   |

# SE-8 BARSEBACK-2

**Operator:** BKAB (BARSEBECK KRAFT AB)  
**Contractor:** ABBATOM (ABBATOM (formerly ASEA-ATOM))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 615.0 MW(e)  
**Design Net RUP:** 570.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4692.0 GW(e).h  
**Energy Availability Factor:** 88.9%  
**Load Factor:** 87.1%  
**Operating Factor:** 91.8%  
**Energy Unavailability Factor:** 11.1%  
**Total Off-line Time:** 716 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 448.0 | 178.1 | 447.2 | 428.5 | 219.7 | 418.4 | 426.8 | 412.2 | 413.1 | 430.3 | 426.2 | 443.6 | 4692.0 |
| <b>EAF (%)</b>  | 99.9  | 41.7  | 99.8  | 98.9  | 50.1  | 96.6  | 95.4  | 92.2  | 95.4  | 96.2  | 98.4  | 99.1  | 88.9   |
| <b>UCF (%)</b>  | 100.0 | 41.8  | 100.0 | 99.8  | 52.6  | 100.0 | 99.9  | 99.0  | 99.9  | 98.7  | 100.0 | 100.0 | 91.3   |
| <b>LF (%)</b>   | 97.9  | 43.1  | 97.7  | 96.9  | 48.0  | 94.5  | 93.3  | 90.1  | 93.3  | 93.9  | 96.2  | 97.0  | 87.1   |
| <b>OF (%)</b>   | 100.0 | 43.8  | 100.0 | 100.1 | 54.6  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 91.8   |
| <b>EUF (%)</b>  | 0.1   | 58.3  | 0.2   | 1.1   | 49.9  | 3.4   | 4.6   | 7.8   | 4.6   | 3.8   | 1.6   | 0.9   | 11.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 46.2  | 0.0   | 0.1   | 0.9   | 0.1   | 0.2   | 0.0   | 0.0   | 4.0    |
| <b>UCLF (%)</b> | 0.0   | 58.2  | 0.0   | 0.2   | 1.2   | 0.0   | 0.0   | 0.1   | 0.0   | 1.1   | 0.0   | 0.0   | 4.7    |
| <b>XUF (%)</b>  | 0.0   | 0.1   | 0.2   | 0.9   | 2.5   | 3.4   | 4.5   | 6.8   | 4.5   | 2.6   | 1.6   | 0.9   | 2.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1973  
**Date of First Criticality:** 20 Feb 1977  
**Date of Grid Connection:** 21 Mar 1977  
**Date of Commercial Operation:** 01 Jul 1977

**Lifetime Generation:** 108043.4 GW(e).h  
**Cumulative Energy Availability Factor:** 82.1%  
**Cumulative Load Factor:** 77.0%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 17.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1977 | 2625.7         | 575.0          | 0.0  | 0.0    | 73.0                              | 100.0  | 55.2               | 0.0    | 5202               | 62.8   |
| 1978 | 3836.2         | 570.0          | 76.8   | 76.8   | 76.8                              | 76.8   | 76.8               | 76.8   | 7078               | 80.8   |
| 1979 | 3928.5         | 570.0          | 78.7   | 77.8   | 78.7                              | 77.7   | 78.7               | 77.8   | 7376               | 84.2   |
| 1980 | 3376.8         | 570.0          | 73.2   | 76.2   | 73.1                              | 76.2   | 67.4               | 74.3   | 6426               | 73.2   |
| 1981 | 3803.1         | 570.0          | 78.9   | 76.9   | 78.9                              | 76.9   | 76.2               | 74.8   | 7590               | 86.6   |
| 1982 | 4606.1         | 570.0          | 96.1   | 80.7   | 96.1                              | 80.7   | 92.2               | 78.3   | 8570               | 97.8   |
| 1983 | 3718.9         | 570.0          | 79.0   | 80.4   | 79.0                              | 80.4   | 74.5               | 77.6   | 7383               | 84.3   |
| 1984 | 4020.9         | 570.0          | 82.7   | 80.8   | 82.7                              | 80.8   | 80.3               | 78.0   | 7784               | 88.6   |
| 1985 | 4306.1         | 570.0          | 99.5   | 83.1   | 99.5                              | 83.1   | 86.2               | 79.0   | 8759               | 100.0  |
| 1986 | 4129.2         | 578.0          | 83.3   | 83.1   | 83.3                              | 83.1   | 81.6               | 79.3   | 7555               | 86.2   |
| 1987 | 4448.2         | 585.0          | 92.0   | 84.0   | 92.0                              | 84.0   | 86.8               | 80.1   | 8253               | 94.2   |
| 1988 | 4392.6         | 585.0          | 89.7   | 84.6   | 89.7                              | 84.6   | 85.5               | 80.6   | 7926               | 90.2   |
| 1989 | 4206.2         | 600.0          | 94.0   | 85.4   | 94.0                              | 85.4   | 80.0               | 80.5   | 8244               | 94.1   |
| 1990 | 4208.6         | 600.0          | 88.5   | 85.6   | 88.4                              | 85.6   | 80.1               | 80.5   | 7817               | 89.2   |
| 1991 | 4614.2         | 600.0          | 94.4   | 86.3   | 94.4                              | 86.3   | 87.8               | 81.0   | 8334               | 95.1   |
| 1992 | 2642.6         | 600.0          | 56.4   | 84.2   | 50.7                              | 83.8   | 50.1               | 78.9   | 5053               | 57.5   |
| 1993 | 2859.0         | 600.0          | 62.9   | 82.8   | 55.1                              | 82.0   | 54.4               | 77.3   | 5545               | 63.3   |
| 1994 | 3745.3         | 615.0          | 88.2   | 83.2   | 84.7                              | 82.1   | 69.5               | 76.8   | 6861               | 78.3   |
| 1995 | 3751.0         | 615.0          | 76.5   | 82.8   | 74.2                              | 81.7   | 69.6               | 76.4   | 6724               | 76.8   |
| 2004 | 4692.0         | 615.0          | 91.3   | 83.3   | 88.9                              | 82.1   | 87.1               | 77.0   | 8044               | 91.8   |

## SE-8 BARSEBACK-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                  |
|--------|-------|---------|------|------|--|
| 31 Jan | 2.0   | 0.1     | UP2  | S11  | FUEL FAILURE                                 |
| 01 Feb | 402.0 | 240.5   | UF1  | S11  | FUEL FALIURE                                 |
| 03 Apr | 3.0   | 0.2     | PP   | E31  |  |
| 05 Apr | 5.0   | 0.7     | UP2  | A32  | LEAKAGE IN SUPERHEATER                       |
| 08 May | 321.0 | 202.3   | PF   | C    | YEARLY MAINTENANCE                           |
| 20 May | 7.0   | 2.1     | UF2  | A32  |  |
| 20 May | 10.0  | 3.3     | UF3  | A    | OUTAGE EXTENSION                             |
| 20 May | 79.0  | 9.0     | PP   | C    |  |
| 14 Jun | 1.0   | 0.0     | PP   | D    | INSPECTION OF VIBRATION                      |
| 03 Jul | 4.0   | 0.3     | PP   | E31  |  |
| 02 Aug | 3.0   | 0.3     | UP2  | A31  | SMALL LEAKAGE                                |
| 14 Aug | 33.0  | 4.3     | PP   | E31  | TEST OF MAINSTEAM VALVES AND TURBINE VALVES  |
| 25 Sep | 3.0   | 0.3     | PP   | E31  |  |
| 14 Oct | 16.0  | 4.9     | UP   | Z    |  |
| 14 Oct | 7.0   | 0.9     | PP   | E31  | TESTING OF MAIN STEAM VALVES, TURBINE VALVES |
| 28 Nov | 2.0   | 0.1     | PP   | E31  |  |
| 30 Nov | 2.0   | 0.1     | UP2  | A    |  |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure  |                 | 17        |          |  | 320       |          |
| C. Inspection, maintenance or repair combined with refuelling                                 | 321             |           |          | 510                                      |           |          |
| E. Testing of plant systems or components   |                 |           |          | 19                                       | 1         |          |
| J. Grid failure or grid unavailability  |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)          |                 |           |          |  | 1         | 1        |
| S. Fuel management limitation (including high flux tilt, stretch out or coast-down operation) |                 | 402       |          |  |           |          |
| Subtotal  | 321             | 419       | 0        | 529                                      | 322       | 1        |
| Total   |                 | 740       |          |  | 852       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 64                                       |
| 12. Reactor I&C Systems             |                 | 1  |
| 13. Reactor Auxiliary Systems       |                 | 44                                       |
| 14. Safety Systems                  |                 | 133                                      |
| 15. Reactor Cooling Systems         |                 | 11                                       |
| 31. Turbine and auxiliaries         |                 | 24                                       |
| 32. Feedwater and Main Steam System | 7               | 1  |
| 33. Circulating Water System        |                 | 3  |
| 41. Main Generator Systems          |                 | 34                                       |
| 42. Electrical Power Supply Systems |                 | 0  |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 7               | 315                                      |

## SE-9 FORSMARK-1

**Operator:** FKA (FORSMARK KRAFTGRUPP AB)  
**Contractor:** ABBATOM (ABBATOM (formerly ASEA-ATOM))

### 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 961.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 8029.0 GW(e).h  
**Energy Availability Factor:** 95.6%  
**Load Factor:** 95.1%  
**Operating Factor:** 97.4%  
**Energy Unavailability Factor:** 4.4%  
**Total Off-line Time:** 229 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 713.3 | 668.8 | 714.9 | 689.4 | 681.4 | 441.4 | 670.2 | 666.7 | 674.9 | 706.2 | 688.2 | 713.5 | 8029.0 |
| <b>EAF (%)</b>  | 99.8  | 100.0 | 100.0 | 99.6  | 95.3  | 63.8  | 97.4  | 95.8  | 97.5  | 98.8  | 99.5  | 99.8  | 95.6   |
| <b>UCF (%)</b>  | 99.8  | 100.0 | 100.0 | 99.8  | 100.0 | 70.8  | 100.0 | 100.0 | 99.7  | 100.0 | 99.8  | 99.8  | 97.5   |
| <b>LF (%)</b>   | 99.8  | 100.0 | 100.0 | 99.6  | 95.3  | 63.8  | 93.7  | 93.2  | 97.5  | 98.8  | 99.5  | 99.8  | 95.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 71.4  | 96.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.4   |
| <b>EUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.4   | 4.7   | 36.2  | 2.6   | 4.2   | 2.5   | 1.2   | 0.5   | 0.2   | 4.4    |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.2   | 0.0   | 29.2  | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.1   | 2.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1   | 0.1   | 0.2   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.2   | 4.7   | 7.0   | 2.6   | 4.2   | 2.2   | 1.2   | 0.3   | 0.0   | 1.9    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

### 5. Historical Summary

**Date of Construction Start:** 01 Jun 1973  
**Date of First Criticality:** 23 Apr 1980  
**Date of Grid Connection:** 06 Jun 1980  
**Date of Commercial Operation:** 10 Dec 1980

**Lifetime Generation:** 162435.2 GW(e).h  
**Cumulative Energy Availability Factor:** 84.2%  
**Cumulative Load Factor:** 80.8%  
**Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 15.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5926.0         | 900.0          | 75.2   | 74.2   | 75.1                              | 74.2   | 75.2               | 74.1   | 8095               | 92.4   |
| 1984 | 6461.8         | 900.0          | 91.9   | 78.6   | 91.9                              | 78.6   | 81.7               | 76.1   | 8207               | 93.4   |
| 1985 | 5587.6         | 900.0          | 79.4   | 78.8   | 79.4                              | 78.8   | 70.9               | 75.0   | 7773               | 88.7   |
| 1986 | 7317.2         | 954.0          | 89.8   | 80.7   | 89.8                              | 80.7   | 87.6               | 77.2   | 8303               | 94.8   |
| 1987 | 6493.4         | 970.0          | 79.5   | 80.5   | 79.5                              | 80.5   | 76.4               | 77.1   | 8291               | 94.6   |
| 1988 | 6852.8         | 970.0          | 81.8   | 80.7   | 81.8                              | 80.7   | 80.4               | 77.5   | 7739               | 88.1   |
| 1989 | 6138.6         | 969.0          | 85.5   | 81.2   | 85.5                              | 81.2   | 72.3               | 76.9   | 7907               | 90.3   |
| 1990 | 6257.5         | 967.0          | 85.8   | 81.7   | 85.8                              | 81.7   | 73.9               | 76.6   | 7885               | 90.0   |
| 1991 | 7486.6         | 968.0          | 90.6   | 82.5   | 88.3                              | 82.3   | 88.3               | 77.7   | 8122               | 92.7   |
| 1992 | 6833.6         | 968.0          | 85.2   | 82.8   | 80.3                              | 82.1   | 80.4               | 77.9   | 8174               | 93.1   |
| 1993 | 7022.8         | 968.0          | 91.9   | 83.5   | 82.7                              | 82.2   | 82.8               | 78.3   | 8009               | 91.4   |
| 1994 | 7393.4         | 968.0          | 91.3   | 84.1   | 87.0                              | 82.5   | 87.2               | 79.0   | 8109               | 92.6   |
| 1995 | 7325.2         | 968.0          | 91.3   | 84.6   | 86.2                              | 82.8   | 86.4               | 79.5   | 8173               | 93.3   |
| 1996 | 7311.4         | 968.0          | 95.3   | 85.3   | 86.4                              | 83.0   | 86.0               | 79.9   | 8412               | 95.8   |
| 1997 | 5403.0         | 968.0          | 64.6   | 84.0   | 64.6                              | 81.9   | 63.5               | 78.9   | 6255               | 71.2   |
| 1998 | 7307.0         | 968.0          | 93.6   | 84.5   | 93.6                              | 82.6   | 86.2               | 79.3   | 8265               | 94.3   |
| 1999 | 7583.0         | 968.0          | 96.7   | 85.2   | 96.3                              | 83.3   | 89.4               | 79.9   | 8420               | 96.1   |
| 2000 | 5731.0         | 968.0          | 86.0   | 85.2   | 80.2                              | 83.2   | 67.4               | 79.2   | 7203               | 82.0   |
| 2001 | 7286.0         | 968.0          | 94.8   | 85.7   | 86.3                              | 83.3   | 85.9               | 79.6   | 8482               | 96.8   |
| 2002 | 7143.0         | 961.0          | 90.0   | 85.9   | 86.0                              | 83.4   | 84.9               | 79.8   | 7978               | 91.1   |
| 2003 | 7456.0         | 961.0          | 88.5   | 86.0   | 88.5                              | 83.7   | 88.6               | 80.2   | 8093               | 92.4   |
| 2004 | 8029.0         | 961.0          | 97.5   | 86.5   | 95.6                              | 84.2   | 95.1               | 80.8   | 8555               | 97.4   |

# SE-9 FORSMARK-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 744.0  | 0.1     | XP2  | S11  | PRODUCTION LIMITATION DUE TO COAST-DOWN OPERATION  |
| 10 Jan | 4.0    | 1.6     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES   |
| 01 Feb | 8040.0 | 88.9    | XP2  | N33  | PRODUCTION LIMITATIONS AND LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.   |
| 03 Apr | 3.0    | 1.2     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES   |
| 01 May | 1464.0 | 69.0    | XP2  | S11  | PRODUCTION LIMITATION DUE TO COAST-DOWN OPERATION  |
| 13 Jun | 206.0  | 198.0   | PF   | C    | ANNUAL OUTAGE AND REFUELLING   |
| 23 Jun | 10.0   | 4.0     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES   |
| 11 Jul | 23.0   | 22.1    | XF5  | J42  | SWITCHGEAR/HV GRID FAILURE.  |
| 18 Jul | 41.0   | 4.4     | XP2  | K    | POWER REDUCTION DUE TO LOW DEMAND  |
| 06 Aug | 20.0   | 18.5    | XP2  | J42  | HV GRID/SWICHGEAR FAILURES NOT ORGINATING FROM THE PLANT ITSELF (EXTERNAL).ONE TURBINE TRIPPED (STOPPED) AND HOUSETURBINE OPERATION FOR THE SECOND TURBINE.  |
| 01 Sep | 30.0   | 0.4     | UP2  | A15  | TRIP (STOPP) AND RESTART OF RCP PUMPS (313P4).   |
| 11 Sep | 4.0    | 1.6     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES   |
| 01 Oct | 1.0    | 0.3     | UP2  | A32  | POWER REDUCTION DUE TO FEED WATER PUMP TRIP WHEN ONE PUMP (OF THREE) ALREDY WAS SHOUTDOWN (TAKEN OUT OF SERVICE).  |
| 01 Nov | 7.0    | 1.3     | UP2  | A32  | AUTOMATIC REACTOR POWER REDUCTION DUE TO REHEATHER BY-PASS.THE FAILURE ORGINATE FROM A EART FOULT ON A POINT OF MESSURING RELATED AND CONNECTED TO FEED WATER PUMP.  |
| 01 Dec | 288.0  | 0.3     | UP2  | A31  | PRODUCTION LOSSES DUE TO EFFICIENCY(?) PROBLEM.RECOGNISED AS A INABILITY TO PRODUCE STIPULATED/PRESCRIBED ELECTRICAL PRODUCTION. A RECURRENT OR FREQVENT PROBLEM OCCURING DURING 12 DAYS OF THE HOLE PERIOD (MONTH). |
| 04 Dec | 2.0    | 0.9     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 103       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 206             |           |          | 639                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 27                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 4  |           |          |
| J. Grid failure or grid unavailability   |                 |           | 23       |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 18       |
| Subtotal   | 206             | 0         | 23       | 670                                      | 106       | 19       |
| Total  |                 | 229       |          |  | 795       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 14                                       |
| 12. Reactor I&C Systems                        |                 | 9  |
| 13. Reactor Auxiliary Systems                  |                 | 7  |
| 15. Reactor Cooling Systems                    |                 | 14                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 21. Fuel Handling and Storage Facilities       |                 | 34                                       |
| 31. Turbine and auxiliaries                    |                 | 8  |
| 32. Feedwater and Main Steam System            |                 | 3  |
| 41. Main Generator Systems                     |                 | 6  |
| XX. Miscellaneous Systems                      |                 | 2  |
| Total  | 0               | 100                                      |

**SE-11 FORSMARK-2**

**Operator:** FKA (FORSMARK KRAFTGRUPP AB)  
**Contractor:** ABBATOM (ABBATOM (formerly ASEA-ATOM))

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 954.0 MW(e)  
**Design Net RUP:** 890.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 7978.7 GW(e).h  
**Energy Availability Factor:** 95.2%  
**Load Factor:** 95.2%  
**Operating Factor:** 97.1%  
**Energy Unavailability Factor:** 4.8%  
**Total Off-line Time:** 255 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 709.7 | 663.7 | 707.1 | 684.7 | 699.9 | 629.5 | 442.5 | 679.0 | 671.7 | 699.7 | 683.3 | 707.8 | 7978.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.6  | 99.7  | 98.6  | 91.6  | 62.3  | 95.7  | 97.8  | 98.6  | 99.5  | 99.7  | 95.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 99.6  | 99.9  | 99.4  | 99.9  | 65.7  | 99.9  | 99.9  | 99.7  | 99.8  | 99.8  | 96.9   |
| <b>LF (%)</b>   | 100.0 | 100.0 | 99.6  | 99.7  | 98.6  | 91.6  | 62.3  | 95.7  | 97.8  | 98.6  | 99.5  | 99.7  | 95.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 65.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.1   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.4   | 0.3   | 1.4   | 8.4   | 37.7  | 4.3   | 2.2   | 1.4   | 0.5   | 0.3   | 4.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.2   | 0.0   | 0.5   | 0.0   | 34.3  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 3.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.2   | 0.1   | 0.1   | 0.1   | 0.0   | 0.1   | 0.1   | 0.2   | 0.2   | 0.2   | 0.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.2   | 0.8   | 8.2   | 3.4   | 4.2   | 2.1   | 1.2   | 0.3   | 0.0   | 1.7    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 01 Jan 1975  
**Date of First Criticality:** 16 Nov 1980  
**Date of Grid Connection:** 26 Jan 1981  
**Date of Commercial Operation:** 07 Jul 1981

**Lifetime Generation:** 157676.8 GW(e).h  
**Cumulative Energy Availability Factor:** 84.5%  
**Cumulative Load Factor:** 80.6%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 15.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5484.4         | 900.0          | 69.6   | 68.5   | 69.6                              | 68.5   | 69.6               | 68.5   | 7879               | 89.9   |
| 1984 | 5911.7         | 900.0          | 82.6   | 73.2   | 82.6                              | 73.2   | 74.8               | 70.6   | 7442               | 84.7   |
| 1985 | 5735.4         | 900.0          | 83.8   | 75.8   | 83.8                              | 75.8   | 72.7               | 71.1   | 8048               | 91.9   |
| 1986 | 6987.9         | 938.0          | 86.5   | 78.0   | 86.5                              | 78.0   | 85.0               | 74.0   | 8231               | 94.0   |
| 1987 | 6553.8         | 949.0          | 85.5   | 79.3   | 85.5                              | 79.3   | 78.8               | 74.8   | 8190               | 93.5   |
| 1988 | 6976.2         | 963.0          | 83.2   | 79.9   | 83.2                              | 79.9   | 82.5               | 76.0   | 8032               | 91.4   |
| 1989 | 5943.4         | 964.0          | 90.0   | 81.2   | 90.0                              | 81.2   | 70.4               | 75.3   | 8222               | 93.9   |
| 1990 | 6426.2         | 970.0          | 88.6   | 82.1   | 88.6                              | 82.1   | 75.6               | 75.3   | 8119               | 92.7   |
| 1991 | 7155.2         | 969.0          | 85.8   | 82.5   | 84.2                              | 82.3   | 84.3               | 76.2   | 8083               | 92.3   |
| 1992 | 6748.9         | 969.0          | 86.2   | 82.8   | 79.2                              | 82.0   | 79.3               | 76.5   | 8293               | 94.4   |
| 1993 | 6715.5         | 969.0          | 88.8   | 83.3   | 79.1                              | 81.8   | 79.2               | 76.7   | 7683               | 87.8   |
| 1994 | 7679.5         | 969.0          | 92.5   | 84.1   | 90.4                              | 82.4   | 90.5               | 77.8   | 8194               | 93.6   |
| 1995 | 7149.2         | 969.0          | 91.6   | 84.6   | 84.1                              | 82.6   | 84.2               | 78.3   | 8143               | 93.0   |
| 1996 | 7348.2         | 969.0          | 91.2   | 85.1   | 86.2                              | 82.8   | 86.3               | 78.9   | 8134               | 92.6   |
| 1997 | 7325.0         | 969.0          | 87.4   | 85.2   | 87.4                              | 83.1   | 86.1               | 79.3   | 7927               | 90.2   |
| 1998 | 7199.0         | 969.0          | 92.1   | 85.6   | 91.9                              | 83.6   | 84.8               | 79.6   | 8240               | 94.1   |
| 1999 | 7292.0         | 968.0          | 91.8   | 86.0   | 91.8                              | 84.1   | 86.0               | 80.0   | 8117               | 92.7   |
| 2000 | 5429.0         | 964.0          | 80.8   | 85.7   | 76.7                              | 83.7   | 64.1               | 79.2   | 6946               | 79.1   |
| 2001 | 7400.0         | 964.0          | 92.3   | 86.0   | 88.8                              | 84.0   | 87.6               | 79.6   | 8321               | 95.0   |
| 2002 | 6824.0         | 964.0          | 89.9   | 86.2   | 82.2                              | 83.9   | 80.8               | 79.6   | 8155               | 93.1   |
| 2003 | 7303.9         | 959.0          | 87.1   | 86.3   | 87.1                              | 84.0   | 86.9               | 80.0   | 7916               | 90.4   |
| 2004 | 7978.7         | 954.0          | 96.9   | 86.7   | 95.2                              | 84.5   | 95.2               | 80.6   | 8529               | 97.1   |



## SE-11 FORSMARK-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 264.0  | 0.0     | XP1  | N31  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 01 Jan | 2904.0 | 2.6     | UP2  | A31  | LOSSES DUE TO UNABILITY DUE WEAR AND EFFICIENCY PROBLEMS.   |
| 01 Feb | 240.0  | 0.0     | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 01 Mar | 384.0  | 0.1     | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 07 Mar | 4.0    | 1.2     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES  |
| 01 Apr | 720.0  | 1.3     | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 01 May | 744.0  | 5.6     | XP   | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 01 May | 6.0    | 3.3     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES  |
| 01 May | 888.0  | 1.7     | UP2  | A31  | LOSSES DUE TO WEAR AND EFFICIENCY PROBLEMS.   |
| 01 May | 744.0  | 0.6     | UP2  | A14  | LOSSES DUE TO MAIN STEAM VALVE PROBLEMS 569MWH.   |
| 01 Jun | 816.0  | 55.9    | XP2  | S11  | COAST-DOWN OPERATION.   |
| 01 Jun | 720.0  | 11.3    | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 01 Jul | 528.0  | 13.4    | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 04 Jul | 255.0  | 243.3   | PF   | C    | ANNUAL OUTAGE FOR REFUELING AND INSPECTION PLANNED 234 HOURS, OUTAGES EXTENSION 39 HOURS = TOTAL 255 HOURS OUTAGES. |
| 01 Aug | 3576.0 | 5.4     | UP2  | A31  | UNABILITY DUE WEAR AND EFFICIENCY PROBLEMS.   |
| 01 Aug | 744.0  | 30.1    | XP   | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 01 Sep | 720.0  | 14.7    | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 01 Oct | 744.0  | 8.2     | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |
| 09 Oct | 4.0    | 0.7     | PP   | E32  | PERIODIC TESTING OF STEAM AND FEED WATER ISOLATION VALVES.  |
| 01 Nov | 1464.0 | 2.5     | XP2  | N33  | LOSSES DUE TO COOLING WATER TEMPERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY.                                     |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 167       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 255             |           |          | 565                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 59                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 21       |
| L. Human factor related  |                 |           |          |  | 0         |          |
| Subtotal   | 255             | 0         | 0        | 624                                      | 170       | 21       |
| Total  |                 | 255       |          |  | 815       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 0  |
| 12. Reactor I&C Systems                  |                 | 1  |
| 13. Reactor Auxiliary Systems            |                 | 2  |
| 14. Safety Systems                       |                 | 1  |
| 15. Reactor Cooling Systems              |                 | 13                                       |
| 21. Fuel Handling and Storage Facilities |                 | 86                                       |
| 31. Turbine and auxiliaries              |                 | 28                                       |
| 32. Feedwater and Main Steam System      |                 | 7  |
| 42. Electrical Power Supply Systems      |                 | 1  |
| Total                                    | 0               | 139                                      |

**SE-14 FORSMARK-3**

**Operator:** FKA (FORSMARK KRAFTGRUPP AB)  
**Contractor:** ABBATOM (ABBATOM (formerly ASEA-ATOM))

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1155.0 MW(e)  
**Design Net RUP:** 1050.0 MW(e)  
**Design Discharge Burnup:** 28400 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 8970.4 GW(e).h  
**Energy Availability Factor:** 87.7%  
**Load Factor:** 87.7%  
**Operating Factor:** 89.8%  
**Energy Unavailability Factor:** 12.3%  
**Total Off-line Time:** 898 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 858.5 | 803.3 | 854.5 | 827.3 | 846.3 | 805.0 | 547.4 | 1.5  | 821.8 | 868.8 | 850.7 | 885.4 | 8970.4 |
| <b>EAF (%)</b>  | 99.9  | 99.9  | 99.4  | 99.5  | 98.5  | 96.8  | 64.1  | 0.2  | 96.3  | 98.5  | 99.7  | 100.0 | 87.7   |
| <b>UCF (%)</b>  | 99.9  | 99.9  | 99.5  | 99.9  | 99.9  | 99.9  | 75.3  | 0.2  | 98.9  | 100.0 | 99.9  | 100.0 | 89.4   |
| <b>LF (%)</b>   | 99.9  | 99.9  | 99.4  | 99.5  | 98.5  | 96.8  | 63.7  | 0.2  | 96.3  | 98.5  | 99.7  | 100.0 | 87.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 75.8  | 3.5  | 100.0 | 100.0 | 100.0 | 100.0 | 89.8   |
| <b>EUF (%)</b>  | 0.1   | 0.1   | 0.6   | 0.5   | 1.5   | 3.2   | 35.9  | 99.8 | 3.7   | 1.5   | 0.3   | 0.0   | 12.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.0   | 0.0   | 0.1   | 24.2  | 96.5 | 1.1   | 0.0   | 0.1   | 0.0   | 10.2   |
| <b>UCLF (%)</b> | 0.1   | 0.1   | 0.4   | 0.1   | 0.1   | 0.1   | 0.5   | 3.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.4   | 1.4   | 3.1   | 11.2  | 0.0  | 2.6   | 1.5   | 0.2   | 0.0   | 1.7    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

THE TURBINE HAS BEEN REPLACED AND THE EFFICIENCY OF THE NEW ONE HAVE BEEN INCREASED. THE UNIT OUTPOWER HAVE CHANGED FROM 1155 TO 1190 MW.

**5. Historical Summary**

**Date of Construction Start:** 01 Jan 1979      **Lifetime Generation:** 138615.9 GW(e).h  
**Date of First Criticality:** 28 Oct 1984      **Cumulative Energy Availability Factor:** 87.0%  
**Date of Grid Connection:** 05 Mar 1985      **Cumulative Load Factor:** 84.2%  
**Date of Commercial Operation:** 18 Aug 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 13.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 4155.5         | 1068.0         | 0.0  | 0.0    | 97.4                              | 100.0  | 44.9               | 0.0    | 4803               | 55.4   |
| 1986 | 8069.6         | 1060.0         | 88.4   | 88.4   | 88.4                              | 88.4   | 86.9               | 86.9   | 7983               | 91.1   |
| 1987 | 7038.9         | 1063.0         | 77.9   | 83.1   | 77.9                              | 83.1   | 75.6               | 81.2   | 7866               | 89.8   |
| 1988 | 7462.9         | 1068.0         | 80.4   | 82.2   | 80.4                              | 82.2   | 79.6               | 80.7   | 7807               | 88.9   |
| 1989 | 7367.2         | 1118.0         | 85.8   | 83.1   | 85.8                              | 83.1   | 75.2               | 79.3   | 7792               | 88.9   |
| 1990 | 7942.1         | 1150.0         | 90.6   | 84.7   | 90.6                              | 84.7   | 78.8               | 79.2   | 8165               | 93.2   |
| 1991 | 8665.1         | 1155.0         | 87.5   | 85.2   | 85.6                              | 84.9   | 85.6               | 80.3   | 8324               | 95.0   |
| 1992 | 8176.2         | 1197.0         | 89.5   | 85.8   | 81.2                              | 84.3   | 77.8               | 79.9   | 7954               | 90.6   |
| 1993 | 8457.9         | 1158.0         | 93.2   | 86.8   | 83.4                              | 84.2   | 83.4               | 80.4   | 8244               | 94.2   |
| 1994 | 9228.8         | 1158.0         | 93.4   | 87.5   | 90.9                              | 84.9   | 91.1               | 81.6   | 8277               | 94.6   |
| 1995 | 8945.9         | 1158.0         | 92.8   | 88.1   | 88.2                              | 85.3   | 88.2               | 82.3   | 8250               | 94.2   |
| 1996 | 8819.2         | 1158.0         | 89.1   | 88.2   | 86.7                              | 85.4   | 86.7               | 82.7   | 8008               | 91.2   |
| 1997 | 8955.0         | 1158.0         | 89.9   | 88.3   | 89.9                              | 85.8   | 88.0               | 83.1   | 8004               | 91.1   |
| 1998 | 8961.0         | 1158.0         | 93.9   | 88.8   | 93.8                              | 86.4   | 88.3               | 83.5   | 8227               | 93.9   |
| 1999 | 8825.0         | 1157.0         | 91.1   | 88.9   | 91.0                              | 86.7   | 87.1               | 83.8   | 8005               | 91.4   |
| 2000 | 7934.0         | 1157.0         | 94.9   | 89.3   | 87.7                              | 86.8   | 78.1               | 83.4   | 8038               | 91.5   |
| 2001 | 8182.0         | 1155.0         | 86.2   | 89.1   | 81.8                              | 86.5   | 80.9               | 83.2   | 7585               | 86.6   |
| 2002 | 9079.0         | 1158.0         | 95.0   | 89.5   | 91.2                              | 86.8   | 89.5               | 83.6   | 8450               | 96.5   |
| 2003 | 9100.3         | 1155.0         | 89.9   | 89.5   | 89.9                              | 87.0   | 89.9               | 84.0   | 8507               | 97.1   |
| 2004 | 8970.4         | 1165.0         | 89.4   | 89.5   | 87.7                              | 87.0   | 87.7               | 84.2   | 7886               | 89.8   |

## SE-14 FORSMARK-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 4944.0 | 11.4    | UP2  | A31  | UNABILITY AND LOSSES DUE TO METHOD OF MEASSUREMENT AND/OR EFFICIENCY.                                     |
| 03 Jan | 48.0   | 0.0     | XP2  | N33  | PRODUCTION LIMITATIONS AND LOSSES DUE TO COOLING WATER TEMERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY. |
| 01 Mar | 2496.0 | 39.3    | XP2  | N33  | PRODUCTION LIMITATIONS AND LOSSES DUE TO COOLING WATER TEMERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY. |
| 07 Mar | 4.0    | 1.2     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES.   |
| 05 Jun | 2.0    | 0.5     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES.   |
| 28 Jun | 72.0   | 2.2     | XP   | S    | COAST DOWN OPERATION  |
| 01 Jul | 576.0  | 79.9    | XP   | S    | COAST DOWN OPERATION  |
| 01 Jul | 576.0  | 16.2    | XP2  | N33  | PRODUCTION LIMITATIONS AND LOSSES DUE TO COOLING WATER TEMERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY. |
| 18 Jul | 12.0   | 3.4     | XP2  | K    | POWER REDUCTION DUE TO LOW DEMAND.  |
| 24 Jul | 180.0  | 207.9   | PF   | C    | PLANNED ANNUAL OUTAGES CONTINUATION.  |
| 01 Aug | 718.0  | 829.3   | PF   | C    | PLANNED ANNUAL OUTAGE.  |
| 30 Aug | 48.0   | 28.4    | UP2  | A31  | UNABILITY AND LOSSES DUE TO METHOD OF MEASUREMENT AND/OR EFFICIENCY PROBLEMS.                             |
| 31 Aug | 24.0   | 0.1     | XP2  | N33  | PRODUCTION LIMITATIONS AND LOSSES DUE TO COOLING WATER TEMERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY. |
| 01 Sep | 744.0  | 22.9    | XP2  | N33  | PRODUCTION LIMITATIONS AND LOSSES DUE TO COOLING WATER TEMERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY. |
| 01 Sep | 60.0   | 9.2     | PP   | E    | TESTING OF PLANT EQUIPMENT AFTER OUTAGES.   |
| 01 Oct | 1176.0 | 13.9    | XP2  | N33  | PRODUCTION LIMITATIONS AND LOSSES DUE TO COOLING WATER TEMERATURE NOT OPTIMAL FOR THE TURBINE EFFICIENCY. |
| 01 Nov | 24.0   | 0.2     | UP2  | A31  | UNABILITY AND LOSSES DUE TO METHOD OF MEASUREMENT AND/OR EFFICIENCY PROBLEMS.                             |
| 28 Nov | 2.0    | 0.6     | PP   | E14  | PERIODIC TESTING OF CONTAINMENT ISOLATION VALVES.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 51        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 898             |           |          | 537                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 15                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 10       |
| Subtotal   | 898             | 0         | 0        | 552                                      | 53        | 10       |
| Total  |                 | 898       |          |  | 615       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 1  |
| 12. Reactor I&C Systems                  |                 | 5  |
| 15. Reactor Cooling Systems              |                 | 12                                       |
| 21. Fuel Handling and Storage Facilities |                 | 6  |
| 31. Turbine and auxiliaries              |                 | 11                                       |
| 41. Main Generator Systems               |                 | 0  |
| 42. Electrical Power Supply Systems      |                 | 14                                       |
| Total                                    | 0               | 49                                       |

**SE-2 OSKARSHAMN-1**

Operator: OKG (OKG AKTIEBOLAG)

Contractor: ASEASTAL (ASEA-ATOM / STAL-LAVAL)

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 470.0 MW(e)  
 Design Net RUP: 440.0 MW(e)  
 Design Discharge Burnup: 25000 MW.d/t

**2. Production Summary 2004**

Energy Production: 3536.5 GW(e).h  
 Energy Availability Factor: 85.8%  
 Load Factor: 86.2%  
 Operating Factor: 88.1%  
 Energy Unavailability Factor: 14.2%  
 Total Off-line Time: 1042 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 338.2 | 310.8 | 352.4 | 340.1 | 328.1 | 270.5 | 21.1 | 215.0 | 335.9 | 350.7 | 338.8 | 335.0 | 3536.5 |
| EAF (%)  | 97.1  | 95.4  | 100.0 | 100.0 | 94.7  | 81.3  | 6.6  | 61.9  | 99.7  | 100.0 | 100.0 | 96.3  | 85.8   |
| UCF (%)  | 97.1  | 95.4  | 100.0 | 100.0 | 98.2  | 98.8  | 8.6  | 63.4  | 100.0 | 100.0 | 100.0 | 96.3  | 87.9   |
| LF (%)   | 96.7  | 95.0  | 100.8 | 100.5 | 93.8  | 79.9  | 6.0  | 61.5  | 99.3  | 100.1 | 100.1 | 95.8  | 86.2   |
| OF (%)   | 96.1  | 96.6  | 99.9  | 100.0 | 100.0 | 98.9  | 8.2  | 64.5  | 100.0 | 100.0 | 100.0 | 95.6  | 88.1   |
| EUF (%)  | 2.9   | 4.6   | 0.0   | 0.0   | 5.3   | 18.7  | 93.4 | 38.1  | 0.3   | 0.0   | 0.0   | 3.7   | 14.2   |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 91.5 | 6.4   | 0.0   | 0.0   | 0.0   | 0.0   | 8.3    |
| UCLF (%) | 2.9   | 4.6   | 0.0   | 0.0   | 1.8   | 1.2   | 0.0  | 30.2  | 0.0   | 0.0   | 0.0   | 3.8   | 3.8    |
| XUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 3.5   | 17.5  | 1.9  | 1.5   | 0.3   | 0.0   | 0.0   | 0.0   | 2.1    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Aug 1966      Lifetime Generation: 78666.8 GW(e).h  
 Date of First Criticality: 12 Dec 1970      Cumulative Energy Availability Factor: 63.4%  
 Date of Grid Connection: 19 Aug 1971      Cumulative Load Factor: 62.0%  
 Date of Commercial Operation: 06 Feb 1972      Cumulative Unit Capability Factor: 77.4%  
    Cumulative Energy Unavailability Factor: 36.6%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 3133.3            | 440.0             | 81.3   | 69.4   | 81.3                                 | 69.2   | 81.3               | 67.8   | 7694                  | 87.8   |
| 1984 | 2959.7            | 440.0             | 81.1   | 70.4   | 81.1                                 | 70.2   | 76.6               | 68.5   | 7249                  | 82.5   |
| 1985 | 2753.2            | 440.0             | 71.8   | 70.5   | 71.8                                 | 70.3   | 71.4               | 68.8   | 6491                  | 74.1   |
| 1986 | 3134.4            | 440.0             | 81.9   | 71.3   | 81.9                                 | 71.2   | 81.3               | 69.7   | 7359                  | 84.0   |
| 1987 | 3232.5            | 440.0             | 86.6   | 72.3   | 86.6                                 | 72.2   | 83.9               | 70.6   | 7809                  | 89.1   |
| 1988 | 2863.1            | 442.0             | 73.6   | 72.4   | 73.6                                 | 72.3   | 73.7               | 70.8   | 6827                  | 77.7   |
| 1989 | 3175.6            | 442.0             | 87.0   | 73.3   | 87.0                                 | 73.1   | 82.0               | 71.5   | 7788                  | 88.9   |
| 1990 | 2493.8            | 442.0             | 64.0   | 72.8   | 64.1                                 | 72.6   | 64.4               | 71.1   | 5794                  | 66.1   |
| 1991 | 3349.2            | 442.0             | 86.1   | 73.5   | 86.1                                 | 73.4   | 86.5               | 71.9   | 7856                  | 89.7   |
| 1992 | 1784.8            | 442.0             | 45.9   | 72.1   | 45.9                                 | 72.0   | 46.0               | 70.6   | 4362                  | 49.7   |
| 1993 | 0.0               | 442.0             | -0.1   | 68.7   | 0.0                                  | 68.5   | 0.0                | 67.2   | 0                     | 0.0    |
| 1994 | 0.0               | 445.0             | 0.0  | 65.5   | 0.0                                  | 65.4   | 0.0                | 64.1   | 0                     | 0.0    |
| 1995 | 0.0               | 445.0             | 0.0  | 62.6   | 0.0                                  | 62.5   | 0.0                | 61.3   | 0                     | 0.0    |
| 1996 | 2380.0            | 442.0             | 61.1   | 62.6   | 61.1                                 | 62.5   | 61.3               | 61.3   | 5564                  | 63.3   |
| 1997 | 2925.9            | 442.0             | 75.8   | 63.1   | 75.8                                 | 63.0   | 75.6               | 61.9   | 6716                  | 76.7   |
| 1998 | 1297.7            | 445.0             | 32.6   | 61.9   | 32.6                                 | 61.8   | 33.3               | 60.8   | 2968                  | 33.9   |
| 1999 | 3298.9            | 445.0             | 86.7   | 62.8   | 86.7                                 | 62.8   | 84.6               | 61.7   | 7647                  | 87.3   |
| 2000 | 3060.2            | 445.0             | 88.8   | 63.8   | 88.8                                 | 63.7   | 78.3               | 62.3   | 7765                  | 88.4   |
| 2001 | 3080.9            | 445.0             | 83.7   | 64.5   | 83.7                                 | 64.4   | 79.0               | 62.9   | 7462                  | 85.2   |
| 2002 | 0.0               | 445.0             | 0.0  | 62.3   | 0.0                                  | 62.2   | 0.0                | 60.7   | 0                     | 0.0    |
| 2003 | 3058.4            | 468.0             | 75.9   | 62.8   | 74.7                                 | 62.6   | 74.6               | 61.2   | 7075                  | 80.8   |
| 2004 | 3536.5            | 467.0             | 88.0   | 63.6   | 85.8                                 | 63.4   | 86.2               | 62.0   | 7743                  | 88.1   |

## SE-2 OSKARSHAMN-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 30 Jan | 29.0  | 10.3    | UF   | A    | DEPENDING ON VIBRATIONS IN CONTROL LINES HARD PIPES WAS EXCHANGED TO FLEXIBLE HOSES. |
| 14 Feb | 19.0  | 13.7    | UF   | A31  | SUPPORTING TURBINE CONTROL VALVES IN ORDER TO DECREASE VIBRATIONS.                   |
| 10 May | 504.0 | 12.1    | XP   | S    | COAST-DOWN OPERATION STARTED.  |
| 17 May | 72.0  | 6.3     | UP2  | A12  | FIXING LEAK IN THE SCRAM SYSTEM  |
| 01 Jun | 712.0 | 58.1    | XP   | S    | COAST-DOWN OPERATION CONTINUATION.   |
| 01 Jul | 61.0  | 6.7     | XP   | S    | FUEL COAST DOWN  |
| 04 Jul | 683.0 | 319.8   | PF   | C    | ANNUAL OUTAGE AND REFUELLING   |
| 01 Aug | 48.0  | 22.5    | PF   | C    | ANNUAL OUTAGE AND REFUELLING   |
| 03 Aug | 189.0 | 88.6    | UF3  | Z    | EXTENDED OUTAGE  |
| 08 Aug | 1.0   | 0.5     | UF4  | A31  | REACTOR TRIP   |
| 11 Aug | 33.0  | 17.0    | UF   | A31  | RE-BALANCING OF MAIN TURBINE.  |
| 06 Dec | 33.0  | 13.1    | UF4  | A15  | MSIV CLOSURE DEPENDING ON FALSE SIGNAL DURING IN SERVICE MAINTENANCE.                |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 115       |          | 3  | 703       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 731             |           |          | 794                                      | 69        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 763                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  | 4         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 252                                      | 9         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 235       |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 124       |          |
| Z. Others  |                 | 189       |          |  | 5         |          |
| Subtotal   | 731             | 304       | 0        | 1815                                     | 1153      | 1        |
| Total  |                 | 1035      |          |  | 2969      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 126                                      |
| 12. Reactor I&C Systems                  |                 | 106                                      |
| 13. Reactor Auxiliary Systems            |                 | 15                                       |
| 14. Safety Systems                       |                 | 27                                       |
| 15. Reactor Cooling Systems              | 33              | 26                                       |
| 21. Fuel Handling and Storage Facilities |                 | 21                                       |
| 31. Turbine and auxiliaries              | 53              | 257                                      |
| 32. Feedwater and Main Steam System      |                 | 27                                       |
| 35. All other I&C Systems                |                 | 4  |
| 41. Main Generator Systems               |                 | 64                                       |
| 42. Electrical Power Supply Systems      |                 | 26                                       |
| XX. Miscellaneous Systems                |                 | 2  |
| Total                                    | 86              | 701                                      |

**SE-3 OSKARSHAMN-2**

Operator: OKG (OKG AKTIEBOLAG)

Contractor: ABBATOM (ABBATOM (formerly ASEA-ATOM))

**1. Station Details**

Type: BWR  
 Net Reference Unit Power  
 at the beginning of 2004: 602.0 MW(e)  
 Design Net RUP: 580.0 MW(e)  
 Design Discharge Burnup: 35000 MW.d/t

**2. Production Summary 2004**

Energy Production: 4625.9 GW(e).h  
 Energy Availability Factor: 87.7%  
 Load Factor: 87.5%  
 Operating Factor: 89.9%  
 Energy Unavailability Factor: 12.3%  
 Total Off-line Time: 884 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 445.6 | 415.9 | 424.4 | 427.4 | 432.0 | 419.2 | 432.8 | 172.0 | 156.0 | 433.4 | 426.2 | 441.1 | 4625.9 |
| EAF (%)  | 99.4  | 99.1  | 94.7  | 98.5  | 96.8  | 97.5  | 96.8  | 38.7  | 36.0  | 98.4  | 98.2  | 98.7  | 87.7   |
| UCF (%)  | 100.0 | 99.7  | 95.5  | 100.0 | 98.9  | 100.0 | 99.8  | 41.6  | 36.6  | 98.4  | 99.6  | 99.5  | 89.1   |
| LF (%)   | 99.5  | 99.3  | 94.9  | 98.6  | 96.5  | 96.7  | 96.6  | 38.4  | 36.0  | 96.6  | 98.3  | 98.5  | 87.5   |
| OF (%)   | 100.0 | 100.0 | 95.7  | 100.0 | 100.0 | 100.0 | 100.0 | 46.5  | 36.9  | 100.0 | 100.0 | 100.0 | 89.9   |
| EUF (%)  | 0.6   | 0.9   | 5.3   | 1.5   | 3.2   | 2.5   | 3.2   | 61.3  | 64.0  | 1.6   | 1.8   | 1.3   | 12.3   |
| PUF (%)  | 0.0   | 0.0   | 0.1   | 0.0   | 0.4   | 0.0   | 0.0   | 55.6  | 50.2  | 0.0   | 0.3   | 0.0   | 8.9    |
| UCLF (%) | 0.0   | 0.2   | 4.4   | 0.0   | 0.8   | 0.0   | 0.1   | 2.8   | 13.3  | 1.6   | 0.0   | 0.5   | 2.0    |
| XUF (%)  | 0.6   | 0.6   | 0.8   | 1.5   | 2.0   | 2.5   | 3.1   | 2.9   | 0.6   | 0.0   | 1.4   | 0.8   | 1.4    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Sep 1969      Lifetime Generation: 117748.2 GW(e).h  
 Date of First Criticality: 06 Mar 1974      Cumulative Energy Availability Factor: 78.7%  
 Date of Grid Connection: 02 Oct 1974      Cumulative Load Factor: 75.1%  
 Date of Commercial Operation: 01 Jan 1975      Cumulative Unit Capability Factor: 77.4%  
    Cumulative Energy Unavailability Factor: 21.3%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 4054.3            | 595.0             | 86.9   | 75.3   | 86.8                                 | 75.3   | 77.8               | 72.2   | 7703                  | 87.9   |
| 1984 | 4797.6            | 595.0             | 92.2   | 77.0   | 92.2                                 | 77.0   | 91.8               | 74.2   | 8253                  | 94.0   |
| 1985 | 3988.7            | 595.0             | 86.9   | 78.0   | 86.9                                 | 78.0   | 76.5               | 74.4   | 7739                  | 88.3   |
| 1986 | 4277.8            | 595.0             | 83.8   | 78.5   | 83.9                                 | 78.5   | 82.1               | 75.1   | 7770                  | 88.7   |
| 1987 | 4230.8            | 595.0             | 83.5   | 78.9   | 83.5                                 | 78.9   | 81.2               | 75.6   | 7789                  | 88.9   |
| 1988 | 4417.4            | 605.0             | 86.0   | 79.4   | 85.9                                 | 79.4   | 83.1               | 76.1   | 7894                  | 89.9   |
| 1989 | 3960.7            | 605.0             | 88.3   | 80.0   | 88.3                                 | 80.0   | 74.7               | 76.0   | 8065                  | 92.1   |
| 1990 | 4050.3            | 605.0             | 84.1   | 80.3   | 84.1                                 | 80.3   | 76.4               | 76.0   | 7885                  | 90.0   |
| 1991 | 4103.4            | 605.0             | 79.4   | 80.2   | 79.4                                 | 80.2   | 77.4               | 76.1   | 7467                  | 85.2   |
| 1992 | 2851.5            | 605.0             | 55.3   | 78.8   | 55.3                                 | 78.8   | 53.7               | 74.8   | 5310                  | 60.5   |
| 1993 | 2611.5            | 605.0             | 55.3   | 77.5   | 51.0                                 | 77.3   | 49.3               | 73.5   | 4924                  | 56.2   |
| 1994 | 4460.8            | 605.0             | 88.6   | 78.1   | 86.8                                 | 77.8   | 84.2               | 74.0   | 7833                  | 89.4   |
| 1995 | 4175.8            | 605.0             | 83.6   | 78.3   | 79.4                                 | 77.9   | 78.8               | 74.2   | 7452                  | 85.1   |
| 1996 | 3760.4            | 605.0             | 73.1   | 78.1   | 71.7                                 | 77.6   | 70.8               | 74.1   | 6543                  | 74.5   |
| 1997 | 4417.4            | 605.0             | 86.4   | 78.5   | 85.4                                 | 77.9   | 83.4               | 74.5   | 7707                  | 88.0   |
| 1998 | 4457.8            | 605.0             | 90.3   | 79.0   | 90.3                                 | 78.4   | 84.1               | 74.9   | 7951                  | 90.8   |
| 1999 | 3198.2            | 605.0             | 64.7   | 78.4   | 64.7                                 | 77.9   | 60.3               | 74.3   | 5667                  | 64.7   |
| 2000 | 3898.5            | 605.0             | 85.3   | 78.7   | 85.3                                 | 78.2   | 73.4               | 74.3   | 7525                  | 85.7   |
| 2001 | 4748.5            | 602.0             | 92.3   | 79.2   | 92.3                                 | 78.7   | 90.0               | 74.9   | 8113                  | 92.6   |
| 2002 | 4508.6            | 602.0             | 91.2   | 79.6   | 90.6                                 | 79.1   | 85.5               | 75.2   | 8043                  | 91.8   |
| 2003 | 3055.3            | 602.0             | 59.5   | 78.9   | 58.3                                 | 78.4   | 57.9               | 74.6   | 5289                  | 60.4   |
| 2004 | 4625.9            | 602.0             | 89.1   | 79.3   | 87.7                                 | 78.7   | 87.5               | 75.1   | 7900                  | 89.9   |

## SE-3 OSKARSHAMN-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 12 Mar | 32.0  | 19.2    | UF2  | A41  | MANUAL REDUCTION TO HOT STAND BY IN ORDER TO FIX HYDROGEN LEAK ON MAIN GENERATOR. |
| 04 Aug | 260.0 | 7.0     | UP   | A31  | POWER REDUCTION, DEPENDING ON HIGH CONDENSER PRESSURE.                            |
| 15 Aug | 398.0 | 239.3   | PF   | C    | ANNUAL OUTAGE AND REFUELLING.   |
| 01 Sep | 360.0 | 217.1   | PF   | C    | ANNUAL OUTAGE AND REFUELLING.   |
| 15 Sep | 30.0  | 18.0    | UF3  | Z    | OUTAGE EXTENSION  |
| 16 Sep | 43.0  | 26.0    | UF   | A11  | REPAIRING OF SMALL PIPE WELD.   |
| 19 Sep | 21.0  | 12.6    | UF   | A31  | REPAIRING OF GASKET FOR MANHOLE COVER.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 96        |          |  | 214       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 758             |           |          | 903                                      | 89        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 49                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 3         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 17                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 141       |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 95        | 2        |
| L. Human factor related  |                 |           |          |  | 0         |          |
| Z. Others  |                 | 30        |          |  | 3         |          |
| Subtotal   | 758             | 126       | 0        | 969                                      | 548       | 3        |
| Total  |                 | 884       |          |  | 1520      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         | 43              | 28                                       |
| 12. Reactor I&C Systems             |                 | 11                                       |
| 13. Reactor Auxiliary Systems       |                 | 0  |
| 14. Safety Systems                  |                 | 8  |
| 15. Reactor Cooling Systems         |                 | 25                                       |
| 31. Turbine and auxiliaries         | 21              | 89                                       |
| 32. Feedwater and Main Steam System |                 | 19                                       |
| 33. Circulating Water System        |                 | 0  |
| 35. All other I&C Systems           |                 | 1  |
| 41. Main Generator Systems          | 32              | 5  |
| 42. Electrical Power Supply Systems |                 | 1  |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 96              | 188                                      |

# SE-12 OSKARSHAMN-3

**Operator:** OKG (OKG AKTIEBOLAG)  
**Contractor:** ASEASTAL (ASEA-ATOM / STAL-LAVAL)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1160.0 MW(e)  
**Design Net RUP:** 1050.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9318.5 GW(e).h  
**Energy Availability Factor:** 92.6%  
**Load Factor:** 91.5%  
**Operating Factor:** 93.8%  
**Energy Unavailability Factor:** 7.4%  
**Total Off-line Time:** 548 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 853.9 | 800.0 | 853.2 | 823.9 | 601.0 | 480.4 | 839.8 | 821.9 | 818.1 | 848.8 | 805.1 | 772.3 | 9318.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 99.7  | 70.8  | 58.8  | 99.7  | 96.5  | 99.0  | 99.2  | 97.3  | 90.5  | 92.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 99.7  | 71.1  | 59.3  | 99.8  | 99.7  | 99.9  | 99.8  | 97.7  | 90.6  | 93.1   |
| <b>LF (%)</b>   | 98.9  | 99.1  | 99.0  | 98.7  | 69.6  | 57.5  | 97.3  | 95.2  | 98.0  | 98.2  | 96.4  | 89.5  | 91.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 71.4  | 60.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 93.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.3   | 29.2  | 41.2  | 0.3   | 3.5   | 1.0   | 0.8   | 2.7   | 9.5   | 7.4    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 28.9  | 24.2  | 0.1   | 0.1   | 0.0   | 0.1   | 0.2   | 0.0   | 4.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 16.5  | 0.0   | 0.2   | 0.1   | 0.1   | 2.1   | 9.5   | 2.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.3   | 0.6   | 0.1   | 3.1   | 0.9   | 0.6   | 0.4   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1980  
**Date of First Criticality:** 29 Dec 1984  
**Date of Grid Connection:** 03 Mar 1985  
**Date of Commercial Operation:** 15 Aug 1985

**Lifetime Generation:** 161077.7 GW(e).h  
**Cumulative Energy Availability Factor:** 87.1%  
**Cumulative Load Factor:** 82.8%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 12.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 3848.5         | 1068.0         | 0.0  | 0.0    | 73.3                              | 100.0  | 41.4               | 0.0    | 4706               | 54.0   |
| 1986 | 8386.9         | 1070.0         | 90.1   | 90.1   | 90.1                              | 90.1   | 89.5               | 89.5   | 8111               | 92.6   |
| 1987 | 7058.0         | 1070.0         | 79.6   | 84.9   | 79.6                              | 84.9   | 75.3               | 82.4   | 7988               | 91.2   |
| 1988 | 7311.9         | 1065.0         | 82.1   | 84.0   | 82.1                              | 83.9   | 78.2               | 81.0   | 7458               | 84.9   |
| 1989 | 7788.2         | 1160.0         | 91.3   | 85.8   | 91.3                              | 86.0   | 82.0               | 79.8   | 8242               | 94.1   |
| 1990 | 7640.2         | 1065.0         | 82.2   | 85.1   | 82.2                              | 85.2   | 80.1               | 80.2   | 7782               | 88.8   |
| 1991 | 8935.8         | 1160.0         | 89.3   | 85.8   | 89.3                              | 85.9   | 87.9               | 81.6   | 8184               | 93.4   |
| 1992 | 8270.6         | 1160.0         | 82.6   | 85.3   | 82.5                              | 85.4   | 81.2               | 81.5   | 7904               | 90.0   |
| 1993 | 8339.5         | 1160.0         | 91.6   | 86.2   | 83.8                              | 85.2   | 82.1               | 81.6   | 8034               | 91.7   |
| 1994 | 8480.4         | 1160.0         | 85.0   | 86.0   | 84.9                              | 85.2   | 83.5               | 81.8   | 7832               | 89.4   |
| 1995 | 8828.1         | 1160.0         | 89.8   | 86.4   | 87.5                              | 85.4   | 86.9               | 82.3   | 7957               | 90.8   |
| 1996 | 8518.6         | 1160.0         | 85.2   | 86.3   | 85.0                              | 85.4   | 83.6               | 82.5   | 7519               | 85.6   |
| 1997 | 8970.4         | 1160.0         | 91.1   | 86.7   | 91.1                              | 85.9   | 88.3               | 83.0   | 8017               | 91.5   |
| 1998 | 8032.3         | 1160.0         | 89.4   | 86.9   | 89.4                              | 86.2   | 79.0               | 82.6   | 7914               | 90.3   |
| 1999 | 8516.6         | 1160.0         | 89.2   | 87.1   | 89.2                              | 86.4   | 83.8               | 82.7   | 7850               | 89.6   |
| 2000 | 7219.1         | 1160.0         | 91.2   | 87.4   | 91.2                              | 86.7   | 70.8               | 81.9   | 8075               | 91.9   |
| 2001 | 9052.0         | 1160.0         | 92.6   | 87.7   | 92.6                              | 87.1   | 89.1               | 82.4   | 8160               | 93.2   |
| 2002 | 8884.0         | 1160.0         | 92.3   | 88.0   | 92.3                              | 87.4   | 87.4               | 82.7   | 8140               | 92.9   |
| 2003 | 7678.0         | 1160.0         | 78.0   | 87.4   | 76.2                              | 86.8   | 75.6               | 82.3   | 6871               | 78.4   |
| 2004 | 9318.5         | 1160.0         | 93.1   | 87.7   | 92.6                              | 87.1   | 91.5               | 82.8   | 8236               | 93.8   |



## SE-12 OSKARSHAMN-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 23 May | 213.0 | 248.9   | PF   | C    | ANNUAL OUTAGE INCLUDING REFUELLING                      |
| 01 Jun | 164.0 | 201.7   | PF   | C    | ANNUAL OUTAGE INCLUDING REFUELLING.                     |
| 07 Jun | 120.0 | 137.5   | UF3  | Z    | OUTAGE EXTENSION.                                       |
| 05 Dec | 51.0  | 69.6    | UF1  | A15  | REPAIR OF LEAKING REACTOR COOLANT SAFETY/RELIEF VALVES. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 51        |          |   | 99        |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 377             |           |          | 573   | 20        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 11  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 55        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 22        |          |
| Z. Others  |                 | 120       |          |   |           |          |
| Subtotal   | 377             | 171       | 0        | 584   | 207       | 0        |
| Total  |                 | 548       |          |   | 791       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 5   |
| 12. Reactor I&C Systems                  |                    | 13  |
| 13. Reactor Auxiliary Systems            |                    | 1   |
| 14. Safety Systems                       |                    | 13  |
| 15. Reactor Cooling Systems              | 51                 | 25  |
| 21. Fuel Handling and Storage Facilities |                    | 13  |
| 31. Turbine and auxiliaries              |                    | 16  |
| 32. Feedwater and Main Steam System      |                    | 9   |
| 35. All other I&C Systems                |                    | 0   |
| Total                                    | 51                 | 95  |

# SE-4 RINGHALS-1

**Operator:** RAB (Ringhals AB)  
**Contractor:** ABBATOM (ABBATOM (formerly ASEA-ATOM))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 830.0 MW(e)  
**Design Net RUP:** 760.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6523.1 GW(e).h  
**Energy Availability Factor:** 89.7%  
**Load Factor:** 89.5%  
**Operating Factor:** 90.8%  
**Energy Unavailability Factor:** 10.3%  
**Total Off-line Time:** 810 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 624.1 | 582.9 | 620.5 | 599.0 | 609.0 | 563.2 | 595.7 | 106.8 | 388.1 | 611.3 | 598.0 | 624.4 | 6523.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.6  | 100.0 | 99.6  | 96.1  | 99.4  | 17.1  | 66.7  | 99.3  | 99.6  | 100.0 | 89.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 99.7  | 100.0 | 99.7  | 100.0 | 100.0 | 17.3  | 66.7  | 99.3  | 99.6  | 100.0 | 90.1   |
| <b>LF (%)</b>   | 101.1 | 100.9 | 100.5 | 100.2 | 98.6  | 94.3  | 96.5  | 17.3  | 64.9  | 99.0  | 100.1 | 101.1 | 89.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.8  | 100.0 | 18.5  | 73.9  | 100.0 | 100.0 | 100.0 | 90.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.4   | 0.0   | 0.4   | 3.9   | 0.6   | 82.9  | 33.3  | 0.7   | 0.4   | 0.0   | 10.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.3   | 0.0   | 0.3   | 0.0   | 0.0   | 74.3  | 4.0   | 0.0   | 0.4   | 0.0   | 6.7    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5   | 29.3  | 0.7   | 0.0   | 0.0   | 3.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.9   | 0.6   | 0.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1969  
**Date of First Criticality:** 20 Aug 1973  
**Date of Grid Connection:** 14 Oct 1974  
**Date of Commercial Operation:** 01 Jan 1976

**Lifetime Generation:** 134665.0 GW(e).h  
**Cumulative Energy Availability Factor:** 71.7%  
**Cumulative Load Factor:** 66.8%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 28.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3265.0         | 750.0          | 49.7   | 57.8   | 49.7                              | 57.7   | 49.7               | 57.2   | 5372               | 61.3   |
| 1984 | 4917.7         | 750.0          | 79.8   | 60.2   | 79.7                              | 60.1   | 74.6               | 59.1   | 7382               | 84.0   |
| 1985 | 5168.8         | 750.0          | 86.0   | 62.8   | 86.0                              | 62.7   | 78.7               | 61.0   | 7832               | 89.4   |
| 1986 | 4470.5         | 750.0          | 69.9   | 63.4   | 69.9                              | 63.4   | 68.0               | 61.7   | 7203               | 82.2   |
| 1987 | 4872.7         | 750.0          | 77.7   | 64.6   | 77.7                              | 64.6   | 74.2               | 62.7   | 7878               | 89.9   |
| 1988 | 4694.7         | 750.0          | 75.1   | 65.4   | 74.7                              | 65.3   | 71.3               | 63.4   | 7338               | 83.5   |
| 1989 | 4855.3         | 755.0          | 81.8   | 66.6   | 81.8                              | 66.5   | 73.4               | 64.1   | 7963               | 90.9   |
| 1990 | 4525.6         | 795.0          | 71.6   | 67.0   | 71.4                              | 66.9   | 65.0               | 64.2   | 7918               | 90.4   |
| 1991 | 5638.9         | 795.0          | 82.6   | 68.0   | 82.5                              | 67.9   | 81.0               | 65.3   | 8034               | 91.7   |
| 1992 | 3383.8         | 795.0          | 51.1   | 66.9   | 51.2                              | 66.9   | 48.5               | 64.2   | 4938               | 56.2   |
| 1993 | 3996.4         | 795.0          | 68.5   | 67.0   | 68.5                              | 67.0   | 57.4               | 63.8   | 6575               | 75.1   |
| 1994 | 5389.2         | 795.0          | 78.0   | 67.6   | 76.4                              | 67.5   | 77.4               | 64.6   | 7189               | 82.1   |
| 1995 | 5667.0         | 826.0          | 78.3   | 68.2   | 78.2                              | 68.1   | 78.3               | 65.3   | 7697               | 87.9   |
| 1996 | 6490.9         | 832.0          | 90.3   | 69.3   | 90.1                              | 69.2   | 88.8               | 66.5   | 8008               | 91.2   |
| 1997 | 2035.6         | 830.0          | 97.3   | 70.7   | 95.8                              | 70.5   | 28.0               | 64.6   | 2663               | 30.4   |
| 1998 | 5601.6         | 830.0          | 84.8   | 71.4   | 80.7                              | 71.0   | 77.0               | 65.2   | 7605               | 86.8   |
| 1999 | 4930.4         | 825.0          | 73.3   | 71.5   | 68.4                              | 70.8   | 68.2               | 65.4   | 6500               | 74.2   |
| 2000 | 3239.7         | 825.0          | 57.2   | 70.8   | 50.8                              | 70.0   | 44.7               | 64.5   | 4659               | 53.0   |
| 2001 | 5835.0         | 825.0          | 86.1   | 71.5   | 86.1                              | 70.7   | 80.7               | 65.1   | 7814               | 89.2   |
| 2002 | 5956.2         | 830.0          | 84.7   | 72.0   | 80.4                              | 71.0   | 81.9               | 65.8   | 7667               | 87.5   |
| 2003 | 5104.3         | 830.0          | 70.4   | 71.9   | 70.2                              | 71.0   | 70.2               | 66.0   | 6269               | 71.6   |
| 2004 | 6523.1         | 830.0          | 90.1   | 72.6   | 89.7                              | 71.7   | 89.5               | 66.8   | 7974               | 90.8   |

## SE-4 RINGHALS-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 06 Mar | 11.0  | 2.1     | PP   | E32  | TESTING MAIN STEAM VALVES.  |
| 20 Mar | 4.0   | 0.0     | UP   | A33  | REDUCING OF POWER DUE TO FAILURE ON SEAWATER COOLING SYSTEM.            |
| 20 May | 12.0  | 2.1     | PP   | E32  | MAIN STEAM VALVE TEST   |
| 30 May | 3.0   | 0.4     | XP   | N33  | REDUCING OF POWER DUE TO JELLYFISH INVASION IN SEAWATER COOLING SYSTEM. |
| 18 Jun | 45.0  | 19.5    | XP   | J    | THE GRID NOT AVAILABLE.   |
| 24 Jun | 15.0  | 3.7     | XP   | N33  | REDUCING OF POWER DUE TO JELLYFISH INVASION IN SEAWATER COOLING SYSTEM. |
| 09 Jul | 14.0  | 3.3     | XP   | N33  | REDUCING OF POWER DUE TO JELLYFISH INVASION IN SEAWATER COOLING SYSTEM. |
| 19 Jul | 4.0   | 0.5     | XP   | N33  | REDUCING OF POWER DUE TO JELLYFISH INVASION IN SEAWATER COOLING SYSTEM. |
| 20 Jul | 1.0   | 0.0     | XP   | N33  | REDUCING OF POWER DUE TO JELLYFISH INVASION IN SEAWATER COOLING SYSTEM. |
| 31 Jul | 23.0  | 0.1     | XP   | S11  | COAST-DOWN OPERATION.   |
| 01 Aug | 132.0 | 0.9     | XP   | S11  | COAST-DOWN OPERATION.   |
| 06 Aug | 550.0 | 458.6   | PF   | C11  | ANNUAL MAINTENANCE  |
| 29 Aug | 177.0 | 148.6   | UF3  | Z11  | OUTAGE EXTENSION  |
| 05 Sep | 89.0  | 23.8    | PP   | D    | START-UP  |
| 10 Sep | 229.0 | 29.4    | UP   | A41  | VIBRATIONS PROBLEMS ON GENERATOR.                                       |
| 15 Sep | 83.0  | 49.5    | UF2  | A15  | PRESSURE RELIEF SYSTEM.   |
| 27 Nov | 12.0  | 2.6     | PP   | E32  | MAIN STEAM VALVE TEST   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 83        |          |  | 574       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 550             |           |          | 993                                      | 43        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 2  |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 6         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 15       |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 32        | 11       |
| L. Human factor related  |                 |           |          |  | 2         |          |
| Z. Others  |                 | 177       |          |  | 9         |          |
| Subtotal   | 550             | 260       | 0        | 995                                      | 668       | 29       |
| Total  |                 | 810       |          |  | 1692      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 191                                      |
| 12. Reactor I&C Systems             |                 | 76                                       |
| 13. Reactor Auxiliary Systems       |                 | 1  |
| 14. Safety Systems                  |                 | 51                                       |
| 15. Reactor Cooling Systems         | 83              | 122                                      |
| 31. Turbine and auxiliaries         |                 | 21                                       |
| 32. Feedwater and Main Steam System |                 | 34                                       |
| 35. All other I&C Systems           |                 | 1  |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 12                                       |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 83              | 509                                      |

**SE-5 RINGHALS-2**

Operator: RAB (Ringhals AB)

Contractor: WEST (WESTINGHOUSE ELECTRIC CORPORATION)

**1. Station Details**

Type: PWR  
 Net Reference Unit Power  
 at the beginning of 2004: 875.0 MW(e)  
 Design Net RUP: 820.0 MW(e)  
 Design Discharge Burnup: 44000 MW.d/t

**2. Production Summary 2004**

Energy Production: 6786.6 GW(e).h  
 Energy Availability Factor: 90.3%  
 Load Factor: 88.3%  
 Operating Factor: 90.8%  
 Energy Unavailability Factor: 9.7%  
 Total Off-line Time: 808 hours

**3. 2004 Monthly Performance Data**

|          | Jan   | Feb   | Mar   | Apr   | May   | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|----------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|
| GW(e).h  | 646.6 | 604.5 | 645.1 | 621.3 | 559.3 | 49.3 | 621.6 | 538.0 | 607.3 | 628.4 | 620.8 | 644.3 | 6786.6 |
| EAF (%)  | 100.0 | 100.0 | 99.8  | 100.0 | 88.0  | 8.8  | 99.8  | 87.3  | 100.0 | 98.7  | 100.0 | 100.0 | 90.3   |
| UCF (%)  | 100.0 | 100.0 | 100.0 | 100.0 | 88.0  | 8.8  | 100.0 | 87.3  | 100.0 | 98.7  | 100.0 | 100.0 | 90.3   |
| LF (%)   | 99.3  | 99.3  | 99.1  | 98.6  | 85.9  | 7.8  | 95.5  | 82.6  | 96.4  | 96.5  | 98.5  | 99.0  | 88.3   |
| OF (%)   | 100.0 | 100.0 | 100.0 | 100.0 | 87.1  | 12.4 | 100.0 | 89.1  | 100.0 | 100.0 | 100.0 | 100.0 | 90.8   |
| EUF (%)  | 0.0   | 0.0   | 0.2   | 0.0   | 12.0  | 91.2 | 0.2   | 12.7  | 0.0   | 1.3   | 0.0   | 0.0   | 9.7    |
| PUF (%)  | 0.0   | 0.0   | 0.0   | 0.0   | 12.0  | 78.3 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.4    |
| UCLF (%) | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.9 | 0.0   | 12.7  | 0.0   | 1.3   | 0.0   | 0.0   | 2.3    |
| XUF (%)  | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

Date of Construction Start: 01 Oct 1970  
 Date of First Criticality: 19 Jun 1974  
 Date of Grid Connection: 17 Aug 1974  
 Date of Commercial Operation: 01 May 1975

Lifetime Generation: 144459.1 GW(e).h  
 Cumulative Energy Availability Factor: 71.2%  
 Cumulative Load Factor: 66.5%  
 Cumulative Unit Capability Factor: 77.5%  
 Cumulative Energy Unavailability Factor: 28.8%

| Year | Energy<br>GW(e).h | Capacity<br>MW(e) | Performance for Full Years of Commercial Operation |        |                                      |        |                    |        |                       |        |
|------|-------------------|-------------------|--|--------|--------------------------------------|--------|--------------------|--------|-----------------------|--------|
|      |                   |                   | Unit Capability<br>Factor (in %)                   |        | Energy Availability<br>Factor (in %) |        | Load Factor (in %) |        | Annual<br>Time Online |        |
|      |                   |                   | Annual   | Cumul. | Annual                               | Cumul. | Annual             | Cumul. | Hours                 | OF (%) |
| 1983 | 3935.3            | 800.0             | 56.1   | 58.6   | 56.2                                 | 58.6   | 56.2               | 58.3   | 6107                  | 69.7   |
| 1984 | 4178.7            | 800.0             | 68.3   | 59.7   | 68.2                                 | 59.6   | 59.5               | 58.4   | 6090                  | 69.3   |
| 1985 | 4294.7            | 800.0             | 74.8   | 61.2   | 74.8                                 | 61.2   | 61.3               | 58.7   | 6680                  | 76.3   |
| 1986 | 3969.1            | 800.0             | 59.4   | 61.0   | 59.4                                 | 61.0   | 56.6               | 58.5   | 6383                  | 72.9   |
| 1987 | 4216.6            | 800.0             | 65.3   | 61.4   | 65.2                                 | 61.3   | 60.2               | 58.6   | 7397                  | 84.4   |
| 1988 | 4216.1            | 800.0             | 68.5   | 61.9   | 68.5                                 | 61.9   | 60.0               | 58.8   | 7368                  | 83.9   |
| 1989 | 3619.6            | 800.0             | 50.0   | 61.1   | 50.0                                 | 61.1   | 51.6               | 58.2   | 6002                  | 68.5   |
| 1990 | 5064.8            | 800.0             | 66.7   | 61.4   | 66.7                                 | 61.4   | 72.3               | 59.2   | 6348                  | 72.5   |
| 1991 | 6232.8            | 875.0             | 83.5   | 62.9   | 83.5                                 | 62.9   | 81.3               | 60.7   | 7909                  | 90.3   |
| 1992 | 5193.4            | 875.0             | 72.1   | 63.5   | 72.1                                 | 63.5   | 67.6               | 61.1   | 6959                  | 79.2   |
| 1993 | 2650.0            | 875.0             | 37.8   | 62.0   | 37.8                                 | 62.0   | 34.6               | 59.5   | 3307                  | 37.8   |
| 1994 | 6258.7            | 875.0             | 84.7   | 63.3   | 83.0                                 | 63.2   | 81.7               | 60.8   | 7429                  | 84.8   |
| 1995 | 6096.6            | 867.0             | 85.6   | 64.4   | 84.8                                 | 64.3   | 80.3               | 61.8   | 7676                  | 87.6   |
| 1996 | 5723.3            | 864.0             | 84.6   | 65.5   | 76.8                                 | 64.9   | 75.4               | 62.5   | 7574                  | 86.2   |
| 1997 | 2372.1            | 864.0             | 98.8   | 67.0   | 98.2                                 | 66.5   | 31.3               | 61.0   | 2748                  | 31.4   |
| 1998 | 6096.4            | 875.0             | 90.5   | 68.1   | 82.2                                 | 67.2   | 79.5               | 61.9   | 7866                  | 89.8   |
| 1999 | 6445.8            | 862.0             | 92.2   | 69.2   | 85.8                                 | 68.0   | 85.4               | 62.9   | 8075                  | 92.2   |
| 2000 | 5143.5            | 862.0             | 84.8   | 69.8   | 77.0                                 | 68.4   | 67.9               | 63.1   | 7284                  | 82.9   |
| 2001 | 6322.7            | 862.0             | 87.0   | 70.5   | 85.7                                 | 69.1   | 83.7               | 63.9   | 8004                  | 91.4   |
| 2002 | 6540.3            | 875.0             | 89.2   | 71.2   | 84.3                                 | 69.7   | 85.3               | 64.7   | 8130                  | 92.8   |
| 2003 | 6811.5            | 875.0             | 92.5   | 72.0   | 90.9                                 | 70.5   | 88.9               | 65.6   | 8093                  | 92.4   |
| 2004 | 6786.6            | 875.0             | 90.3   | 72.7   | 90.3                                 | 71.2   | 88.3               | 66.5   | 7976                  | 90.8   |

## SE-5 RINGHALS-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 28 Feb | 4.0   | 0.2     | PP   | E31  | TEST  |
| 14 Mar | 7.0   | 1.0     | XP   | J    | REDUCING OF POWER DUE TO GRID PROBLEMS.   |
| 20 Mar | 3.0   | 0.1     | XP   | N33  | REDUCE POWER DUE TO JELLYFISH PROBLEMS IN SEAWATER COOLING SYSTEM.  |
| 15 May | 319.0 | 16.2    | PP   | S11  | COAST-DOWN OPERATION.   |
| 28 May | 1.0   | 0.1     | UP   | E31  | TEST  |
| 28 May | 634.0 | 555.0   | PF   | C11  | ANNUAL MAINTENANCE  |
| 26 Jun | 93.0  | 82.3    | UF   | A41  | EQUIPMENT FAILURE IN MAIN GENERATOR PROTECTION SYSTEM, TURBIN TRIPP, THEN COOL DOWN TO COLD SHUTDOWN FOR PERAIR OF LEAKAGE IN A RCS POWER OPERATED VALVE. |
| 09 Jul | 6.0   | 2.5     | XP   | N33  | REDUCE POWER DUE TO JELLYFISH PROBLEMS IN SEAWATER COOLING SYSTEM.  |
| 11 Aug | 17.0  | 6.5     | UP   | A41  | EQUIPMENT FAILURE IN MAIN GENERATOR PROTECTION SYSTEM   |
| 19 Aug | 81.0  | 63.7    | UF   | A14  | HIGH PRESSURE SAFETY AND INJECTION SYSTEM   |
| 23 Aug | 8.0   | 2.8     | UP   | A41  | EQUIPMENT FAILURE IN MAIN GENERATOR PROTECTION SYSTEM   |
| 23 Aug | 14.0  | 9.2     | UP   | A32  | CONDENSATE SYSTEM   |
| 24 Aug | 7.0   | 0.5     | UP   | A32  | CONDENSATE TREATMENT SYSTEM   |
| 27 Oct | 26.0  | 8.3     | UP   | A    | PLANT EQUIPMENT FAILURE   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 174       |          |  | 683       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 634             |           |          | 988                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 89                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 4         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 8        |
| Z. Others  |                 |           |          |  | 1         |          |
| Subtotal   | 634             | 174       | 0        | 1080                                     | 688       | 13       |
| Total  |                 | 808       |          |  | 1781      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 185                                      |
| 12. Reactor I&C Systems                  |                 | 8  |
| 14. Safety Systems                       | 81              | 37                                       |
| 15. Reactor Cooling Systems              |                 | 19                                       |
| 16. Steam generation systems             |                 | 248                                      |
| 21. Fuel Handling and Storage Facilities |                 | 51                                       |
| 31. Turbine and auxiliaries              |                 | 16                                       |
| 32. Feedwater and Main Steam System      |                 | 39                                       |
| 33. Circulating Water System             |                 | 0  |
| 35. All other I&C Systems                |                 | 0  |
| 41. Main Generator Systems               | 93              | 35                                       |
| 42. Electrical Power Supply Systems      |                 | 32                                       |
| Total                                    | 174             | 670                                      |

# SE-7 RINGHALS-3

**Operator:** RAB (Ringhals AB)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 915.0 MW(e)  
**Design Discharge Burnup:** 44000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7497.9 GW(e).h  
**Energy Availability Factor:** 93.9%  
**Load Factor:** 93.3%  
**Operating Factor:** 94.4%  
**Energy Unavailability Factor:** 6.1%  
**Total Off-line Time:** 489 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 688.4 | 644.2 | 674.0 | 644.4 | 308.1 | 645.8 | 583.4 | 655.3 | 643.7 | 676.7 | 647.9 | 686.2 | 7497.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 97.9  | 97.7  | 45.6  | 100.0 | 88.3  | 100.0 | 100.0 | 100.0 | 98.0  | 100.0 | 93.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 97.9  | 98.9  | 45.6  | 100.0 | 88.5  | 100.0 | 100.0 | 100.0 | 98.0  | 100.0 | 94.0   |
| <b>LF (%)</b>   | 101.1 | 101.2 | 99.0  | 97.8  | 45.3  | 98.0  | 85.7  | 96.3  | 97.7  | 99.4  | 98.3  | 100.8 | 93.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 45.7  | 100.0 | 88.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 2.1   | 2.3   | 54.4  | 0.0   | 11.7  | 0.0   | 0.0   | 0.0   | 2.0   | 0.0   | 6.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 52.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.4    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 2.1   | 1.1   | 2.1   | 0.0   | 11.5  | 0.0   | 0.0   | 0.0   | 2.0   | 0.0   | 1.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 1.2   | 0.0   | 0.0   | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1972  
**Date of First Criticality:** 29 Jul 1980  
**Date of Grid Connection:** 07 Sep 1980  
**Date of Commercial Operation:** 09 Sep 1981

**Lifetime Generation:** 135056.3 GW(e).h  
**Cumulative Energy Availability Factor:** 77.9%  
**Cumulative Load Factor:** 71.7%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 22.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2909.9         | 867.0          | 38.3   | 26.6   | 38.1                              | 26.6   | 38.3               | 26.7   | 5886               | 67.2   |
| 1984 | 5346.6         | 915.0          | 72.4   | 42.2   | 72.4                              | 42.2   | 66.5               | 40.2   | 6450               | 73.4   |
| 1985 | 6090.3         | 915.0          | 84.8   | 53.0   | 84.8                              | 53.0   | 76.0               | 49.3   | 7580               | 86.5   |
| 1986 | 6233.9         | 915.0          | 78.8   | 58.2   | 78.8                              | 58.2   | 77.8               | 55.0   | 7026               | 80.2   |
| 1987 | 6169.2         | 915.0          | 83.1   | 62.4   | 83.1                              | 62.4   | 77.0               | 58.7   | 7485               | 85.4   |
| 1988 | 6151.2         | 915.0          | 77.1   | 64.5   | 77.1                              | 64.5   | 76.5               | 61.3   | 7645               | 87.0   |
| 1989 | 5829.7         | 915.0          | 82.6   | 66.8   | 82.6                              | 66.8   | 72.7               | 62.7   | 7757               | 88.6   |
| 1990 | 5871.3         | 915.0          | 74.2   | 67.6   | 74.0                              | 67.6   | 73.2               | 63.9   | 7855               | 89.7   |
| 1991 | 5923.6         | 915.0          | 75.7   | 68.4   | 75.7                              | 68.4   | 73.9               | 64.9   | 8007               | 91.4   |
| 1992 | 5622.1         | 915.0          | 82.3   | 69.7   | 82.3                              | 69.7   | 69.9               | 65.4   | 7941               | 90.4   |
| 1993 | 6685.8         | 915.0          | 89.8   | 71.4   | 89.8                              | 71.3   | 83.4               | 66.9   | 7964               | 90.9   |
| 1994 | 6873.4         | 918.0          | 86.1   | 72.5   | 86.1                              | 72.5   | 85.5               | 68.3   | 8097               | 92.4   |
| 1995 | 4873.6         | 918.0          | 60.7   | 71.7   | 60.7                              | 71.6   | 60.6               | 67.8   | 6040               | 68.9   |
| 1996 | 6816.8         | 910.0          | 92.5   | 73.0   | 87.3                              | 72.7   | 85.3               | 68.9   | 8166               | 93.0   |
| 1997 | 2284.3         | 910.0          | 95.5   | 74.5   | 95.5                              | 74.1   | 28.7               | 66.4   | 2809               | 32.1   |
| 1998 | 6382.6         | 915.0          | 90.2   | 75.4   | 81.3                              | 74.5   | 79.6               | 67.2   | 8008               | 91.4   |
| 1999 | 6976.0         | 911.0          | 90.0   | 76.2   | 88.0                              | 75.3   | 87.4               | 68.3   | 7899               | 90.2   |
| 2000 | 6165.8         | 911.0          | 92.3   | 77.0   | 89.5                              | 76.0   | 77.1               | 68.8   | 7966               | 90.7   |
| 2001 | 6285.3         | 911.0          | 88.6   | 77.6   | 79.4                              | 76.2   | 78.8               | 69.3   | 7942               | 90.7   |
| 2002 | 6890.6         | 915.0          | 90.8   | 78.2   | 88.8                              | 76.8   | 86.0               | 70.1   | 7930               | 90.5   |
| 2003 | 6714.6         | 915.0          | 85.3   | 78.6   | 84.4                              | 77.2   | 83.8               | 70.7   | 7475               | 85.3   |
| 2004 | 7497.9         | 915.0          | 94.0   | 79.2   | 93.9                              | 77.9   | 93.3               | 71.7   | 8295               | 94.4   |

## SE-7 RINGHALS-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 04 Jan | 8.0   | 0.3     | PP   | E31  | TESTING OF TURBINE VALVES.                              |
| 15 Feb | 6.0   | 0.1     | PP   | E31  | TESTING OF TURBINE VALVES.                              |
| 27 Mar | 6.0   | 0.2     | PP   | E31  | TESTING OF TURBINE VALVES.                              |
| 30 Mar | 51.0  | 21.5    | UP   | A31  | TURBINE CONTROL AND PROTECTION SYSTEM                   |
| 14 Apr | 422.0 | 9.2     | XP   | S11  | COAST-DOWN OPERATION.                                   |
| 02 May | 389.0 | 356.1   | PF   | C11  | YEARLY MAINTENANCE.                                     |
| 17 May | 15.0  | 14.4    | UF4  | A11  | WHEN STARTING UP AFTER YEARLY MAINTENANCE, RCP TRIPPED. |
| 19 Jun | 4.0   | 0.1     | PP   | E31  | TESTING OF TURBINE VALVES.                              |
| 17 Jul | 12.0  | 1.4     | XP   | K42  | ORDER FROM THE GRID.                                    |
| 25 Jul | 85.0  | 77.8    | UF   | A11  | REACTOR VESSEL SAFETY VALVE LEAKAGE.                    |
| 31 Jul | 4.0   | 0.3     | UP   | A41  | STATOR AND ROTOR COOLING WATER SYSTEM FAILURE.          |
| 01 Aug | 2.0   | 0.1     | UP   | A41  | STATOR AND ROTOR COOLING WATER SYSTEM FAILURE.          |
| 19 Sep | 3.0   | 0.1     | PP   | E31  | TESTING OF TURBINE VALVES.                              |
| 31 Oct | 3.0   | 0.1     | PP   | E31  | TESTING OF TURBINE VALVES.                              |
| 20 Nov | 33.0  | 13.0    | UP   | A31  | TURBINE BY-PASS VALVE FAILURE                           |
| 12 Dec | 5.0   | 0.1     | PP   | E31  | TESTING OF TURBINE VALVES.                              |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 100       |          |   | 284       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 389             |           |          | 636   | 19        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 312   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 6   | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 3   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 5        |
| Z. Others  |                 |           |          |   | 3         |          |
| Subtotal   | 389             | 100       | 0        | 957   | 307       | 8        |
| Total  |                 | 489       |          |   | 1272      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1981 to 2004<br>Average Hours Lost Per Year |
|--|-----------------|---|
| 11. Reactor and Accessories                    | 100             | 10  |
| 12. Reactor I&C Systems                        |                 | 1   |
| 15. Reactor Cooling Systems                    |                 | 60  |
| 16. Steam generation systems                   |                 | 191   |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0   |
| 31. Turbine and auxiliaries                    |                 | 1   |
| 32. Feedwater and Main Steam System            |                 | 14  |
| 42. Electrical Power Supply Systems            |                 | 0   |
| Total  | 100             | 277   |

# SE-10 RINGHALS-4

**Operator:** RAB (Ringhals AB)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 915.0 MW(e)  
**Design Net RUP:** 915.0 MW(e)  
**Design Discharge Burnup:** 44000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7209.6 GW(e).h  
**Energy Availability Factor:** 92.1%  
**Load Factor:** 89.7%  
**Operating Factor:** 92.1%  
**Energy Unavailability Factor:** 7.9%  
**Total Off-line Time:** 692 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 677.1 | 634.2 | 677.7 | 650.3 | 658.3 | 625.8 | 642.6 | 595.7 | 105.8 | 620.2 | 648.9 | 672.9 | 7209.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.8  | 16.7  | 93.5  | 100.0 | 100.0 | 92.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.9  | 16.7  | 93.5  | 100.0 | 100.0 | 92.1   |
| <b>LF (%)</b>   | 99.5  | 99.6  | 99.6  | 98.7  | 96.7  | 95.0  | 94.4  | 87.5  | 16.1  | 91.1  | 98.5  | 98.8  | 89.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.0  | 16.8  | 93.5  | 100.0 | 100.0 | 92.1   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.2   | 83.3  | 6.5   | 0.0   | 0.0   | 7.9    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 78.6  | 0.0   | 0.0   | 0.0   | 6.4    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.2   | 4.7   | 6.5   | 0.0   | 0.0   | 1.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1973  
**Date of First Criticality:** 19 May 1982  
**Date of Grid Connection:** 23 Jun 1982  
**Date of Commercial Operation:** 21 Nov 1983

**Lifetime Generation:** 130479.9 GW(e).h  
**Cumulative Energy Availability Factor:** 84.6%  
**Cumulative Load Factor:** 75.9%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 15.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2653.1         | 915.0          | 0.0  | 0.0    | 33.1                              | 100.0  | 33.1               | 0.0    | 4122               | 47.1   |
| 1984 | 5987.7         | 915.0          | 82.3   | 82.3   | 82.2                              | 82.2   | 74.5               | 74.5   | 7517               | 85.6   |
| 1985 | 5923.7         | 915.0          | 87.9   | 85.1   | 87.9                              | 85.0   | 73.9               | 74.2   | 7755               | 88.5   |
| 1986 | 5619.3         | 915.0          | 70.7   | 80.3   | 70.7                              | 80.3   | 70.1               | 72.8   | 6839               | 78.1   |
| 1987 | 5665.9         | 915.0          | 88.2   | 82.3   | 88.2                              | 82.2   | 70.7               | 72.3   | 7827               | 89.3   |
| 1988 | 6641.7         | 915.0          | 83.4   | 82.5   | 83.4                              | 82.5   | 82.6               | 74.4   | 7945               | 90.4   |
| 1989 | 5536.8         | 915.0          | 85.8   | 83.0   | 85.8                              | 83.0   | 69.1               | 73.5   | 7624               | 87.0   |
| 1990 | 6467.3         | 915.0          | 89.1   | 83.9   | 89.1                              | 83.9   | 80.7               | 74.5   | 8080               | 92.2   |
| 1991 | 6916.2         | 915.0          | 85.8   | 84.2   | 85.9                              | 84.1   | 86.3               | 76.0   | 8041               | 91.8   |
| 1992 | 6432.4         | 915.0          | 90.1   | 84.8   | 90.0                              | 84.8   | 80.0               | 76.4   | 8156               | 92.9   |
| 1993 | 6342.3         | 915.0          | 88.8   | 85.2   | 88.8                              | 85.2   | 79.1               | 76.7   | 7906               | 90.3   |
| 1994 | 6234.7         | 914.0          | 84.8   | 85.2   | 84.8                              | 85.2   | 77.9               | 76.8   | 7476               | 85.3   |
| 1995 | 6251.7         | 912.0          | 88.4   | 85.4   | 80.6                              | 84.8   | 78.3               | 76.9   | 7684               | 87.7   |
| 1996 | 6426.8         | 912.0          | 91.8   | 85.9   | 79.6                              | 84.4   | 80.2               | 77.2   | 8067               | 91.8   |
| 1997 | 2560.0         | 912.0          | 98.9   | 86.9   | 98.9                              | 85.4   | 32.0               | 74.0   | 2783               | 31.8   |
| 1998 | 6809.8         | 915.0          | 92.5   | 87.2   | 86.5                              | 85.5   | 85.0               | 74.7   | 8146               | 93.0   |
| 1999 | 6986.8         | 907.0          | 91.7   | 87.5   | 88.6                              | 85.7   | 87.9               | 75.5   | 8042               | 91.8   |
| 2000 | 4060.7         | 907.0          | 66.5   | 86.3   | 63.4                              | 84.4   | 51.0               | 74.1   | 5898               | 67.1   |
| 2001 | 6624.0         | 909.0          | 88.4   | 86.4   | 86.5                              | 84.5   | 83.2               | 74.6   | 7758               | 88.6   |
| 2002 | 5942.2         | 915.0          | 80.3   | 86.1   | 75.5                              | 84.0   | 74.1               | 74.6   | 7056               | 80.5   |
| 2003 | 6996.5         | 915.0          | 89.2   | 86.2   | 88.9                              | 84.3   | 87.3               | 75.2   | 7843               | 89.5   |
| 2004 | 7209.6         | 915.0          | 92.1   | 86.5   | 92.1                              | 84.6   | 89.7               | 75.9   | 8092               | 92.1   |



## SE-10 RINGHALS-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 20 Feb | 2.0   | 0.0     | PP   | E31  | TURBINE TEST   |
| 21 Feb | 2.0   | 0.0     | PP   | E31  | TURBINE TEST   |
| 03 Apr | 3.0   | 0.0     | PP   | E31  | TURBINE TEST   |
| 15 May | 4.0   | 0.1     | PP   | E31  | TURBINE TEST   |
| 27 Jun | 4.0   | 0.1     | PP   | E31  | TURBINE TEST   |
| 24 Aug | 45.0  | 41.0    | UF4  | A32  | FIRST IT WAS PROBLEMS WITH ELECTRICGENERATOR 42 (WATER LEAKAGE), THAT TRIPPED THE TURBIN 42. LATER BECAUSE OF SLOW REGULATION ON MAIN FEEDWATERVALVE TO SG 3 CAUSED HIGH-HIGH LEVEL IN SG 3 AND REACTOR SCRAM. |
| 02 Sep | 566.0 | 517.9   | PF   | C    | ANNUAL MAINTENANCE   |
| 25 Sep | 33.0  | 30.7    | UF3  | Z11  | OUTAGE EXTENSION   |
| 02 Oct | 48.0  | 44.2    | UF   | L32  | HIGH LEVEL OF SODIUM IN THE SG COMMING FROM THE CONDENSATE TREATMENT SYSTEM.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 45        |          |  | 167       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 566             |           |          | 687                                      | 1         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 261                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 46                                       | 20        |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 3         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1         |          |
| L. Human factor related  |                 | 48        |          |  |           |          |
| Z. Others  |                 | 33        |          | 1  | 17        |          |
| Subtotal   | 566             | 126       | 0        | 995                                      | 210       | 0        |
| Total  |                 | 692       |          |  | 1205      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 14                                       |
| 12. Reactor I&C Systems             |                 | 3  |
| 14. Safety Systems                  |                 | 1  |
| 15. Reactor Cooling Systems         |                 | 92                                       |
| 16. Steam generation systems        |                 | 38                                       |
| 31. Turbine and auxiliaries         |                 | 1  |
| 32. Feedwater and Main Steam System | 45              | 16                                       |
| Total                               | 45              | 165                                      |

# CH-1 BEZNAU-1

**Operator:** NOK (NORDOSTSCHWEIZERISCHE KRAFTWERKE)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 365.0 MW(e)  
**Design Net RUP:** 350.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2801.2 GW(e).h  
**Energy Availability Factor:** 87.4%  
**Load Factor:** 87.4%  
**Operating Factor:** 88.3%  
**Energy Unavailability Factor:** 12.6%  
**Total Off-line Time:** 1027 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 273.7 | 256.0 | 273.5 | 264.3 | 236.0 | 0.0   | 162.4 | 265.5 | 260.0 | 271.4 | 264.5 | 274.0 | 2801.2 |
| <b>EAF (%)</b>  | 99.9  | 99.9  | 100.0 | 100.0 | 87.4  | 0.0   | 61.4  | 100.0 | 100.0 | 99.9  | 100.0 | 99.9  | 87.4   |
| <b>UCF (%)</b>  | 100.0 | 99.9  | 100.0 | 100.0 | 88.5  | 0.0   | 61.4  | 100.0 | 100.0 | 99.9  | 100.0 | 99.9  | 87.5   |
| <b>LF (%)</b>   | 100.8 | 100.8 | 100.7 | 100.6 | 86.9  | 0.0   | 59.8  | 97.8  | 98.9  | 99.8  | 100.6 | 100.9 | 87.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 91.7  | 0.0   | 67.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.3   |
| <b>EUF (%)</b>  | 0.1   | 0.1   | 0.0   | 0.0   | 12.6  | 100.0 | 38.6  | 0.0   | 0.0   | 0.1   | 0.0   | 0.1   | 12.6   |
| <b>PUF (%)</b>  | 0.1   | 0.1   | 0.0   | 0.0   | 7.9   | 100.0 | 28.6  | 0.0   | 0.0   | 0.1   | 0.0   | 0.1   | 11.3   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 3.6   | 0.0   | 10.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 1.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

- OPERATION AT FULL POWER IN BASE LOAD MODE - STRETCH OUT OPERATION BEFORE REFUELLING OUTAGE
- PLANT SHUTDOWN FOR REFUELLING WITH MAINTENANCE - TWO REACTOR TRIPS CAUSED BY FEEDWATER SYSTEM EQUIPMENT FAILURE

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1965      **Lifetime Generation:** 89186.0 GW(e).h  
**Date of First Criticality:** 30 Jun 1969      **Cumulative Energy Availability Factor:** 82.9%  
**Date of Grid Connection:** 17 Jul 1969      **Cumulative Load Factor:** 82.3%  
**Date of Commercial Operation:** 01 Sep 1969      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 17.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 2634.3         | 350.0          | 86.0   | 86.9   | 86.0                              | 79.4   | 85.9               | 77.6   | 7906               | 90.3   |
| 1986 | 2496.3         | 350.0          | 81.6   | 86.6   | 81.6                              | 79.5   | 81.4               | 77.8   | 7403               | 84.5   |
| 1987 | 2486.3         | 350.0          | 80.7   | 86.3   | 80.7                              | 79.6   | 81.1               | 78.0   | 7256               | 82.8   |
| 1988 | 2566.5         | 350.0          | 83.0   | 86.1   | 83.0                              | 79.7   | 83.5               | 78.3   | 7499               | 85.4   |
| 1989 | 2433.1         | 350.0          | 78.7   | 85.7   | 78.6                              | 79.7   | 79.4               | 78.4   | 7062               | 80.6   |
| 1990 | 2562.5         | 350.0          | 84.4   | 85.7   | 84.4                              | 79.9   | 83.6               | 78.6   | 7506               | 85.7   |
| 1991 | 2495.3         | 350.0          | 83.5   | 85.6   | 83.5                              | 80.1   | 81.4               | 78.7   | 7430               | 84.8   |
| 1992 | 2477.4         | 350.0          | 81.7   | 85.4   | 81.7                              | 80.1   | 80.6               | 78.8   | 7303               | 83.1   |
| 1993 | 2158.4         | 350.0          | 69.9   | 84.8   | 69.4                              | 79.7   | 70.4               | 78.5   | 6241               | 71.2   |
| 1994 | 2686.9         | 350.0          | 86.2   | 84.8   | 85.1                              | 79.9   | 87.6               | 78.8   | 7610               | 86.9   |
| 1995 | 2850.5         | 350.0          | 90.5   | 85.0   | 90.2                              | 80.3   | 93.0               | 79.4   | 7993               | 91.2   |
| 1996 | 2753.2         | 353.0          | 87.5   | 85.1   | 86.8                              | 80.5   | 88.8               | 79.7   | 7704               | 87.7   |
| 1997 | 2708.2         | 365.0          | 87.5   | 85.2   | 85.1                              | 80.7   | 84.7               | 79.9   | 7731               | 88.3   |
| 1998 | 3183.1         | 365.0          | 99.9   | 85.7   | 99.8                              | 81.4   | 99.6               | 80.6   | 8760               | 100.0  |
| 1999 | 2841.3         | 365.0          | 91.3   | 85.9   | 88.6                              | 81.7   | 88.9               | 80.9   | 8074               | 92.2   |
| 2000 | 2539.2         | 365.0          | 79.2   | 85.7   | 78.3                              | 81.5   | 79.2               | 80.9   | 7113               | 81.0   |
| 2001 | 3090.2         | 365.0          | 96.8   | 86.1   | 96.8                              | 82.0   | 96.6               | 81.4   | 8504               | 97.1   |
| 2002 | 2908.8         | 365.0          | 91.3   | 86.2   | 91.0                              | 82.3   | 91.0               | 81.7   | 8000               | 91.3   |
| 2003 | 3061.8         | 365.0          | 96.9   | 86.5   | 96.2                              | 82.7   | 95.8               | 82.1   | 8494               | 97.0   |
| 2004 | 2801.2         | 365.0          | 87.5   | 86.6   | 87.4                              | 82.9   | 87.4               | 82.3   | 7758               | 88.3   |

**CH-1 BEZNAU-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 02 May | 15.0  | 2.4     | UP2  | A31  | TRIP TURBINE 1 DUE TO MALFUNCTIONING OF HEATER 2 LEVEL CONTROLLER.         |
| 20 May | 163.0 | 3.0     | XP1  | S11  | STRETCH OUT OPERATION BEFORE REFUELLING OUTAGE                             |
| 25 May | 29.0  | 7.3     | UF4  | A32  | R-TRIP DUE TO LOSS OF FEEDWATER-PUMP.                                      |
| 29 May | 991.0 | 362.0   | PF   | C    | PLANT SHUT-DOWN FOR REFUELLING AND MAINTENANCE                             |
| 08 Jul | 72.0  | 26.3    | UF3  | A11  | TECHNICAL PROBLEMS AND EXTENSION ULTRA SOUND MEASUREMENT OF REACTOR VESSEL |
| 10 Jul | 2.0   | 0.8     | UF4  | A32  | R-TRIP AT 14% POWER DUE TO MALFUNCTIONING OF A FEEDWATER CONTROL-VALVE     |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 103       |          |   | 258       |          |
| B. Refuelling without a maintenance                           |                 |           |          | 7   |           |          |
| C. Inspection, maintenance or repair combined with refuelling | 991             |           |          | 982   |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 19  |           |          |
| E. Testing of plant systems or components                     |                 |           |          |   | 0         |          |
| Subtotal  | 991             | 103       | 0        | 1008  | 258       | 0        |
| Total   |                 | 1094      |          |   | 1266      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         | 72                 | 16  |
| 12. Reactor I&C Systems             |                    | 104   |
| 13. Reactor Auxiliary Systems       |                    | 3   |
| 14. Safety Systems                  |                    | 3   |
| 15. Reactor Cooling Systems         |                    | 13  |
| 16. Steam generation systems        |                    | 102   |
| 31. Turbine and auxiliaries         |                    | 2   |
| 32. Feedwater and Main Steam System | 31                 | 13  |
| 35. All other I&C Systems           |                    | 0   |
| Total                               | 103                | 256   |

**CH-3 BEZNAU-2**

**Operator:** NOK (NORDOSTSCHWEIZERISCHE KRAFTWERKE)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

**1. Station Details**

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 365.0 MW(e)  
**Design Net RUP:** 350.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 3099.4 GW(e).h  
**Energy Availability Factor:** 97.0%  
**Load Factor:** 96.7%  
**Operating Factor:** 97.4%  
**Energy Unavailability Factor:** 3.0%  
**Total Off-line Time:** 229 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 272.6 | 255.1 | 272.4 | 263.5 | 271.5 | 260.5 | 262.6 | 176.3 | 258.9 | 270.3 | 263.2 | 272.4 | 3099.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.5  | 100.0 | 100.0 | 100.0 | 100.0 | 97.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.6  | 100.0 | 100.0 | 100.0 | 100.0 | 97.0   |
| <b>LF (%)</b>   | 100.4 | 100.4 | 100.3 | 100.3 | 100.0 | 99.1  | 96.7  | 64.9  | 98.5  | 99.4  | 100.2 | 100.3 | 96.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 98.9  | 70.4  | 100.0 | 100.0 | 100.0 | 100.0 | 97.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.5   | 33.5  | 0.0   | 0.0   | 0.0   | 0.0   | 3.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.5   | 33.5  | 0.0   | 0.0   | 0.0   | 0.0   | 3.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

- OPERATION AT FULL POWER IN BASE LOAD MODE - REFUELLING WITHOUT A MAINTENANCE (10 DAYS)

**5. Historical Summary**

**Date of Construction Start:** 01 Jan 1968      **Lifetime Generation:** 88906.0 GW(e).h  
**Date of First Criticality:** 16 Oct 1971      **Cumulative Energy Availability Factor:** 86.5%  
**Date of Grid Connection:** 23 Oct 1971      **Cumulative Load Factor:** 86.9%  
**Date of Commercial Operation:** 01 Dec 1971      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 13.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2790.5         | 350.0          | 89.6   | 86.7   | 89.6                              | 85.0   | 91.0               | 85.4   | 7977               | 91.1   |
| 1984 | 2724.2         | 350.0          | 87.5   | 86.8   | 87.5                              | 85.2   | 88.6               | 85.7   | 7874               | 89.6   |
| 1985 | 2629.1         | 350.0          | 85.0   | 86.7   | 84.9                              | 85.2   | 85.7               | 85.7   | 7647               | 87.3   |
| 1986 | 2769.8         | 350.0          | 90.2   | 86.9   | 90.2                              | 85.5   | 90.3               | 86.0   | 7983               | 91.1   |
| 1987 | 2527.6         | 350.0          | 82.4   | 86.6   | 82.4                              | 85.3   | 82.4               | 85.8   | 7535               | 86.0   |
| 1988 | 2630.2         | 350.0          | 84.5   | 86.5   | 84.5                              | 85.3   | 85.6               | 85.7   | 7604               | 86.6   |
| 1989 | 2643.3         | 350.0          | 85.1   | 86.4   | 85.1                              | 85.3   | 86.2               | 85.8   | 7614               | 86.9   |
| 1990 | 2636.1         | 350.0          | 85.3   | 86.4   | 85.3                              | 85.3   | 86.0               | 85.8   | 7568               | 86.4   |
| 1991 | 2619.5         | 350.0          | 84.5   | 86.3   | 84.5                              | 85.2   | 85.4               | 85.8   | 7551               | 86.2   |
| 1992 | 2375.9         | 350.0          | 76.3   | 85.8   | 76.3                              | 84.8   | 77.3               | 85.4   | 6836               | 77.8   |
| 1993 | 2650.9         | 350.0          | 85.1   | 85.8   | 84.9                              | 84.8   | 86.5               | 85.4   | 7517               | 85.8   |
| 1994 | 3062.8         | 350.0          | 98.9   | 86.3   | 98.8                              | 85.4   | 99.9               | 86.0   | 8710               | 99.4   |
| 1995 | 2560.9         | 350.0          | 82.7   | 86.2   | 82.6                              | 85.3   | 83.5               | 85.9   | 7247               | 82.7   |
| 1996 | 2754.1         | 351.0          | 88.5   | 86.3   | 87.9                              | 85.4   | 89.3               | 86.1   | 7912               | 90.1   |
| 1997 | 3090.2         | 357.0          | 99.5   | 86.8   | 99.5                              | 86.0   | 98.8               | 86.6   | 8732               | 99.7   |
| 1998 | 2717.8         | 357.0          | 87.8   | 86.8   | 87.3                              | 86.0   | 86.9               | 86.6   | 7755               | 88.5   |
| 1999 | 2217.2         | 357.0          | 70.7   | 86.2   | 70.3                              | 85.4   | 70.9               | 86.0   | 6322               | 72.2   |
| 2000 | 3071.0         | 365.0          | 96.2   | 86.6   | 96.2                              | 85.8   | 95.8               | 86.4   | 8499               | 96.8   |
| 2001 | 2568.7         | 365.0          | 80.7   | 86.4   | 80.7                              | 85.6   | 80.3               | 86.2   | 7107               | 81.1   |
| 2002 | 3012.0         | 365.0          | 94.6   | 86.7   | 94.6                              | 85.9   | 94.2               | 86.4   | 8292               | 94.7   |
| 2003 | 2920.3         | 365.0          | 92.0   | 86.8   | 91.8                              | 86.1   | 91.3               | 86.6   | 8070               | 92.1   |
| 2004 | 3099.4         | 365.0          | 97.0   | 87.2   | 97.0                              | 86.5   | 96.7               | 86.9   | 8556               | 97.4   |

## CH-3 BEZNAU-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                      |
|--------|-------|---------|------|------|----------------------------------|
| 31 Jul | 259.0 | 94.7    | PF   | B11  | REFUELLING WITHOUT A MAINTENANCE |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 92        |          |
| B. Refuelling without a maintenance                           | 259             |           |          | 8   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling |                 |           |          | 867   |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 41  |           |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 0        |
| L. Human factor related                                       |                 |           |          |   | 0         |          |
| Subtotal  | 259             | 0         | 0        | 916   | 93        | 0        |
| Total   |                 | 259       |          |   | 1009      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 6   |
| 12. Reactor I&C Systems                        |                    | 8   |
| 13. Reactor Auxiliary Systems                  |                    | 1   |
| 14. Safety Systems                             |                    | 0   |
| 15. Reactor Cooling Systems                    |                    | 10  |
| 16. Steam generation systems                   |                    | 28  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 1   |
| 31. Turbine and auxiliaries                    |                    | 15  |
| 32. Feedwater and Main Steam System            |                    | 3   |
| 35. All other I&C Systems                      |                    | 1   |
| 42. Electrical Power Supply Systems            |                    | 1   |
| Total  | 0                  | 74  |

# CH-4 GOESGEN

**Operator:** KKG (KERNKRAFTWERK GOESGEN-DAENIKEN AG)  
**Contractor:** KWU (SIEMENS KRAFTWERK UNION AG)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 970.0 MW(e)  
**Design Net RUP:** 920.0 MW(e)  
**Design Discharge Burnup:** 23000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8015.6 GW(e).h  
**Energy Availability Factor:** 93.8%  
**Load Factor:** 94.1%  
**Operating Factor:** 94.5%  
**Energy Unavailability Factor:** 6.2%  
**Total Off-line Time:** 484 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 733.0 | 684.2 | 727.9 | 701.1 | 689.1 | 218.8 | 714.2 | 712.3 | 694.4 | 703.4 | 705.5 | 731.8 | 8015.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 95.2  | 32.1  | 100.0 | 100.0 | 100.0 | 97.3  | 100.0 | 100.0 | 93.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 33.5  | 100.0 | 100.0 | 100.0 | 97.3  | 100.0 | 100.0 | 94.3   |
| <b>LF (%)</b>   | 101.6 | 101.3 | 100.9 | 100.4 | 95.5  | 31.3  | 99.0  | 98.7  | 99.4  | 97.5  | 101.0 | 101.4 | 94.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 35.1  | 100.0 | 100.0 | 100.0 | 97.8  | 100.0 | 100.0 | 94.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 4.8   | 67.9  | 0.0   | 0.0   | 0.0   | 2.7   | 0.0   | 0.0   | 6.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 66.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.7   | 0.0   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 4.8   | 1.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1973      **Lifetime Generation:** 185851.0 GW(e).h  
**Date of First Criticality:** 20 Jan 1979      **Cumulative Energy Availability Factor:** 87.7%  
**Date of Grid Connection:** 02 Feb 1979      **Cumulative Load Factor:** 87.8%  
**Date of Commercial Operation:** 01 Nov 1979      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 12.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1982 | 6436.1         | 920.0          | 79.8   | 78.0   | 79.8                              | 78.0   | 79.9               | 78.1   | 7665               | 87.5   |
| 1983 | 6891.6         | 920.0          | 86.2   | 80.0   | 86.1                              | 80.0   | 85.5               | 80.0   | 7790               | 88.9   |
| 1984 | 7134.8         | 900.0          | 90.6   | 82.1   | 89.8                              | 82.0   | 90.2               | 82.0   | 8015               | 91.2   |
| 1985 | 6747.7         | 909.0          | 85.7   | 82.7   | 84.6                              | 82.4   | 84.7               | 82.4   | 7789               | 88.9   |
| 1986 | 6754.5         | 941.0          | 84.1   | 82.9   | 82.8                              | 82.5   | 81.9               | 82.4   | 7386               | 84.3   |
| 1987 | 6910.3         | 935.0          | 85.2   | 83.2   | 84.4                              | 82.7   | 84.4               | 82.6   | 7521               | 85.9   |
| 1988 | 6859.0         | 936.0          | 84.7   | 83.4   | 83.4                              | 82.8   | 83.4               | 82.7   | 7476               | 85.1   |
| 1989 | 6878.7         | 931.0          | 85.4   | 83.6   | 84.3                              | 82.9   | 84.3               | 82.9   | 7514               | 85.8   |
| 1990 | 7131.5         | 929.0          | 89.4   | 84.1   | 87.6                              | 83.4   | 87.6               | 83.3   | 7983               | 91.1   |
| 1991 | 7141.9         | 925.0          | 89.7   | 84.6   | 88.1                              | 83.7   | 88.1               | 83.7   | 7918               | 90.4   |
| 1992 | 7406.9         | 934.0          | 92.1   | 85.2   | 90.2                              | 84.2   | 90.3               | 84.2   | 8107               | 92.3   |
| 1993 | 7408.1         | 950.0          | 89.3   | 85.5   | 88.9                              | 84.6   | 89.0               | 84.6   | 8075               | 92.2   |
| 1994 | 7661.1         | 947.0          | 92.1   | 85.9   | 91.1                              | 85.0   | 92.3               | 85.1   | 8102               | 92.5   |
| 1995 | 7820.9         | 971.0          | 91.8   | 86.3   | 91.1                              | 85.4   | 91.9               | 85.5   | 8109               | 92.6   |
| 1996 | 7928.4         | 986.0          | 93.4   | 86.7   | 91.5                              | 85.8   | 91.5               | 85.9   | 8204               | 93.4   |
| 1997 | 7967.8         | 986.0          | 93.5   | 87.1   | 91.6                              | 86.1   | 92.2               | 86.3   | 8189               | 93.5   |
| 1998 | 7839.7         | 986.0          | 93.2   | 87.5   | 90.8                              | 86.4   | 90.8               | 86.5   | 8179               | 93.4   |
| 1999 | 7533.9         | 970.0          | 89.9   | 87.6   | 88.7                              | 86.5   | 88.7               | 86.6   | 7887               | 90.0   |
| 2001 | 7870.5         | 970.0          | 93.5   | 87.9   | 92.6                              | 86.8   | 92.6               | 86.9   | 8206               | 93.7   |
| 2002 | 7853.3         | 970.0          | 92.9   | 88.1   | 92.3                              | 87.1   | 92.4               | 87.2   | 8154               | 93.1   |
| 2003 | 7988.7         | 970.0          | 94.5   | 88.4   | 93.9                              | 87.4   | 94.0               | 87.5   | 8291               | 94.6   |
| 2004 | 8015.6         | 970.0          | 94.3   | 88.7   | 93.8                              | 87.7   | 94.1               | 87.8   | 8300               | 94.5   |

## CH-4 GOESGEN

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description              |
|--------|-------|---------|------|------|--------------------------|
| 05 Jun | 467.0 | 464.6   | PF   | C    | SHUTDOWN FOR REFUELLING  |
| 12 Oct | 17.0  | 19.3    | UF1  | A32  | FEEDWATER SYSTEM PROBLEM |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1979 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 17        |          |   | 38        |          |
| C. Inspection, maintenance or repair combined with refuelling | 467             |           |          | 757   |           |          |
| E. Testing of plant systems or components                     |                 |           |          |   | 0         |          |
| J. Grid failure or grid unavailability                        |                 |           |          |   |           | 0        |
| Subtotal  | 467             | 17        | 0        | 757   | 38        | 0        |
| Total   |                 | 484       |          |   | 795       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1979 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 4   |
| 16. Steam generation systems        |                    | 2   |
| 31. Turbine and auxiliaries         |                    | 5   |
| 32. Feedwater and Main Steam System | 17                 | 22  |
| 41. Main Generator Systems          |                    | 3   |
| Total                               | 17                 | 36  |

# CH-5 LEIBSTADT

**Operator:** KKL (KERNKRAFTWERK LEIBSTADT)

**Contractor:** GETSCO (GENERAL ELECTRIC TECHNICAL SERVICES CO.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1165.0 MW(e)  
**Design Net RUP:** 942.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8692.0 GW(e).h  
**Energy Availability Factor:** 84.9%  
**Load Factor:** 84.9%  
**Operating Factor:** 86.9%  
**Energy Unavailability Factor:** 15.1%  
**Total Off-line Time:** 1151 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 871.9 | 816.2 | 870.3 | 837.0 | 793.8 | 819.1 | 828.7 | 125.7 | 200.3 | 809.3 | 844.6 | 875.2 | 8692.0 |
| <b>EAF (%)</b>  | 99.8  | 99.9  | 100.0 | 99.8  | 92.5  | 97.1  | 95.4  | 16.0  | 25.2  | 93.5  | 100.0 | 99.8  | 84.9   |
| <b>UCF (%)</b>  | 99.8  | 99.9  | 100.0 | 100.0 | 93.1  | 99.0  | 98.3  | 20.4  | 25.4  | 93.7  | 100.0 | 99.8  | 85.7   |
| <b>LF (%)</b>   | 100.6 | 100.7 | 100.4 | 99.8  | 91.6  | 97.6  | 95.6  | 14.5  | 23.9  | 93.4  | 100.7 | 101.0 | 84.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 94.6  | 100.0 | 100.0 | 22.0  | 30.7  | 95.8  | 100.0 | 100.0 | 86.9   |
| <b>EUF (%)</b>  | 0.2   | 0.1   | 0.0   | 0.2   | 7.5   | 2.9   | 4.6   | 84.0  | 74.8  | 6.5   | 0.0   | 0.2   | 15.1   |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.2   | 0.3   | 1.7   | 79.6  | 74.6  | 0.1   | 0.0   | 0.2   | 13.1   |
| <b>UCLF (%)</b> | 0.0   | 0.1   | 0.0   | 0.0   | 6.7   | 0.7   | 0.0   | 0.0   | 0.0   | 6.3   | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.1   | 0.6   | 1.8   | 2.9   | 4.4   | 0.1   | 0.2   | 0.0   | 0.0   | 0.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

IN MAY SHUTDOWN TO REPAIR LEAKAGE IN THE DRYWELL.COASTDOWN OPERATION FROM JULY 15 UNTIL AUGUST 07, 2004.AUGUST 07 - SEPTEMBER 21: REFUELLING OUTAGE.OCTOBER: LOSS OF EXCITATION TO MAIN GENERATOR

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1974  
**Date of First Criticality:** 09 Mar 1984  
**Date of Grid Connection:** 24 May 1984  
**Date of Commercial Operation:** 15 Dec 1984

**Lifetime Generation:** 158985.5 GW(e).h  
**Cumulative Energy Availability Factor:** 85.4%  
**Cumulative Load Factor:** 86.0%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 14.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 0.0            | 1030.0         | 0.0  | 0.0    | 0.0                               | 100.0  | 0.0                | 0.0    | 0                  | 0.0    |
| 1985 | 6769.3         | 955.0          | 80.1   | 80.1   | 80.1                              | 80.2   | 81.2               | 80.9   | 7233               | 82.6   |
| 1986 | 7209.2         | 957.0          | 83.2   | 81.7   | 83.2                              | 81.7   | 86.0               | 83.5   | 7668               | 87.5   |
| 1987 | 7376.4         | 990.0          | 85.2   | 82.9   | 85.2                              | 82.9   | 85.1               | 84.0   | 7917               | 90.4   |
| 1988 | 7003.5         | 990.0          | 80.0   | 82.2   | 80.0                              | 82.2   | 80.5               | 83.1   | 7536               | 85.8   |
| 1989 | 7364.2         | 990.0          | 85.5   | 82.8   | 85.5                              | 82.8   | 84.9               | 83.5   | 7671               | 87.6   |
| 1990 | 7596.2         | 990.0          | 89.8   | 84.0   | 89.9                              | 84.0   | 87.6               | 84.2   | 7905               | 90.2   |
| 1991 | 7060.3         | 990.0          | 86.0   | 84.3   | 81.3                              | 83.6   | 81.4               | 83.8   | 7580               | 86.5   |
| 1992 | 7537.6         | 990.0          | 90.5   | 85.1   | 86.4                              | 84.0   | 86.7               | 84.1   | 7986               | 90.9   |
| 1993 | 7338.1         | 990.0          | 89.1   | 85.5   | 84.4                              | 84.0   | 84.6               | 84.2   | 7898               | 90.2   |
| 1994 | 6988.2         | 1003.0         | 81.4   | 85.1   | 79.4                              | 83.6   | 79.5               | 83.7   | 7108               | 81.1   |
| 1995 | 7673.8         | 1030.0         | 89.1   | 85.5   | 84.2                              | 83.6   | 85.0               | 83.8   | 7819               | 89.3   |
| 1996 | 7705.1         | 1030.0         | 87.6   | 85.7   | 84.8                              | 83.7   | 85.2               | 84.0   | 7734               | 88.0   |
| 1997 | 7762.5         | 1030.0         | 89.2   | 86.0   | 86.2                              | 83.9   | 86.0               | 84.1   | 7830               | 89.4   |
| 1998 | 8046.2         | 1030.0         | 92.3   | 86.4   | 88.2                              | 84.2   | 89.2               | 84.5   | 8102               | 92.5   |
| 1999 | 8320.0         | 1080.0         | 91.8   | 86.8   | 86.8                              | 84.4   | 87.9               | 84.7   | 8126               | 92.8   |
| 2000 | 8823.2         | 1115.0         | 92.3   | 87.2   | 89.5                              | 84.8   | 90.1               | 85.1   | 8159               | 92.9   |
| 2002 | 9173.8         | 1115.0         | 91.5   | 87.5   | 90.8                              | 85.2   | 93.9               | 85.7   | 8250               | 94.2   |
| 2003 | 9309.3         | 1165.0         | 90.9   | 87.7   | 90.1                              | 85.5   | 91.2               | 86.0   | 8204               | 93.6   |
| 2004 | 8692.0         | 1165.0         | 85.7   | 87.6   | 84.9                              | 85.4   | 84.9               | 86.0   | 7633               | 86.9   |



# CH-5 LEIBSTADT

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 27 May | 40.0   | 46.6    | UF5  | A11  | REPAIR LEAKAGE CAUSING INCREASING REACTOR COOLANT SYSTEM UNIDENTIFIED LEAKAGE IN THE DRYWELL  |
| 29 May | 108.0  | 17.1    | UP2  | A11  | REPAIR LEAKAGE CAUSING INCREASING REACTOR COOLANT SYSTEM UNIDENTIFIED LEAKAGE IN THE DRYWELL  |
| 16 Jul | 360.0  | 25.1    | XP   | S    | EOC COASTDOWN   |
| 01 Aug | 164.0  | 38.1    | XP   | S11  | END-OF-CYCLE-COASTDOWN  |
| 07 Aug | 1079.0 | 1257.0  | PF   | C    | ANNUAL REFUELLING OUTAGETHERE WAS A PLANNED MANUAL REACTOR SCRAM FOR CONTROL ROD SCRAM TIME TESTING (TECHNICAL SPECIFICATION SURVEILLANCE REQUIREMENT) DURING THE OUTAGE. |
| 21 Sep | 104.0  | 56.7    | PP   | C    | POST PF OUTAGE POWER ASCENSION  |
| 01 Oct | 31.8   | 37.0    | UF4  | A41  | LOSS OF EXCITATION TO MAIN GENERATOR RESULTED IN A REACTOR SCRAM  |
| 02 Oct | 72.4   | 17.2    | UP2  | A41  | POWER ASCENSION TO 100% AFTER RESYNCHRONIZATION TO THE GRID   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 71        |          | 0  | 44        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1079            |           |          | 750                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 22                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 3  |           |          |
| Subtotal   | 1079            | 71        | 0        | 775                                      | 49        | 2        |
| Total  |                 | 1150      |          |  | 826       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         | 40              | 1  |
| 12. Reactor I&C Systems             |                 | 3  |
| 15. Reactor Cooling Systems         |                 | 5  |
| 31. Turbine and auxiliaries         |                 | 17                                       |
| 32. Feedwater and Main Steam System |                 | 8  |
| 35. All other I&C Systems           |                 | 3  |
| 41. Main Generator Systems          | 31              | 2  |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 71              | 39                                       |

# CH-2 MUEHLEBERG

**Operator:** BKW (BKW ENERGIE AG)

**Contractor:** GETSCO (GENERAL ELECTRIC TECHNICAL SERVICES CO.)

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 355.0 MW(e)  
**Design Net RUP:** 306.0 MW(e)  
**Design Discharge Burnup:** 22000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2906.1 GW(e).h  
**Energy Availability Factor:** 92.4%  
**Load Factor:** 93.2%  
**Operating Factor:** 94.3%  
**Energy Unavailability Factor:** 7.6%  
**Total Off-line Time:** 503 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 268.2 | 251.1 | 267.0 | 258.2 | 265.9 | 253.5 | 249.0 | 55.3 | 243.5 | 266.8 | 259.4 | 268.3 | 2906.1 |
| <b>EAF (%)</b>  | 99.9  | 100.0 | 99.8  | 99.8  | 99.7  | 99.4  | 95.2  | 21.0 | 96.1  | 100.0 | 99.8  | 99.5  | 92.4   |
| <b>UCF (%)</b>  | 99.9  | 100.0 | 99.8  | 99.8  | 99.7  | 99.4  | 100.0 | 25.2 | 97.8  | 100.0 | 99.8  | 99.5  | 93.3   |
| <b>LF (%)</b>   | 101.5 | 101.6 | 101.1 | 101.0 | 100.7 | 99.2  | 94.3  | 20.9 | 95.3  | 100.9 | 101.5 | 101.6 | 93.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.0 | 100.0 | 100.0 | 100.0 | 32.5 | 100.0 | 100.0 | 100.0 | 100.0 | 94.3   |
| <b>EUF (%)</b>  | 0.1   | 0.0   | 0.2   | 0.2   | 0.3   | 0.6   | 4.8   | 79.0 | 3.9   | 0.0   | 0.2   | 0.5   | 7.6    |
| <b>PUF (%)</b>  | 0.1   | 0.0   | 0.2   | 0.1   | 0.3   | 0.1   | 0.0   | 74.0 | 2.2   | 0.0   | 0.2   | 0.5   | 6.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.1   | 0.0   | 0.6   | 0.0   | 0.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.8   | 4.2  | 1.7   | 0.0   | 0.0   | 0.0   | 0.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

NORMAL OPERATION WHITOUT ANY MAYOR PROBLEMS. THE PLANNED COAST-DOWN OPERATION STARTED JULY 11TH. THE REFUELING AND MAINTENANCE OUTAGE LASTED AS PLANNED 20 DAYS FROM AUGUST 8TH TO AUGUST 27ST. DURING THE WHOLE YEAR THE HYDROGEN INJECTION, IN OPERATION SINCE OCTOBER 2000, WAS APPLIED.

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1967      **Lifetime Generation:** 81063.1 GW(e).h  
**Date of First Criticality:** 08 Mar 1971      **Cumulative Energy Availability Factor:** 85.7%  
**Date of Grid Connection:** 01 Jul 1971      **Cumulative Load Factor:** 86.1%  
**Date of Commercial Operation:** 06 Nov 1972      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 14.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 2500.7         | 323.0          | 87.3   | 87.0   | 87.2                              | 86.1   | 88.4               | 86.2   | 7882               | 90.0   |
| 1986 | 2114.5         | 326.0          | 73.7   | 86.0   | 73.7                              | 85.2   | 74.0               | 85.3   | 6645               | 75.9   |
| 1987 | 2465.0         | 326.0          | 85.5   | 86.0   | 85.5                              | 85.2   | 86.3               | 85.4   | 7959               | 90.9   |
| 1988 | 2497.6         | 326.0          | 87.1   | 86.0   | 87.1                              | 85.3   | 87.2               | 85.5   | 7968               | 90.7   |
| 1989 | 2297.5         | 323.0          | 81.3   | 85.7   | 81.3                              | 85.1   | 81.2               | 85.3   | 7226               | 82.5   |
| 1990 | 2477.9         | 324.0          | 86.5   | 85.8   | 86.5                              | 85.2   | 87.3               | 85.4   | 7910               | 90.3   |
| 1991 | 2415.1         | 323.0          | 87.3   | 85.9   | 84.8                              | 85.2   | 85.4               | 85.4   | 7714               | 88.1   |
| 1992 | 2413.5         | 323.0          | 85.0   | 85.8   | 85.0                              | 85.1   | 85.1               | 85.4   | 7755               | 88.3   |
| 1993 | 2568.5         | 338.0          | 88.5   | 86.0   | 86.8                              | 85.2   | 86.7               | 85.4   | 7917               | 90.4   |
| 1994 | 2643.1         | 355.0          | 89.3   | 86.1   | 84.9                              | 85.2   | 85.0               | 85.4   | 7952               | 90.8   |
| 1995 | 2669.0         | 355.0          | 87.8   | 86.2   | 85.4                              | 85.2   | 85.8               | 85.4   | 7894               | 90.1   |
| 1996 | 2649.0         | 355.0          | 87.7   | 86.3   | 84.4                              | 85.2   | 85.0               | 85.4   | 7847               | 89.3   |
| 1997 | 2549.2         | 355.0          | 86.9   | 86.3   | 81.8                              | 85.0   | 82.0               | 85.2   | 7671               | 87.6   |
| 1998 | 2659.7         | 355.0          | 86.5   | 86.3   | 85.2                              | 85.0   | 85.5               | 85.3   | 7886               | 90.0   |
| 1999 | 2702.8         | 355.0          | 87.2   | 86.3   | 86.6                              | 85.1   | 86.9               | 85.3   | 8064               | 92.1   |
| 2000 | 2817.0         | 355.0          | 93.5   | 86.6   | 90.1                              | 85.3   | 90.3               | 85.5   | 8290               | 94.4   |
| 2002 | 2828.2         | 355.0          | 91.4   | 86.8   | 87.7                              | 85.4   | 90.9               | 85.7   | 8280               | 94.5   |
| 2003 | 2744.2         | 355.0          | 89.6   | 86.9   | 87.7                              | 85.5   | 88.2               | 85.8   | 8034               | 91.7   |
| 2004 | 2906.1         | 355.0          | 93.3   | 87.1   | 92.4                              | 85.7   | 93.2               | 86.1   | 8282               | 94.3   |

# CH-2 MUEHLEBERG

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 27 Apr | 4.0    | 0.3     | UP2  | A32  | DUE TO A SHORT CIRCUIT ON A BUS COUPLER PRINT A PARTIAL LOSS OF INTERNAL 24V DC POWER OF FEEDWATER PUMP MOTOR CONTROL TRAIN B TOOK PLACE. THE FEEDWATER PUMP WAS SWITCHED OFF AUTOMATICALLY AND THE SPARE FEEDWATER PUMP TOOK OVER SUCCESSFULLY.  |
| 29 Jun | 11.5   | 1.5     | UP2  | A41  | A MALFUNCTION ON A DIFFERENTIAL PROTECTION RELAIS GENERATOR B WAS THE REASON FOR A TURBINE TRIP TRAIN B WITH A LOAD REDUCTION TO 28%.   |
| 11 Jul | 504.0  | 5.5     | XP   | S    | AT JULY 11ND THE PLANNED COAST-DOWN OPERATION BEGAN.  |
| 18 Jul | 1440.0 | 18.4    | XP   | N    | FROM JULY 18TH TO SEPTEMBER 16TH AN ONGOING LOAD REDUCTION DUE TO HIGH COOLING WATER TEMPERATURE TOOK PLACE.  |
| 01 Aug | 192.0  | 4.2     | XP   | S    | COAST-DOWN OPERATION  |
| 08 Aug | 497.0  | 173.7   | PF   | C    | FROM AUGUST 8TH TO AUGUST 27TH THE PLANNED OUTAGE FOR REFUELING AND MAINTENANCE TOOK PLACE. IN-SERVICE INSPECTIONS AND NON-DESTRUCTIVE TESTS OF THE REACTOR PRESSURE VESSEL WERE SUCCESSFULLY CARRIED OUT. ONE OF THE FOUR BUILT-IN TIE RODS WAS INSPECTED. THE PRESSURE CONTROL SYSTEMS AND THE HIGH PRESSURE PREHEATER TURBINE A WERE REPLACED. 40 OUT OF 240 FUEL ELEMENTS WERE REPLACED.                    |
| 27 Aug | 120.0  | 21.8    | PP   | C    | PLANT START-UP AND TESTS AFTER REFUELLING OUTAGE  |
| 30 Aug | 5.0    | 2.1     | UF4  | A31  | DURING THE TEST OF THE NEWLY INSTALLED PRESSURE CONTROL SYSTEMS OF BOTH TURBINE TRAINS AN AUTOMATIC ISOLATION OF THE MSIVS DUE TO LOW STEAM PRESSURE OCCURRED AND A CONSEQUENTIAL SCRAM TOOK PLACE. CAUSE WAS A LOGIC MISMATCH IN THE CONTROL OF ONE VACUUM LIMITER, PART OF THE NEWLY INSTALLED SYSTEMS. THE SCRAM HAPPENED DURING THE PLANNED TEST PHASE PERFORMED DURING THE PLANT START-UP AFTER REFUELING. |
| 01 Sep | 72.0   | 3.6     | PP   | C    | PLANT START-UP AND TESTS  |
| 08 Sep | 10.0   | 1.7     | PP   | D31  | EXCHANGE OF RUPTURE DISC OF TURBINE CONDENSER   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 5         |          |  | 192       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 497             |           |          | 762                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 23                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 2         | 0        |
| Subtotal   | 497             | 5         | 0        | 788                                      | 195       | 1        |
| Total  |                 | 502       |          |  | 984       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 8  |
| 12. Reactor I&C Systems             |                 | 0  |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 1  |
| 31. Turbine and auxiliaries         | 5               | 176                                      |
| 32. Feedwater and Main Steam System |                 | 1  |
| 35. All other I&C Systems           |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 0  |
| Total                               | 5               | 188                                      |

## UA-40 KHMELNITSKI-1

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)

**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6325.1 GW(e).h  
**Energy Availability Factor:** 75.4%  
**Load Factor:** 75.8%  
**Operating Factor:** 79.0%  
**Energy Unavailability Factor:** 24.6%  
**Total Off-line Time:** 1849 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 715.7 | 671.0 | 531.7 | 0.0   | 0.0   | 527.2 | 705.9 | 710.6 | 547.4 | 696.4 | 647.3 | 571.9 | 6325.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 75.3  | 0.0   | 0.0   | 77.1  | 99.9  | 100.0 | 80.0  | 97.2  | 94.6  | 80.9  | 75.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 96.4  | 6.7   | 0.7   | 91.7  | 100.0 | 100.0 | 80.0  | 97.2  | 100.0 | 98.3  | 80.9   |
| <b>LF (%)</b>   | 101.3 | 101.5 | 75.3  | 0.0   | 0.0   | 77.1  | 99.9  | 100.5 | 80.0  | 98.4  | 94.6  | 80.9  | 75.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 77.1  | 0.0   | 0.0   | 91.5  | 100.0 | 100.0 | 81.3  | 97.4  | 100.0 | 100.0 | 79.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 24.7  | 100.0 | 100.0 | 22.9  | 0.1   | 0.0   | 20.0  | 2.8   | 5.4   | 19.1  | 24.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 93.3  | 99.3  | 0.5   | 0.0   | 0.0   | 20.0  | 2.8   | 0.0   | 0.0   | 18.0   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 3.6   | 0.0   | 0.0   | 7.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.7   | 1.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 21.1  | 6.7   | 0.7   | 14.6  | 0.1   | 0.0   | 0.0   | 0.0   | 5.4   | 17.4  | 5.5    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: THERE WERE DONE THE FOLLOWING MEASUREMENTS ACCORDING TO «COMPREHENSIVE PROGRAMME ON PRIORITY MEASURES ON UPGRADING AND SAFETY IMPROVEMENTS OF NUCLEAR POWER UNITS OF UKRAINE NPPS»: PENETRATIONS REPLACEMENT; REPLACEMENT OF TG CONTROL SYSTEM ELECTRIC PART4; REPLACEMENT OF SG BLOWDOWN PIPES AND NIPPLES4; MODERNIZATION OF AUTOMATED SYSTEM FOR RADIATION SAFETY MONITORING4; REPLACEMENT OF THE FIRE FIGHTING DOORS

### 5. Historical Summary

**Date of Construction Start:** 01 Nov 1981      **Lifetime Generation:** 98670.9 GW(e).h  
**Date of First Criticality:** 10 Dec 1987      **Cumulative Energy Availability Factor:** 70.5%  
**Date of Grid Connection:** 31 Dec 1987      **Cumulative Load Factor:** 71.3%  
**Date of Commercial Operation:** 13 Aug 1988      **Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 29.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 3578.2         | 950.0          | 0.0  | 0.0    | 86.2                              | 100.0  | 42.9               | 0.0    | 5266               | 59.9   |
| 1989 | 5872.3         | 950.0          | 70.7   | 70.7   | 70.6                              | 70.6   | 70.6               | 70.6   | 6295               | 71.9   |
| 1990 | 6498.6         | 950.0          | 77.3   | 74.0   | 77.4                              | 74.0   | 78.1               | 74.3   | 6870               | 78.4   |
| 1991 | 5172.5         | 950.0          | 61.2   | 69.8   | 61.2                              | 69.7   | 62.2               | 70.3   | 5551               | 63.4   |
| 1992 | 6075.1         | 950.0          | 67.6   | 69.2   | 66.5                              | 68.9   | 72.8               | 70.9   | 6167               | 70.2   |
| 1993 | 5487.7         | 950.0          | 65.2   | 68.4   | 65.2                              | 68.2   | 65.9               | 69.9   | 5782               | 66.0   |
| 1994 | 6303.4         | 950.0          | 76.0   | 69.7   | 75.5                              | 69.4   | 75.7               | 70.9   | 6775               | 77.3   |
| 1995 | 5700.3         | 950.0          | 68.0   | 69.5   | 68.0                              | 69.2   | 68.5               | 70.5   | 6014               | 68.7   |
| 1996 | 4497.9         | 950.0          | 54.3   | 67.5   | 53.9                              | 67.3   | 53.9               | 68.5   | 4854               | 55.3   |
| 1997 | 6152.1         | 950.0          | 72.8   | 68.1   | 72.6                              | 67.9   | 73.9               | 69.1   | 6415               | 73.2   |
| 1998 | 5499.2         | 950.0          | 67.1   | 68.0   | 65.8                              | 67.7   | 66.1               | 68.8   | 5904               | 67.4   |
| 1999 | 5526.7         | 950.0          | 66.8   | 67.9   | 66.4                              | 67.6   | 66.4               | 68.6   | 6506               | 74.3   |
| 2000 | 5899.6         | 950.0          | 74.3   | 68.4   | 70.4                              | 67.8   | 70.7               | 68.7   | 6541               | 74.5   |
| 2001 | 6167.3         | 950.0          | 76.5   | 69.1   | 73.6                              | 68.2   | 73.9               | 69.1   | 6781               | 77.2   |
| 2002 | 6730.5         | 950.0          | 80.3   | 69.9   | 79.9                              | 69.1   | 80.9               | 70.0   | 7049               | 80.5   |
| 2003 | 7137.7         | 950.0          | 85.4   | 70.9   | 84.9                              | 70.1   | 85.8               | 71.0   | 7512               | 85.8   |
| 2004 | 6325.1         | 950.0          | 80.9   | 71.5   | 75.4                              | 70.5   | 75.8               | 71.3   | 6935               | 79.0   |

# UA-40 KHMELNITSKI-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 12 Mar | 289.0  | 13.3    | XP1  | S    | OPERATION AT REDUCED POWER. COASTDOWN OPERATION.   |
| 24 Mar | 27.0   | 25.5    | UF5  | A41  | UNIT SHUTDOWN DUE TO GENERATOR PROTECTION ACTUATION. REACTOR SCRAM, MANUAL                                     |
| 26 Mar | 191.0  | 181.5   | XF1  | K    | UNIT SHUTDOWN. THE GRID DISPATCHER'S LIMITATION WITH FOLLOWING OVERHAUL: MAINTENANCE COMBINED WITH REFUELLING. |
| 03 Apr | 1405.0 | 1343.9  | PF   | C    | UNIT SHUTDOWN. OVERHAUL: MAINTENANCE COMBINED WITH REFUELLING.   |
| 05 Jun | 1.0    | 0.8     | UF1  | A31  | UNIT SHUTDOWN. TEST OF TG CONTROL SYSTEM ELECTRIC PART   |
| 05 Jun | 9.0    | 10.5    | UF1  | A31  | TG-1 SWITCH OFF: REMOVING OF BEARING VIBRATION   |
| 05 Jun | 504.0  | 88.3    | XP   | J    | OPERATION AT REDUCED POWER. LIMITATION DUE TO POWER DISTRIBUTION CIRCUIT.                                      |
| 06 Jun | 52.0   | 40.4    | UF2  | A15  | UNIT SHUTDOWN. CHECK VALVE 1TX44SO4 DEFECT   |
| 13 Jun | 10.0   | 1.5     | UP2  | A15  | REDUCED POWER DUE TO REACTOR COOLANT PUMP -1,3 SWITCH OFF  |
| 18 Sep | 130.0  | 130.5   | PF   | D41  | UNIT SHUTDOWN. GENERATOR INSPECTION  |
| 24 Sep | 5.0    | 6.4     | PF   | D31  | UNIT SHUTDOWN.TG-1 SWITCH OFF. PREVENTIVE MAINTENANCE OF MOISTURE SEPARATOR                                    |
| 11 Oct | 19.0   | 20.0    | PF   | D31  | UNIT SHUTDOWN.TG-1 SWITCH OFF. TG CONTROL SYSTEM ELECTRIC PART   |
| 26 Nov | 658.0  | 167.3   | XP   | J    | OPERATION AT REDUCED POWER. LIMITATION DUE TO POWER DISTRIBUTION CIRCUIT.                                      |
| 18 Dec | 30.0   | 12.1    | UP1  | A32  | OPERATION AT REDUCED POWER. TURBINE DRIVEN FEED WATER PUMP SWITCH OFF  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 89        |          |  | 268       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 7         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1405            |           |          | 1619                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 154             |           |          | 260                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 21                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           | 191      |  | 1         |          |
| Subtotal   | 1559            | 89        | 191      | 1900                                     | 276       | 0        |
| Total  |                 | 1839      |          |  | 2176      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 33                                       |
| 13. Reactor Auxiliary Systems                  |                 | 15                                       |
| 14. Safety Systems                             |                 | 1  |
| 15. Reactor Cooling Systems                    | 52              | 27                                       |
| 16. Steam generation systems                   |                 | 1  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 4  |
| 31. Turbine and auxiliaries                    | 10              | 28                                       |
| 32. Feedwater and Main Steam System            |                 | 17                                       |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     | 27              | 131                                      |
| 42. Electrical Power Supply Systems            |                 | 7  |
| Total  | 89              | 264                                      |

# UA-27 ROVNO-1

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)  
**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 381.0 MW(e)  
**Design Net RUP:** 361.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 2876.6 GW(e).h  
**Energy Availability Factor:** 86.5%  
**Load Factor:** 86.0%  
**Operating Factor:** 90.1%  
**Energy Unavailability Factor:** 13.5%  
**Total Off-line Time:** 870 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 262.9 | 280.7 | 290.7 | 82.8 | 148.2 | 259.4 | 228.1 | 279.8 | 264.5 | 283.5 | 277.3 | 218.9 | 2876.6 |
| <b>EAF (%)</b>  | 87.1  | 99.1  | 97.4  | 28.9 | 51.1  | 95.4  | 95.0  | 95.2  | 95.2  | 98.1  | 99.3  | 96.6  | 86.5   |
| <b>UCF (%)</b>  | 87.1  | 99.1  | 97.5  | 28.9 | 51.7  | 98.5  | 99.7  | 99.5  | 97.4  | 99.4  | 99.4  | 96.6  | 87.9   |
| <b>LF (%)</b>   | 92.8  | 105.9 | 102.5 | 30.2 | 52.3  | 94.5  | 80.5  | 98.7  | 96.4  | 99.9  | 101.1 | 77.2  | 86.0   |
| <b>OF (%)</b>   | 95.0  | 100.0 | 99.9  | 30.0 | 55.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.1   |
| <b>EUF (%)</b>  | 12.9  | 0.9   | 2.6   | 71.1 | 48.9  | 4.6   | 5.0   | 4.8   | 4.8   | 1.9   | 0.7   | 3.4   | 13.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.3   | 70.1 | 46.4  | 0.0   | 0.0   | 0.0   | 2.0   | 0.0   | 0.0   | 2.4   | 10.1   |
| <b>UCLF (%)</b> | 12.9  | 0.9   | 2.2   | 1.0  | 2.0   | 1.6   | 0.3   | 0.5   | 0.6   | 0.6   | 0.6   | 1.0   | 2.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.0  | 0.6   | 3.0   | 4.7   | 4.3   | 2.1   | 1.3   | 0.1   | 0.0   | 1.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

AS RESULT OF 4 LOAD FOLLOWINGS PRODUCTION LOSSES AMOUNTED 118,3 MILLION KWH. ADDITIONAL ELECTRICITY GENERATION (2004.01.01 - 12.31) - 106,5 MILLION KWH.

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1973      **Lifetime Generation:** 62140.4 GW(e).h  
**Date of First Criticality:** 17 Dec 1980      **Cumulative Energy Availability Factor:** 80.4%  
**Date of Grid Connection:** 31 Dec 1980      **Cumulative Load Factor:** 81.0%  
**Date of Commercial Operation:** 21 Sep 1981      **Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 19.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 2686.3         | 361.0          | 82.5   | 65.3   | 82.5                              | 65.3   | 84.7               | 67.9   | 7782               | 88.6   |
| 1985 | 2664.8         | 365.0          | 81.4   | 69.4   | 81.4                              | 69.4   | 83.3               | 71.8   | 7636               | 87.2   |
| 1986 | 2712.7         | 361.0          | 77.5   | 71.0   | 77.5                              | 71.0   | 85.8               | 74.6   | 7606               | 86.8   |
| 1987 | 3040.8         | 402.0          | 86.6   | 73.9   | 86.6                              | 73.9   | 86.3               | 76.7   | 7756               | 88.5   |
| 1988 | 2718.0         | 361.0          | 86.0   | 75.6   | 86.0                              | 75.6   | 85.7               | 78.0   | 7877               | 89.7   |
| 1989 | 2823.8         | 361.0          | 89.2   | 77.2   | 89.2                              | 77.2   | 89.3               | 79.4   | 7994               | 91.3   |
| 1990 | 2590.6         | 361.0          | 79.3   | 77.5   | 79.3                              | 77.5   | 81.9               | 79.7   | 7265               | 82.9   |
| 1991 | 2640.1         | 361.0          | 81.4   | 77.8   | 81.4                              | 77.8   | 83.5               | 80.0   | 7430               | 84.8   |
| 1992 | 3082.9         | 403.0          | 88.5   | 78.9   | 87.3                              | 78.8   | 87.1               | 80.7   | 7989               | 90.9   |
| 1993 | 2584.4         | 406.0          | 83.0   | 79.3   | 81.4                              | 79.0   | 72.7               | 80.0   | 7159               | 81.7   |
| 1994 | 2578.6         | 361.0          | 81.8   | 79.5   | 81.7                              | 79.2   | 81.5               | 80.1   | 7378               | 84.2   |
| 1995 | 2747.4         | 361.0          | 88.4   | 80.1   | 86.1                              | 79.7   | 86.9               | 80.6   | 7756               | 88.5   |
| 1996 | 2432.0         | 361.0          | 79.0   | 80.0   | 76.7                              | 79.5   | 76.7               | 80.3   | 6960               | 79.2   |
| 1997 | 2701.1         | 361.0          | 82.2   | 80.1   | 81.6                              | 79.6   | 85.4               | 80.6   | 7867               | 89.8   |
| 1998 | 2612.9         | 361.0          | 78.1   | 80.0   | 77.8                              | 79.5   | 82.6               | 80.8   | 6912               | 78.9   |
| 1999 | 2240.5         | 361.0          | 82.8   | 80.2   | 82.8                              | 79.7   | 70.8               | 80.2   | 6214               | 70.9   |
| 2000 | 2733.7         | 361.0          | 85.7   | 80.5   | 82.6                              | 79.9   | 86.2               | 80.5   | 7580               | 86.3   |
| 2001 | 2753.8         | 381.0          | 82.6   | 80.6   | 81.4                              | 79.9   | 82.3               | 80.6   | 7369               | 83.9   |
| 2002 | 2656.2         | 381.0          | 81.0   | 80.6   | 79.9                              | 79.9   | 79.6               | 80.6   | 7242               | 82.7   |
| 2003 | 2816.1         | 381.0          | 84.5   | 80.8   | 83.5                              | 80.1   | 84.4               | 80.7   | 7560               | 86.3   |
| 2004 | 2876.6         | 381.0          | 87.9   | 81.1   | 86.5                              | 80.4   | 86.0               | 81.0   | 7914               | 90.1   |

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## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 04 Jan | 13.0  | 14.5    | UF4  | A42  | UNIT SHUTDOWN BY THE DIFFERENTIAL PROTECTION OF HOUSE LOADS TRANSFORMER TSN 11T DUE TO 3-PHASE SHORT CIRCUIT IN THE POWER OPERATION VOLTAGE CONTROLLER AND REACTOR TRIP. |
| 06 Jan | 109.0 | 20.0    | UP2  | A42  | HOUSE LOADS TRANSFORMER REPLACEMENT WITH TG-1.   |
| 12 Mar | 154.0 | 0.6     | UP2  | A32  | SHUTDOWN OF A GROUP OF HP HEATERS AT TG-1 FOR LEAKS ELIMINATION.   |
| 21 Mar | 480.0 | 1.7     | UP2  | A32  | SHUTDOWN OF A GROUP OF HP HEATERS AT TG-2 FOR LEAKS ELIMINATION.   |
| 21 Mar | 5.0   | 0.8     | PP   | D31  | TG-2 SHUTDOWN: ELIMINATION OF 32 MM PIPELINE BREAK OF THE SUCTION KS-2, STEAM REHEATER BYPASS.   |
| 11 Apr | 833.0 | 323.5   | PF   | C    | UNIT OUTAGE.   |
| 14 May | 809.0 | 7.4     | UP2  | A32  | ACTIVATION OF TG-2 HPH (TG-1 HPH IS UNDER REPAIR).   |
| 26 Jun | 653.0 | 52.6    | XP   | J    | DISPATCHER RESTRICTION. REPAIR OF ZU HIGH VOLTAGE TRANSMISSION LINE DUE TO DISCONNECTION OF ROVNO NPP_KHMELNITSKAYA NPP LINE   |
| 03 Sep | 32.0  | 5.6     | PP   | D31  | TG-2 DISCONNECTION TO IDENTIFY AND ELIMINATE LEAKS IN SEPARATOR REHEATER.  |
| 28 Nov | 704.0 | 61.8    | XP   | J    | DISPATCHER RESTRICTION DUE TO DISBALANCE OF NEL IN THE POWER GRID.   |
| 11 Dec | 23.0  | 3.6     | PP   | D31  | TG-1 ISOLATION TO ELIMINATE AIR INFLOW TO THE CONDENSERS.  |
| 12 Dec | 22.0  | 3.3     | PP   | D31  | TG-2 ISOLATION TO ELIMINATE INFLOW TO THE CONDENSERS.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|--|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure                                    |                 | 13        |          |  | 52        |          |
| C. Inspection, maintenance or repair combined with refuelling | 833             |           |          | 987                                      |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 143                                      | 1         |          |
| L. Human factor related                                       |                 |           |          |  | 0         |          |
| Subtotal  | 833             | 13        | 0        | 1130                                     | 53        | 0        |
| Total   | 846             |           |          | 1183                                     |           |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 3  |
| 12. Reactor I&C Systems             |                 | 6  |
| 13. Reactor Auxiliary Systems       |                 | 4  |
| 14. Safety Systems                  |                 | 0  |
| 15. Reactor Cooling Systems         |                 | 16                                       |
| 16. Steam generation systems        |                 | 9  |
| 32. Feedwater and Main Steam System |                 | 0  |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 3  |
| 42. Electrical Power Supply Systems | 13              | 6  |
| Total                               | 13              | 47                                       |

**UA-28 ROVNO-2****Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH, VOLGODONSK, RUSSIA)**1. Station Details**

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 376.0 MW(e)  
**Design Net RUP:** 384.0 MW(e)  
**Design Discharge Burnup:** 28600 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 2999.7 GW(e).h  
**Energy Availability Factor:** 88.4%  
**Load Factor:** 90.8%  
**Operating Factor:** 91.6%  
**Energy Unavailability Factor:** 11.6%  
**Total Off-line Time:** 737 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 295.6 | 276.0 | 290.6 | 254.4 | 282.4 | 226.1 | 34.2 | 257.0 | 275.7 | 285.4 | 274.7 | 247.6 | 2999.7 |
| <b>EAF (%)</b>  | 99.3  | 99.1  | 98.8  | 98.5  | 96.3  | 78.3  | 12.1 | 87.3  | 96.8  | 97.5  | 98.7  | 99.2  | 88.4   |
| <b>UCF (%)</b>  | 99.3  | 99.2  | 99.0  | 98.6  | 97.2  | 80.9  | 13.0 | 91.3  | 99.1  | 99.1  | 98.8  | 99.2  | 89.5   |
| <b>LF (%)</b>   | 105.7 | 105.5 | 104.0 | 94.0  | 100.9 | 83.5  | 12.2 | 91.9  | 101.8 | 101.9 | 101.5 | 88.5  | 90.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.3  | 25.1 | 91.9  | 100.0 | 100.0 | 100.0 | 100.0 | 91.6   |
| <b>EUF (%)</b>  | 0.7   | 0.9   | 1.2   | 1.5   | 3.7   | 21.7  | 87.9 | 12.7  | 3.2   | 2.5   | 1.3   | 0.8   | 11.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.9  | 86.5 | 8.0   | 0.0   | 0.0   | 0.4   | 0.0   | 9.4    |
| <b>UCLF (%)</b> | 0.7   | 0.8   | 1.0   | 1.4   | 2.8   | 2.3   | 0.5  | 0.7   | 0.9   | 0.9   | 0.8   | 0.8   | 1.1    |
| <b>XUF (%)</b>  | 0.0   | 0.1   | 0.2   | 0.1   | 0.9   | 2.5   | 0.9  | 4.0   | 2.3   | 1.5   | 0.1   | 0.0   | 1.1    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

ADDITIONAL ELECTRICITY GENERATION (2004.01.01 - 12.31) - 125,0 MILLION KWH.

**5. Historical Summary**

**Date of Construction Start:** 01 Oct 1973      **Lifetime Generation:** 61558.6 GW(e).h  
**Date of First Criticality:** 19 Dec 1981      **Cumulative Energy Availability Factor:** 80.2%  
**Date of Grid Connection:** 30 Dec 1981      **Cumulative Load Factor:** 79.8%  
**Date of Commercial Operation:** 30 Jul 1982      **Cumulative Unit Capability Factor:** 77.9%  
**Cumulative Energy Unavailability Factor:** 19.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1926.9         | 384.0          | 58.0   | 58.0   | 58.0                              | 58.0   | 57.3               | 57.3   | 5572               | 63.6   |
| 1984 | 2808.2         | 384.0          | 83.0   | 70.5   | 83.1                              | 70.5   | 83.3               | 70.3   | 7884               | 89.8   |
| 1985 | 2913.5         | 384.0          | 86.0   | 75.7   | 86.0                              | 75.7   | 86.6               | 75.7   | 7994               | 91.3   |
| 1986 | 2891.8         | 384.0          | 83.0   | 77.5   | 83.0                              | 77.5   | 86.0               | 78.3   | 7819               | 89.3   |
| 1987 | 3166.4         | 416.0          | 86.3   | 79.4   | 86.3                              | 79.4   | 86.9               | 80.1   | 7649               | 87.3   |
| 1988 | 2778.3         | 384.0          | 85.8   | 80.4   | 85.8                              | 80.4   | 82.4               | 80.5   | 7875               | 89.7   |
| 1989 | 2700.4         | 384.0          | 86.3   | 81.3   | 86.3                              | 81.3   | 80.3               | 80.5   | 7989               | 91.2   |
| 1990 | 2799.0         | 384.0          | 83.1   | 81.5   | 83.1                              | 81.5   | 83.2               | 80.8   | 7815               | 89.2   |
| 1991 | 2393.2         | 384.0          | 71.0   | 80.3   | 71.0                              | 80.3   | 71.1               | 79.7   | 6560               | 74.9   |
| 1992 | 2983.7         | 416.0          | 83.8   | 80.7   | 82.9                              | 80.6   | 81.7               | 79.9   | 7487               | 85.2   |
| 1993 | 2053.7         | 406.0          | 66.0   | 79.3   | 64.4                              | 79.1   | 57.7               | 77.9   | 5981               | 68.3   |
| 1994 | 2690.7         | 384.0          | 83.1   | 79.6   | 83.1                              | 79.4   | 80.0               | 78.0   | 7626               | 87.1   |
| 1995 | 2568.5         | 384.0          | 79.6   | 79.6   | 76.4                              | 79.2   | 76.4               | 77.9   | 7215               | 82.4   |
| 1996 | 2783.1         | 384.0          | 87.8   | 80.2   | 82.5                              | 79.4   | 82.5               | 78.2   | 7905               | 90.0   |
| 1997 | 2585.6         | 384.0          | 77.6   | 80.0   | 76.5                              | 79.2   | 76.9               | 78.1   | 6847               | 78.2   |
| 1998 | 2739.6         | 384.0          | 83.2   | 80.2   | 81.2                              | 79.3   | 81.4               | 78.3   | 7424               | 84.7   |
| 1999 | 2543.7         | 384.0          | 78.0   | 80.1   | 75.5                              | 79.1   | 75.6               | 78.2   | 6958               | 79.4   |
| 2000 | 2718.2         | 384.0          | 84.0   | 80.3   | 80.3                              | 79.2   | 80.6               | 78.3   | 7460               | 84.9   |
| 2001 | 2796.9         | 376.0          | 86.6   | 80.6   | 83.2                              | 79.4   | 84.7               | 78.6   | 7691               | 87.6   |
| 2002 | 2861.8         | 376.0          | 86.5   | 80.9   | 85.7                              | 79.7   | 86.9               | 79.0   | 7756               | 88.5   |
| 2003 | 2784.2         | 376.0          | 82.7   | 81.0   | 81.6                              | 79.8   | 84.5               | 79.3   | 7376               | 84.2   |
| 2004 | 2999.7         | 376.0          | 89.5   | 81.4   | 88.4                              | 80.2   | 90.8               | 79.8   | 8047               | 91.6   |



## UA-28 ROVNO-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 Apr | 19.0  | 3.6     | XP   | K    | LOAD FOLLOWING   |
| 07 Apr | 22.0  | 4.1     | XP   | K    | LOAD FOLLOWING (EXCESSIVE POWER GENERATION).   |
| 08 Apr | 131.0 | 13.0    | XP   | K    | LOAD FOLLOWING (EXCESSIVE POWER GENERATION).   |
| 27 Apr | 686.0 | 9.7     | UP2  | A32  | ISOLATION OF TG-3 HPH GROUP TO STOP LEAKAGES.  |
| 26 Jun | 677.0 | 305.4   | PF   | C    | SCHEDULED PREVENTIVE MAINTENANCE.  |
| 24 Jul | 330.0 | 1.8     | UP2  | A32  | TG-3 LOW PRE-HEATER MAINTENANCE (INCLUDING REPLACEMENT OF SPRINGS).  |
| 01 Aug | 47.0  | 17.8    | PF   | C    | COMPLETION OF TG-4 INTERMEDIATE REPAIR: REPLACEMENT OF ROTOR G-4, CAUSED BY THE SHAFT DEFECT, IDENTIFIED IN THE COURSE OF CUTTING A GROOVE IN THE SLIP-RINGS |
| 03 Aug | 13.0  | 4.7     | PF   | E42  | SHUT DOWN FOR TESTING 9AT DUE TO PREPARATION FOR UNIT 4 START UP.  |
| 23 Nov | 5.0   | 1.0     | PP   | D41  | TG-3 WAS TRIPPED BY PROTECTION G-3 FROM ASYNCHRONOUS RUNNING, DUE TO FAILURE OF AUTOMATIC UNIT CONTROLLING EXCITATION (ARV).                                 |
| 28 Nov | 704.0 | 40.8    | XP   | J    | DISPATCHER RESTRICTION DUE TO NEL DISBALANCE IN THE POWER GRID.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 161       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 724             |           |          | 901                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 146                                      |           |          |
| E. Testing of plant systems or components  | 13              |           |          | 47                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           |          |
| Subtotal   | 737             | 0         | 0        | 1094                                     | 162       | 0        |
| Total  |                 | 737       |          |  | 1256      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 20                                       |
| 13. Reactor Auxiliary Systems                  |                 | 2  |
| 15. Reactor Cooling Systems                    |                 | 6  |
| 16. Steam generation systems                   |                 | 101                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 0  |
| 32. Feedwater and Main Steam System            |                 | 17                                       |
| 41. Main Generator Systems                     |                 | 3  |
| 42. Electrical Power Supply Systems            |                 | 8  |
| Total  | 0               | 157                                      |

**UA-29 ROVNO-3****Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)**1. Station Details**

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 6693.3 GW(e).h  
**Energy Availability Factor:** 83.2%  
**Load Factor:** 80.2%  
**Operating Factor:** 83.3%  
**Energy Unavailability Factor:** 16.8%  
**Total Off-line Time:** 1463 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 710.1 | 662.9 | 521.2 | 625.5 | 697.6 | 668.0 | 669.7 | 679.2 | 568.8 | 0.0   | 225.7 | 664.6 | 6693.3 |
| <b>EAF (%)</b>  | 99.6  | 99.5  | 94.1  | 99.2  | 98.5  | 97.5  | 96.6  | 96.1  | 83.8  | 0.0   | 37.1  | 97.1  | 83.2   |
| <b>UCF (%)</b>  | 99.6  | 99.6  | 94.3  | 99.6  | 99.6  | 99.6  | 99.6  | 99.2  | 85.3  | 0.0   | 37.1  | 97.1  | 84.2   |
| <b>LF (%)</b>   | 100.5 | 100.3 | 73.7  | 91.6  | 98.7  | 97.7  | 94.8  | 96.1  | 83.2  | 0.0   | 33.0  | 94.0  | 80.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 77.7  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 86.7  | 0.0   | 39.0  | 97.6  | 83.3   |
| <b>EUF (%)</b>  | 0.4   | 0.5   | 5.9   | 0.8   | 1.5   | 2.5   | 3.4   | 3.9   | 16.2  | 100.0 | 62.9  | 2.9   | 16.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 5.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 14.5  | 100.0 | 61.1  | 0.0   | 15.2   |
| <b>UCLF (%)</b> | 0.4   | 0.4   | 0.4   | 0.4   | 0.4   | 0.4   | 0.4   | 0.3   | 0.2   | 0.0   | 1.7   | 2.9   | 0.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.1   | 0.4   | 1.1   | 2.1   | 2.9   | 3.1   | 1.6   | 0.0   | 0.0   | 0.0   | 1.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation**

DURING THE YEAR THE UNIT OPERATED IN THE BASE LOAD MODE. DURING 6 MONTHS THERE WAS 8 CASE OF LOAD FOLLOWING. UNDER PRODUCTION (NET) AMOUNTED 240,9 MILLION KWH. OPERATION AT REDUCED POWER. CONDENSER PROBLEM (2004.01.03 - 12.31). ENERGY LOSS (NET) - 27,27 MILLION KWH. ADDITIONAL ELECTRICITY GENERATION (2004.01.01 - 12.31) - 149,68 MILLION KWH.

**5. Historical Summary**

**Date of Construction Start:** 01 Feb 1980      **Lifetime Generation:** 104636.0 GW(e).h  
**Date of First Criticality:** 11 Nov 1986      **Cumulative Energy Availability Factor:** 70.8%  
**Date of Grid Connection:** 21 Dec 1986      **Cumulative Load Factor:** 70.0%  
**Date of Commercial Operation:** 16 May 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 29.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 5202.2         | 1000.0         | 0.0  | 0.0    | 87.5                              | 100.0  | 59.4               | 0.0    | 6485               | 74.0   |
| 1988 | 5661.3         | 950.0          | 71.0   | 71.0   | 71.1                              | 71.1   | 67.8               | 67.8   | 6357               | 72.4   |
| 1989 | 6046.1         | 950.0          | 75.1   | 73.1   | 75.1                              | 73.1   | 72.7               | 70.2   | 6771               | 77.3   |
| 1990 | 6360.1         | 950.0          | 77.3   | 74.5   | 77.3                              | 74.5   | 76.4               | 72.3   | 6981               | 79.7   |
| 1991 | 5454.8         | 950.0          | 66.0   | 72.4   | 66.0                              | 72.4   | 65.5               | 70.6   | 5971               | 68.2   |
| 1992 | 7084.9         | 1000.0         | 82.2   | 74.4   | 82.2                              | 74.4   | 80.7               | 72.7   | 7323               | 83.4   |
| 1993 | 6195.1         | 950.0          | 76.5   | 74.8   | 75.9                              | 74.7   | 74.4               | 73.0   | 6861               | 78.3   |
| 1994 | 5574.7         | 950.0          | 67.7   | 73.8   | 67.7                              | 73.7   | 67.0               | 72.1   | 6042               | 69.0   |
| 1995 | 5018.3         | 950.0          | 61.0   | 72.2   | 60.3                              | 72.0   | 60.3               | 70.7   | 5500               | 62.8   |
| 1996 | 5550.9         | 950.0          | 66.8   | 71.6   | 66.5                              | 71.4   | 66.5               | 70.2   | 6064               | 69.0   |
| 1997 | 6249.6         | 950.0          | 75.9   | 72.0   | 74.7                              | 71.7   | 75.1               | 70.7   | 6730               | 76.8   |
| 1998 | 5603.5         | 950.0          | 68.2   | 71.7   | 67.3                              | 71.3   | 67.3               | 70.4   | 6036               | 68.9   |
| 1999 | 5303.5         | 950.0          | 72.5   | 71.7   | 63.7                              | 70.7   | 63.7               | 69.8   | 6342               | 72.4   |
| 2000 | 4991.3         | 950.0          | 72.4   | 71.8   | 59.8                              | 69.9   | 59.8               | 69.1   | 5641               | 64.2   |
| 2001 | 5783.6         | 950.0          | 75.3   | 72.0   | 69.6                              | 69.8   | 69.3               | 69.1   | 6387               | 72.7   |
| 2002 | 5562.6         | 950.0          | 69.8   | 71.9   | 68.4                              | 69.7   | 66.8               | 68.9   | 6320               | 72.1   |
| 2003 | 6250.5         | 950.0          | 75.2   | 72.1   | 74.3                              | 70.0   | 75.1               | 69.3   | 6815               | 77.8   |
| 2004 | 6693.3         | 950.0          | 84.2   | 72.8   | 83.2                              | 70.8   | 80.2               | 70.0   | 7321               | 83.3   |

**UA-29 ROVNO-3****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 23 Mar | 112.0  | 116.8   | XF2  | J    | GRID FAILURE  |
| 28 Mar | 88.0   | 68.7    | XP   | K    | LOAD FOLLOWING (EXCESSIVE POWER GENERATION).  |
| 29 Mar | 53.0   | 37.3    | PF   | D41  | UNIT SHUTDOWN FOR ELIMINATION OF DEFECT OF KAG PHASE A.   |
| 27 Jun | 640.0  | 15.2    | XP   | J    | DISPATCHER RESTRICTION REPAIR OF WESTERN-UKRAINIAN HIGH VOLTAGE TRANSMISSION LINE DUE TO DISCONNECTION OF ROVNO-KHNP                    |
| 18 Sep | 20.0   | 6.2     | PP   | D32  | ELIMINATE LEAK IN THE VALVE JOINT ON THE DOWNSTREAM LINE OF FEED WATER PUMP WITH THE CONNECTION OF FWP TO RE-CIRCULATION LINE.          |
| 27 Sep | 1262.0 | 1210.2  | PF   | C    | PREVENTIVE MAINTENANCE  |
| 18 Nov | 125.0  | 2.0     | PP   | D32  | TERMINATION OF PREVENTIVE MAINTENANCE WITH NO HIGH PRESSURE HEATER OF GROUP B AVAILABLE: FLUSHING OF STEAM SECTION.                     |
| 19 Nov | 46.0   | 19.7    | XP   | J    | DISPATCHER RESTRICTION DUE TO DISCONNECTION OF WESTERN-UKRAINIAN HIGH VOLTAGE TRANSMISSION LINE -750V.                                  |
| 19 Nov | 9.0    | 6.4     | PP   | D32  | UNIT SHUT DOWN TO ELIMINATE STEAM LEAK IN THE FLANGE JOINT OF LOW PRESSURE TURBINE-4 STEAM SUPPLY LINE.                                 |
| 30 Nov | 27.0   | 28.4    | UF2  | A42  | FAILURE OF NPP EQUIPMENT WHICH CAUSED DISCONNECTION OF HIGH VOLTAGE TRANSMISSION LINE -750EV AND DISCONNECTION OF UNIT 3 FROM THE GRID. |
| 01 Dec | 31.0   | 15.5    | XP   | J    | DISPATCHER RESTRICTION AT UNIT 3 DUE TO DISBALANCE OF NEL IN THE GRID.  |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 27        |          |  | 290       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1262            |           |          | 1642                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 53              |           |          | 123                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 31                                       |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 10       |
| J. Grid failure or grid unavailability   |                 |           | 112      |  |           | 15       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         | 41       |
| Subtotal   | 1315            | 27        | 112      | 1796                                     | 303       | 66       |
| Total  |                 | 1454      |          |  | 2165      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 32                                       |
| 13. Reactor Auxiliary Systems                  |                 | 16                                       |
| 15. Reactor Cooling Systems                    |                 | 1  |
| 16. Steam generation systems                   |                 | 35                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 31. Turbine and auxiliaries                    |                 | 33                                       |
| 32. Feedwater and Main Steam System            |                 | 4  |
| 33. Circulating Water System                   |                 | 2  |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     |                 | 119                                      |
| 42. Electrical Power Supply Systems            | 27              | 40                                       |
| Total  | 27              | 285                                      |

# UA-44 SOUTH UKRAINE-1

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)  
**Contractor:** PAA (PRODUCTION AMALGAMATION 'ATOMMASH', VOLGODONSK)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6988.9 GW(e).h  
**Energy Availability Factor:** 84.0%  
**Load Factor:** 83.8%  
**Operating Factor:** 86.4%  
**Energy Unavailability Factor:** 16.0%  
**Total Off-line Time:** 1192 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 673.7 | 672.4 | 701.7 | 627.1 | 695.3 | 541.6 | 627.6 | 666.3 | 554.0 | 0.0   | 530.9 | 698.2 | 6988.9 |
| <b>EAF (%)</b>  | 92.9  | 99.6  | 98.1  | 98.5  | 98.1  | 79.2  | 88.8  | 99.1  | 81.0  | 0.0   | 76.2  | 97.1  | 84.0   |
| <b>UCF (%)</b>  | 92.9  | 99.6  | 98.1  | 98.5  | 98.1  | 82.2  | 97.5  | 99.1  | 82.2  | 0.0   | 76.3  | 97.1  | 85.0   |
| <b>LF (%)</b>   | 95.3  | 101.7 | 99.3  | 91.8  | 98.4  | 79.2  | 88.8  | 94.3  | 81.0  | 0.0   | 77.6  | 98.8  | 83.8   |
| <b>OF (%)</b>   | 94.9  | 100.0 | 99.9  | 100.1 | 100.0 | 83.9  | 100.0 | 100.0 | 83.8  | 0.0   | 77.5  | 98.1  | 86.4   |
| <b>EUF (%)</b>  | 7.1   | 0.4   | 1.9   | 1.5   | 1.9   | 20.8  | 11.2  | 0.9   | 19.0  | 100.0 | 23.8  | 2.9   | 16.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.2  | 0.0   | 0.0   | 16.5  | 100.0 | 23.3  | 0.0   | 13.1   |
| <b>UCLF (%)</b> | 7.1   | 0.4   | 1.9   | 1.5   | 1.9   | 1.5   | 2.5   | 0.9   | 1.3   | 0.0   | 0.4   | 2.9   | 1.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.1   | 8.7   | 0.0   | 1.2   | 0.0   | 0.0   | 0.0   | 1.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. BUT THERE WERE ENERGY LOSSES DUE TO EXTERNAL CAUSES: HIGH TEMPERATURE OF COOLING WATER = 313 GW(E)H. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: SWITCHGEARS REPLACEMENT IN THE THREE-PHASE M-DOOR SWITCHGEAR WITH ONE-SIDE ACCESS; INSTRUMENTATION SENSORS REPLACEMENT; PENETRATIONS REPLACEMENT.

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1977      **Lifetime Generation:** 117664.9 GW(e).h  
**Date of First Criticality:** 09 Dec 1982      **Cumulative Energy Availability Factor:** 65.3%  
**Date of Grid Connection:** 31 Dec 1982      **Cumulative Load Factor:** 65.7%  
**Date of Commercial Operation:** 18 Oct 1983      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 34.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 6385.9         | 1000.0         | 75.6   | 75.7   | 75.6                              | 75.5   | 72.9               | 75.8   | 6642               | 75.8   |
| 1988 | 5467.5         | 950.0          | 65.9   | 73.7   | 65.9                              | 73.6   | 65.5               | 73.7   | 6177               | 70.3   |
| 1989 | 2501.6         | 950.0          | 30.9   | 66.7   | 30.8                              | 66.5   | 30.1               | 66.5   | 3321               | 37.9   |
| 1990 | 6174.4         | 950.0          | 75.3   | 67.9   | 75.0                              | 67.7   | 74.2               | 67.6   | 7063               | 80.6   |
| 1991 | 3865.9         | 950.0          | 46.5   | 65.2   | 46.5                              | 65.1   | 46.4               | 65.0   | 5532               | 63.1   |
| 1992 | 4946.8         | 1000.0         | 49.2   | 63.6   | 49.1                              | 64.2   | 67.6               | 64.0   | 6142               | 69.9   |
| 1993 | 5277.8         | 950.0          | 62.3   | 63.5   | 61.4                              | 63.9   | 63.4               | 63.9   | 5650               | 64.5   |
| 1994 | 5117.4         | 950.0          | 58.7   | 63.1   | 58.7                              | 63.5   | 61.5               | 63.7   | 5667               | 64.7   |
| 1995 | 5438.6         | 950.0          | 66.1   | 63.3   | 65.4                              | 63.6   | 65.4               | 63.8   | 6212               | 70.9   |
| 1996 | 5138.2         | 950.0          | 62.1   | 63.2   | 61.6                              | 63.5   | 61.6               | 63.7   | 5549               | 63.2   |
| 1997 | 6196.1         | 950.0          | 73.0   | 63.9   | 72.5                              | 64.1   | 74.5               | 64.4   | 6416               | 73.2   |
| 1998 | 6164.9         | 950.0          | 73.7   | 64.6   | 73.1                              | 64.7   | 74.1               | 65.1   | 6477               | 73.9   |
| 1999 | 5558.9         | 950.0          | 67.1   | 64.7   | 66.5                              | 64.8   | 66.8               | 65.2   | 5920               | 67.6   |
| 2000 | 5203.0         | 950.0          | 63.9   | 64.7   | 61.2                              | 64.6   | 62.4               | 65.0   | 5677               | 64.6   |
| 2001 | 5563.7         | 950.0          | 68.3   | 64.9   | 66.6                              | 64.7   | 66.7               | 65.1   | 6015               | 68.5   |
| 2002 | 4254.8         | 950.0          | 52.2   | 64.2   | 50.9                              | 64.0   | 51.1               | 64.4   | 4625               | 52.8   |
| 2003 | 6008.2         | 950.0          | 74.2   | 64.7   | 72.6                              | 64.4   | 72.2               | 64.8   | 6612               | 75.5   |
| 2004 | 6988.9         | 950.0          | 85.0   | 65.7   | 84.0                              | 65.3   | 83.8               | 65.7   | 7592               | 86.4   |

# UA-44 SOUTH UKRAINE-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 38.3   | 46.1    | UF3  | Z    | UNIT SHUTDOWN. EXTENSION OF PLANNED OUTAGE   |
| 02 Jan | 7591.0 | 42.5    | UP1  | A31  | OPERATION AT REDUCED POWER. CONDENSER PROBLEM  |
| 22 Mar | 39.0   | 3.5     | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST   |
| 25 Mar | 22.0   | 8.2     | UP1  | A32  | OPERATION AT REDUCED POWER. TURBINE DRIVER FEEDWATER PUMP-B REPAIR   |
| 02 Apr | 401.0  | 52.9    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST   |
| 26 Jun | 115.0  | 110.9   | PF   | D16  | UNIT SHUTDOWN. PREVENTIVE MAINTENANCE. TESTING OF WEDDING JOINTS FOR SG-1,2,3,4                                |
| 02 Jul | 73.0   | 11.8    | UP1  | A32  | OPERATION AT REDUCED POWER. TURBINE DRIVER FEEDWATER PUMP-A SWITCH OFF   |
| 26 Sep | 1025.0 | 980.0   | PF   | C    | UNIT SHUTDOWN. INTERMEDIATE OUTAGE: MAINTENANCE COMBINED WITH REFUELLING.                                      |
| 08 Dec | 14.0   | 19.0    | UF4  | A31  | UNIT SHUTDOWN. FALSE ACTUATION OF TG TECHNOLOGICAL PROTECTION LEVEL INCREASING IN CONDENSER WITH FURTHER SCRAM |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 14        |          |  | 450       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1025            |           |          | 1386                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 115             |           |          | 360                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 11                                       | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 40        | 0        |
| Z. Others  |                 | 38        |          |  |           |          |
| Subtotal   | 1140            | 52        | 0        | 1757                                     | 493       | 0        |
| Total  |                 | 1192      |          |  | 2250      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1980 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 13                                       |
| 14. Safety Systems                  |                 | 1  |
| 15. Reactor Cooling Systems         |                 | 6  |
| 16. Steam generation systems        |                 | 223                                      |
| 31. Turbine and auxiliaries         | 14              | 61                                       |
| 32. Feedwater and Main Steam System |                 | 11                                       |
| 33. Circulating Water System        |                 | 1  |
| 35. All other I&C Systems           |                 | 1  |
| 41. Main Generator Systems          |                 | 126                                      |
| 42. Electrical Power Supply Systems |                 | 2  |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 14              | 446                                      |

## UA-45 SOUTH UKRAINE-2

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)

**Contractor:** PAA (PRODUCTION AMALGAMATION 'ATOMMASH', VOLGODONSK)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6899.7 GW(e).h  
**Energy Availability Factor:** 82.2%  
**Load Factor:** 82.7%  
**Operating Factor:** 87.1%  
**Energy Unavailability Factor:** 17.8%  
**Total Off-line Time:** 1137 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 698.1 | 664.1 | 687.7 | 676.8 | 177.1 | 121.9 | 652.8 | 621.8 | 540.6 | 682.6 | 658.5 | 717.7 | 6899.7 |
| <b>EAF (%)</b>  | 98.5  | 98.7  | 96.5  | 98.2  | 25.1  | 17.8  | 92.4  | 88.0  | 79.0  | 96.5  | 96.3  | 99.7  | 82.2   |
| <b>UCF (%)</b>  | 98.5  | 98.7  | 96.5  | 98.2  | 25.2  | 21.1  | 99.6  | 100.0 | 99.6  | 97.0  | 99.5  | 99.7  | 86.1   |
| <b>LF (%)</b>   | 98.8  | 100.4 | 97.3  | 99.1  | 25.1  | 17.8  | 92.4  | 88.0  | 79.0  | 96.5  | 96.3  | 101.5 | 82.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 98.8  | 100.1 | 26.1  | 22.1  | 100.0 | 100.0 | 100.0 | 97.6  | 100.0 | 100.0 | 87.1   |
| <b>EUF (%)</b>  | 1.5   | 1.3   | 3.5   | 1.8   | 74.9  | 82.2  | 7.6   | 12.0  | 21.0  | 3.5   | 3.7   | 0.3   | 17.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 74.2  | 78.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.7   |
| <b>UCLF (%)</b> | 1.5   | 1.3   | 3.5   | 1.8   | 0.6   | 0.5   | 0.4   | 0.0   | 0.4   | 3.0   | 0.5   | 0.3   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 3.3   | 7.2   | 12.0  | 20.6  | 0.5   | 3.2   | 0.0   | 3.9    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: SWITCHGEARS REPLACEMENT IN THE THREE-PHASE M-DOOR SWITCHGEAR WITH ONE-SIDE ACCESS; INSTRUMENTATION SENSORS REPLACEMENT; PENETRATIONS REPLACEMENT; REFUELLING MASHINE MP-1000 MAST REPLACEMENT.

### 5. Historical Summary

**Date of Construction Start:** 01 Oct 1979      **Lifetime Generation:** 100856.8 GW(e).h  
**Date of First Criticality:** 30 Dec 1984      **Cumulative Energy Availability Factor:** 59.6%  
**Date of Grid Connection:** 06 Jan 1985      **Cumulative Load Factor:** 59.9%  
**Date of Commercial Operation:** 06 Apr 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 40.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 5565.5         | 950.0          | 67.0   | 67.0   | 66.2                              | 66.2   | 66.9               | 66.9   | 6315               | 72.1   |
| 1987 | 1641.7         | 1000.0         | 22.0   | 43.9   | 22.0                              | 43.6   | 18.7               | 42.2   | 1941               | 22.2   |
| 1988 | 4850.6         | 950.0          | 57.4   | 48.4   | 57.4                              | 48.1   | 58.1               | 47.4   | 5198               | 59.2   |
| 1989 | 4437.3         | 950.0          | 54.3   | 49.8   | 54.3                              | 49.6   | 53.3               | 48.9   | 6674               | 76.2   |
| 1990 | 1769.0         | 950.0          | 21.9   | 44.3   | 21.9                              | 44.1   | 21.3               | 43.4   | 4522               | 51.6   |
| 1991 | 6209.8         | 950.0          | 72.0   | 48.9   | 72.0                              | 48.7   | 74.6               | 48.6   | 6722               | 76.7   |
| 1992 | 6412.1         | 1000.0         | 72.9   | 52.4   | 71.7                              | 52.1   | 73.0               | 52.2   | 6574               | 74.8   |
| 1993 | 5204.0         | 950.0          | 64.0   | 53.9   | 61.7                              | 53.3   | 62.5               | 53.5   | 6570               | 75.0   |
| 1994 | 3958.5         | 950.0          | 47.3   | 53.1   | 46.9                              | 52.6   | 47.6               | 52.8   | 6471               | 73.9   |
| 1995 | 5429.4         | 950.0          | 66.1   | 54.4   | 65.2                              | 53.9   | 65.2               | 54.0   | 6514               | 74.4   |
| 1996 | 4593.7         | 950.0          | 55.4   | 54.5   | 55.0                              | 54.0   | 55.0               | 54.1   | 5590               | 63.6   |
| 1997 | 6326.5         | 950.0          | 77.2   | 56.4   | 75.4                              | 55.7   | 76.0               | 55.9   | 7400               | 84.5   |
| 1998 | 4542.4         | 950.0          | 55.1   | 56.3   | 54.0                              | 55.6   | 54.6               | 55.8   | 4867               | 55.6   |
| 1999 | 5537.9         | 950.0          | 72.0   | 57.4   | 66.4                              | 56.4   | 66.5               | 56.6   | 6372               | 72.7   |
| 2000 | 4103.5         | 950.0          | 50.0   | 56.9   | 49.2                              | 55.9   | 49.2               | 56.1   | 4486               | 51.1   |
| 2001 | 6206.5         | 950.0          | 74.8   | 58.0   | 74.4                              | 57.0   | 74.4               | 57.2   | 6869               | 78.2   |
| 2002 | 6057.2         | 950.0          | 74.2   | 59.0   | 72.7                              | 58.0   | 72.8               | 58.2   | 6565               | 74.9   |
| 2003 | 5507.7         | 950.0          | 66.2   | 59.4   | 65.8                              | 58.4   | 66.2               | 58.6   | 5868               | 67.0   |
| 2004 | 6899.7         | 950.0          | 86.1   | 60.8   | 82.2                              | 59.6   | 82.7               | 59.9   | 7647               | 87.1   |

## UA-45 SOUTH UKRAINE-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 7647.0 | 459.6   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS   |
| 01 Jan | 7647.0 | 19.6    | UP1  | A31  | OPERATION AT REDUCED POWER. CONDENSER PROBLEM  |
| 12 Jan | 13.0   | 4.0     | UP2  | A32  | OPERATION AT REDUCED POWER DUE TO CONDENSATE PUMP SWITCH OFF.  |
| 13 Mar | 8.0    | 14.3    | UF2  | L    | TG-2 DISCONNECTION FROM THE GRID.  |
| 20 Mar | 59.0   | 5.4     | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST   |
| 09 May | 1111.0 | 1060.3  | PF   | C    | UNIT SHUTDOWN. INTERMEDIATE OUTAGE: MAINTENANCE COMBINED WITH REFUELLING.                                      |
| 16 Sep | 76.0   | 12.9    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST   |
| 13 Oct | 18.0   | 19.6    | UF4  | A31  | UNIT SHUTDOWN. FALSE ACTUATION OF TG TECHNOLOGICAL PROTECTION LEVEL INCREASING IN CONDENSER WITH FURTHER SCRAM |
| 16 Nov | 125.0  | 23.9    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 18        |          |  | 591       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1111            |           |          | 1344                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 535                                      | 5         |          |
| E. Testing of plant systems or components  |                 |           |          | 14                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 77        |          |
| L. Human factor related  |                 | 8         |          |  |           |          |
| Subtotal   | 1111            | 26        | 0        | 1893                                     | 674       | 5        |
| Total  |                 | 1137      |          |  | 2572      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 11                                       |
| 15. Reactor Cooling Systems                    |                 | 22                                       |
| 16. Steam generation systems                   |                 | 476                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 13                                       |
| 31. Turbine and auxiliaries                    | 18              | 20                                       |
| 32. Feedwater and Main Steam System            |                 | 43                                       |
| 41. Main Generator Systems                     |                 | 2  |
| 42. Electrical Power Supply Systems            |                 | 0  |
| Total  | 18              | 587                                      |

## UA-48 SOUTH UKRAINE-3

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)

**Contractor:** PAA (PRODUCTION AMALGAMATION 'ATOMMASH', VOLGODONSK)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6625.1 GW(e).h  
**Energy Availability Factor:** 79.9%  
**Load Factor:** 79.4%  
**Operating Factor:** 82.5%  
**Energy Unavailability Factor:** 20.1%  
**Total Off-line Time:** 1538 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 472.3 | 663.9 | 675.9 | 662.4 | 687.7 | 668.7 | 109.3 | 30.8 | 551.3 | 707.7 | 680.4 | 714.8 | 6625.1 |
| <b>EAF (%)</b>  | 65.9  | 99.7  | 100.0 | 99.4  | 97.3  | 97.8  | 15.5  | 4.4  | 82.9  | 99.8  | 99.9  | 100.0 | 79.9   |
| <b>UCF (%)</b>  | 65.9  | 99.7  | 100.0 | 100.0 | 98.2  | 99.2  | 15.9  | 9.6  | 99.4  | 99.8  | 99.9  | 100.0 | 82.0   |
| <b>LF (%)</b>   | 66.8  | 100.4 | 95.6  | 97.0  | 97.3  | 97.8  | 15.5  | 4.4  | 80.6  | 100.0 | 99.5  | 101.1 | 79.4   |
| <b>OF (%)</b>   | 66.5  | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 16.4  | 10.3 | 100.0 | 100.0 | 100.0 | 100.0 | 82.5   |
| <b>EUF (%)</b>  | 34.1  | 0.3   | 0.0   | 0.6   | 2.7   | 2.2   | 84.5  | 95.6 | 17.1  | 0.2   | 0.1   | 0.0   | 20.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 83.7  | 90.3 | 0.0   | 0.0   | 0.0   | 0.0   | 14.7   |
| <b>UCLF (%)</b> | 34.1  | 0.3   | 0.0   | 0.0   | 1.8   | 0.8   | 0.4   | 0.1  | 0.6   | 0.2   | 0.1   | 0.0   | 3.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.6   | 0.9   | 1.4   | 0.4   | 5.3  | 16.5  | 0.0   | 0.0   | 0.0   | 2.1    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: SWITCHGEARS REPLACEMENT IN THE THREE-PHASE M-DOOR SWITCHGEAR WITH ONE-SIDE ACCESS; INSTRUMENTATION SENSORS REPLACEMENT; PENETRATIONS REPLACEMENT; REPLACEMENT OF BATTERY OF UNINTERRUPTIBLE POWER SUPPLY UNIT; REPLACEMENT OF THE NEUTRON FLUX MONITORING SYSTEM EQUIPMENT.

### 5. Historical Summary

**Date of Construction Start:** 01 Feb 1985      **Lifetime Generation:** 90803.3 GW(e).h  
**Date of First Criticality:** 01 Sep 1989      **Cumulative Energy Availability Factor:** 71.5%  
**Date of Grid Connection:** 20 Sep 1989      **Cumulative Load Factor:** 71.4%  
**Date of Commercial Operation:** 29 Dec 1989      **Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 28.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 1299.7         | 950.0          | 0.0  | 0.0    | 15.6                              | 100.0  | 15.6               | 0.0    | 1992               | 22.7   |
| 1990 | 5691.6         | 950.0          | 69.4   | 69.4   | 69.4                              | 69.4   | 68.4               | 68.4   | 6408               | 73.2   |
| 1991 | 5762.8         | 950.0          | 70.4   | 69.9   | 70.0                              | 69.7   | 69.2               | 68.8   | 6996               | 79.9   |
| 1992 | 6458.1         | 1000.0         | 75.3   | 71.7   | 75.2                              | 71.6   | 73.5               | 70.4   | 6646               | 75.7   |
| 1993 | 6043.4         | 950.0          | 72.8   | 72.0   | 71.7                              | 71.6   | 72.6               | 71.0   | 6527               | 74.5   |
| 1994 | 5565.0         | 950.0          | 66.5   | 70.9   | 66.4                              | 70.6   | 66.9               | 70.2   | 6223               | 71.0   |
| 1995 | 4954.8         | 950.0          | 60.2   | 69.1   | 59.5                              | 68.8   | 59.5               | 68.4   | 6300               | 71.9   |
| 1996 | 6155.0         | 950.0          | 76.4   | 70.2   | 73.8                              | 69.5   | 73.8               | 69.2   | 7463               | 85.0   |
| 1997 | 6514.8         | 950.0          | 79.8   | 71.3   | 77.7                              | 70.5   | 78.3               | 70.3   | 7079               | 80.8   |
| 1998 | 5851.0         | 950.0          | 71.0   | 71.3   | 69.9                              | 70.4   | 70.3               | 70.3   | 6396               | 73.0   |
| 1999 | 5464.3         | 950.0          | 67.2   | 70.9   | 65.5                              | 69.9   | 65.7               | 69.8   | 6244               | 71.3   |
| 2000 | 5909.7         | 950.0          | 73.3   | 71.1   | 70.6                              | 70.0   | 70.8               | 69.9   | 6588               | 75.0   |
| 2001 | 6136.3         | 950.0          | 76.3   | 71.5   | 73.7                              | 70.3   | 73.5               | 70.2   | 6985               | 79.5   |
| 2002 | 6335.2         | 950.0          | 77.5   | 72.0   | 76.0                              | 70.7   | 76.1               | 70.7   | 7043               | 80.4   |
| 2003 | 6036.5         | 950.0          | 74.3   | 72.2   | 73.1                              | 70.9   | 72.5               | 70.8   | 6680               | 76.3   |
| 2004 | 6625.1         | 950.0          | 82.0   | 72.8   | 79.9                              | 71.5   | 79.4               | 71.4   | 7246               | 82.5   |



## UA-48 SOUTH UKRAINE-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 249.0  | 240.7   | UF2  | A31  | UNIT SHUTDOWN. ACTUATION OF TG TRANSVERSE DIFFERENTIAL PROTECTION         |
| 11 Jan | 7246.0 | 254.9   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS              |
| 20 Mar | 118.0  | 11.1    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 28 Mar | 94.0   | 21.2    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 01 Apr | 46.0   | 8.8     | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 14 Apr | 116.0  | 87.8    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 11 May | 37.0   | 12.9    | UP1  | A32  | OPERATION AT REDUCED POWER. TURBINE DRIVER FEEDWATER PUMP-B REPAIR        |
| 06 Jul | 1185.0 | 1130.1  | PF   | C    | UNIT SHUTDOWN. INTERMEDIATE OUTAGE: MAINTENANCE COMBINED WITH REFUELLING. |
| 27 Aug | 104.0  | 100.0   | PF   | D16  | UNIT SHUTDOWN. PREVENTIVE MAINTENANCE. REMOVING OF SG TUBE LEAKAGE        |
| 07 Sep | 91.0   | 9.5     | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 16 Sep | 65.0   | 6.1     | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 16 Nov | 125.0  | 5.6     | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1990 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 | 249       |          |   | 144       |          |
| B. Refuelling without a maintenance                           |                 |           |          |   | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling | 1185            |           |          | 1513  |           |          |
| D. Inspection, maintenance or repair without refuelling       | 104             |           |          | 250   |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 26  |           |          |
| Subtotal  | 1289            | 249       | 0        | 1789  | 144       | 0        |
| Total   |                 | 1538      |          |   | 1933      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1990 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 5   |
| 12. Reactor I&C Systems                        |                    | 5   |
| 13. Reactor Auxiliary Systems                  |                    | 1   |
| 15. Reactor Cooling Systems                    |                    | 3   |
| 16. Steam generation systems                   |                    | 5   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 4   |
| 31. Turbine and auxiliaries                    | 249                | 15  |
| 32. Feedwater and Main Steam System            |                    | 1   |
| 33. Circulating Water System                   |                    | 0   |
| 35. All other I&C Systems                      |                    | 1   |
| 41. Main Generator Systems                     |                    | 95  |
| 42. Electrical Power Supply Systems            |                    | 2   |
| Total  | 249                | 137   |

# UA-54 ZAPOROZHE-1

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)  
**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6748.3 GW(e).h  
**Energy Availability Factor:** 80.6%  
**Load Factor:** 80.9%  
**Operating Factor:** 83.0%  
**Energy Unavailability Factor:** 19.4%  
**Total Off-line Time:** 1494 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 697.3 | 661.6 | 710.3 | 225.3 | 0.0   | 389.2 | 685.3 | 691.0 | 680.2 | 715.4 | 614.1 | 678.5 | 6748.3 |
| <b>EAF (%)</b>  | 97.8  | 99.8  | 99.9  | 32.8  | 0.0   | 56.9  | 97.0  | 97.8  | 99.5  | 99.8  | 89.8  | 96.0  | 80.6   |
| <b>UCF (%)</b>  | 97.8  | 99.8  | 99.9  | 32.8  | 0.0   | 63.5  | 99.5  | 99.4  | 99.8  | 99.8  | 99.7  | 99.6  | 82.6   |
| <b>LF (%)</b>   | 98.7  | 100.1 | 100.5 | 33.0  | 0.0   | 56.9  | 97.0  | 97.8  | 99.5  | 101.1 | 89.8  | 96.0  | 80.9   |
| <b>OF (%)</b>   | 98.0  | 100.0 | 99.9  | 33.4  | 0.0   | 64.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0   |
| <b>EUF (%)</b>  | 2.2   | 0.2   | 0.1   | 67.2  | 100.0 | 43.1  | 3.0   | 2.2   | 0.5   | 0.2   | 10.2  | 4.0   | 19.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 67.1  | 100.0 | 36.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.9   |
| <b>UCLF (%)</b> | 2.2   | 0.2   | 0.1   | 0.0   | 0.0   | 0.2   | 0.5   | 0.6   | 0.3   | 0.2   | 0.3   | 0.4   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.6   | 2.6   | 1.6   | 0.3   | 0.0   | 9.9   | 3.6   | 2.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: CHECK VALVES TX60,70S07 REPLACEMENT ON STEAM PIPES; RECONSTRUCTION OF SG-1,4 BLOWDOWN SYSTEM IN REACTOR CONTAINMENT; USING COATING FOR TUBING TO PREVENT CORROSION.

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1980      **Lifetime Generation:** 98440.5 GW(e).h  
**Date of First Criticality:** 07 Dec 1984      **Cumulative Energy Availability Factor:** 59.8%  
**Date of Grid Connection:** 10 Dec 1984      **Cumulative Load Factor:** 59.5%  
**Date of Commercial Operation:** 25 Dec 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 40.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 4826.3         | 950.0          | 61.5   | 61.5   | 58.3                              | 58.3   | 58.0               | 58.0   | 5580               | 63.7   |
| 1987 | 6720.9         | 1000.0         | 80.8   | 71.4   | 80.8                              | 69.8   | 76.7               | 67.6   | 7205               | 82.2   |
| 1988 | 5170.4         | 950.0          | 67.4   | 70.1   | 67.2                              | 69.0   | 62.0               | 65.7   | 6225               | 70.9   |
| 1989 | 0.0            | 950.0          | 0.0  | 52.8   | 0.0                               | 52.0   | 0.0                | 49.5   | 0                  | 0.0    |
| 1990 | 4668.7         | 950.0          | 58.8   | 54.0   | 56.4                              | 52.8   | 56.1               | 50.8   | 5684               | 64.9   |
| 1991 | 5332.2         | 950.0          | 68.5   | 56.4   | 64.2                              | 54.7   | 64.1               | 53.0   | 6343               | 72.4   |
| 1992 | 6103.5         | 950.0          | 70.3   | 58.4   | 67.8                              | 56.6   | 73.1               | 55.9   | 6739               | 76.7   |
| 1993 | 4209.7         | 950.0          | 53.5   | 57.8   | 52.1                              | 56.0   | 50.6               | 55.2   | 6591               | 75.2   |
| 1994 | 3771.0         | 950.0          | 45.5   | 56.4   | 45.5                              | 54.9   | 45.3               | 54.1   | 5062               | 57.8   |
| 1995 | 3557.3         | 950.0          | 44.9   | 55.3   | 42.7                              | 53.7   | 42.7               | 53.0   | 4213               | 48.1   |
| 1996 | 4299.5         | 950.0          | 53.5   | 55.1   | 51.5                              | 53.5   | 51.5               | 52.9   | 5224               | 59.5   |
| 1997 | 4070.6         | 950.0          | 53.9   | 55.0   | 48.9                              | 53.1   | 48.9               | 52.5   | 5531               | 63.1   |
| 1998 | 5517.5         | 950.0          | 68.7   | 56.0   | 66.3                              | 54.1   | 66.3               | 53.6   | 6122               | 69.9   |
| 1999 | 5992.5         | 950.0          | 84.0   | 58.0   | 72.0                              | 55.4   | 72.0               | 54.9   | 7422               | 84.7   |
| 2000 | 4222.7         | 950.0          | 52.0   | 57.6   | 50.3                              | 55.0   | 50.6               | 54.6   | 4589               | 52.2   |
| 2001 | 5847.1         | 950.0          | 71.8   | 58.5   | 69.9                              | 56.0   | 70.1               | 55.6   | 6434               | 73.2   |
| 2002 | 6735.0         | 950.0          | 83.2   | 60.0   | 80.6                              | 57.4   | 80.9               | 57.1   | 7334               | 83.7   |
| 2003 | 6596.4         | 950.0          | 81.8   | 61.2   | 79.0                              | 58.6   | 79.3               | 58.3   | 7223               | 82.5   |
| 2004 | 6748.3         | 950.0          | 82.6   | 62.3   | 80.6                              | 59.8   | 80.9               | 59.5   | 7290               | 83.0   |

**UA-54 ZAPOROZHE-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 7290.0 | 151.8   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS              |
| 07 Jan | 15.0   | 15.3    | UF2  | A41  | UNIT SHUTDOWN. GENERATOR SHUTDOWN   |
| 01 Feb | 19.0   | 3.1     | XP   | J    | OPERATION AT REDUCED POWER. GRID UNAVAILABILITY: TRANSMISSION LINE REPAIR |
| 11 Apr | 1479.0 | 1413.9  | PF   | C    | UNIT SHUTDOWN.OVERHAUL: MAINTENANCE COMBINED WITH REFUELLING.             |
| 11 Jun | 96.0   | 27.9    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 16 Nov | 122.0  | 57.5    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 25 Nov | 124.0  | 18.4    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 01 Dec | 250.0  | 34.2    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 15        |          | 394   | 366       | 4        |
| B. Refuelling without a maintenance  |                 |           |          |   | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1479            |           |          | 1527  | 39        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 399   | 12        |          |
| E. Testing of plant systems or components  |                 |           |          | 7   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 4         | 5        |
| Subtotal   | 1479            | 15        | 0        | 2327  | 434       | 9        |
| Total  |                 | 1494      |          |   | 2770      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 55  |
| 15. Reactor Cooling Systems                    |                    | 38  |
| 16. Steam generation systems                   |                    | 485   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 9   |
| 31. Turbine and auxiliaries                    |                    | 61  |
| 32. Feedwater and Main Steam System            |                    | 44  |
| 33. Circulating Water System                   |                    | 4   |
| 35. All other I&C Systems                      |                    | 0   |
| 41. Main Generator Systems                     | 15                 | 42  |
| 42. Electrical Power Supply Systems            |                    | 17  |
| XX. Miscellaneous Systems                      |                    | 1   |
| Total  | 15                 | 756   |

## UA-56 ZAPOROZHE-2

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)

**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6944.3 GW(e).h  
**Energy Availability Factor:** 83.1%  
**Load Factor:** 83.2%  
**Operating Factor:** 85.7%  
**Energy Unavailability Factor:** 16.9%  
**Total Off-line Time:** 1253 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 707.4 | 636.4 | 681.8 | 669.8 | 625.8 | 502.7 | 0.0   | 415.2 | 676.2 | 710.1 | 627.0 | 691.7 | 6944.3 |
| <b>EAF (%)</b>  | 99.9  | 96.2  | 96.6  | 97.9  | 88.5  | 73.5  | 0.0   | 58.7  | 98.9  | 99.7  | 91.7  | 97.9  | 83.1   |
| <b>UCF (%)</b>  | 99.9  | 99.9  | 99.9  | 99.8  | 99.7  | 74.9  | 0.0   | 61.0  | 99.5  | 99.7  | 99.8  | 99.7  | 86.0   |
| <b>LF (%)</b>   | 100.1 | 96.2  | 96.5  | 98.1  | 88.5  | 73.5  | 0.0   | 58.7  | 98.9  | 100.3 | 91.7  | 97.9  | 83.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 90.9  | 76.7  | 0.0   | 63.3  | 100.0 | 100.0 | 100.0 | 100.0 | 85.7   |
| <b>EUF (%)</b>  | 0.1   | 3.8   | 3.4   | 2.1   | 11.5  | 26.5  | 100.0 | 41.3  | 1.1   | 0.3   | 8.3   | 2.1   | 16.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 23.7  | 100.0 | 38.5  | 0.0   | 0.0   | 0.0   | 0.0   | 13.7   |
| <b>UCLF (%)</b> | 0.1   | 0.1   | 0.1   | 0.2   | 0.4   | 1.4   | 0.0   | 0.5   | 0.5   | 0.3   | 0.2   | 0.3   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 3.6   | 3.3   | 1.9   | 11.1  | 1.4   | 0.0   | 2.2   | 0.7   | 0.0   | 8.1   | 1.9   | 2.8    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: SG BLOWDOWN SYSTEM RECONSTRUCTION; DISPATCH OF 48 SPENT FUEL ASSEMBLIES TO SPENT FUEL PIT BUILDING; CONTROL VALVE VF40-60S05 REPLACEMENT; REPLACEMENT THE TUBING SYSTEMS IN LOW PRESSURE FEED WATER HEATERS-4; REPLACEMENT THE TUBING ELBOWS IN HIGH PRESSURE FEED WATER HEATERS-6A, 7A.

### 5. Historical Summary

**Date of Construction Start:** 01 Jan 1981      **Lifetime Generation:** 101189.2 GW(e).h  
**Date of First Criticality:** 28 Jun 1985      **Cumulative Energy Availability Factor:** 64.5%  
**Date of Grid Connection:** 22 Jul 1985      **Cumulative Load Factor:** 63.2%  
**Date of Commercial Operation:** 15 Feb 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 35.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 6058.3         | 1000.0         | 76.0   | 76.0   | 76.0                              | 76.0   | 69.2               | 69.2   | 6675               | 76.2   |
| 1988 | 6088.6         | 950.0          | 81.2   | 78.5   | 81.2                              | 78.5   | 73.0               | 71.0   | 7253               | 82.6   |
| 1989 | 3050.9         | 950.0          | 45.1   | 67.6   | 45.1                              | 67.6   | 36.7               | 59.8   | 3393               | 38.7   |
| 1990 | 1869.1         | 950.0          | 22.6   | 56.5   | 22.3                              | 56.4   | 22.5               | 50.6   | 2165               | 24.7   |
| 1991 | 4583.9         | 950.0          | 56.1   | 56.4   | 55.4                              | 56.2   | 55.1               | 51.5   | 5112               | 58.4   |
| 1992 | 6551.7         | 950.0          | 77.7   | 59.9   | 76.2                              | 59.6   | 78.5               | 55.9   | 7016               | 79.9   |
| 1993 | 4386.1         | 950.0          | 56.5   | 59.5   | 53.8                              | 58.7   | 52.7               | 55.5   | 6194               | 70.7   |
| 1994 | 4103.5         | 950.0          | 49.9   | 58.3   | 49.8                              | 57.6   | 49.3               | 54.7   | 5924               | 67.6   |
| 1995 | 5051.8         | 950.0          | 63.5   | 58.9   | 60.7                              | 58.0   | 60.7               | 55.4   | 7329               | 83.7   |
| 1996 | 5373.0         | 950.0          | 67.5   | 59.7   | 64.4                              | 58.6   | 64.4               | 56.3   | 6247               | 71.1   |
| 1997 | 6081.7         | 950.0          | 76.5   | 61.2   | 73.0                              | 59.9   | 73.1               | 57.8   | 6745               | 77.0   |
| 1998 | 4922.8         | 950.0          | 63.0   | 61.4   | 59.0                              | 59.8   | 59.2               | 57.9   | 5601               | 63.9   |
| 1999 | 5476.0         | 950.0          | 66.9   | 61.8   | 65.7                              | 60.3   | 65.8               | 58.5   | 5887               | 67.2   |
| 2000 | 5626.4         | 950.0          | 70.7   | 62.4   | 67.4                              | 60.8   | 67.4               | 59.1   | 6281               | 71.5   |
| 2001 | 5867.6         | 950.0          | 72.5   | 63.1   | 70.6                              | 61.4   | 70.3               | 59.9   | 6422               | 73.1   |
| 2002 | 6315.6         | 950.0          | 78.8   | 64.1   | 75.9                              | 62.3   | 75.9               | 60.9   | 6834               | 78.0   |
| 2003 | 6742.4         | 950.0          | 83.8   | 65.2   | 80.9                              | 63.4   | 81.0               | 62.1   | 7387               | 84.3   |
| 2004 | 6944.3         | 950.0          | 86.0   | 66.4   | 83.1                              | 64.5   | 83.2               | 63.2   | 7531               | 85.7   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 7531.0 | 143.0   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS              |
| 01 Jan | 7531.0 | 9.9     | UP1  | A31  | OPERATION AT REDUCED POWER. STEAM UNDERHEATING IN MOISTURE SEPARATOR      |
| 01 Feb | 21.0   | 5.9     | XP2  | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE-750KV DISCONNECTION         |
| 10 Feb | 95.0   | 20.9    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 27 Mar | 103.0  | 17.9    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 29 Mar | 86.0   | 15.9    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 01 May | 68.0   | 68.4    | XF   | K    | RESERVE SHUTDOWN DUE TO REDUCED ENERGY DEMAND                             |
| 15 Jun | 9.0    | 5.5     | UP1  | A32  | OPERATION AT REDUCED POWER. HIGH PRESSURE FEEDWATER HEATER REPAIR         |
| 24 Jun | 1184.0 | 1137.2  | PF   | C    | UNIT SHUTDOWN. INTERMEDIATE OUTAGE: MAINTENANCE COMBINED WITH REFUELLING. |
| 28 Aug | 1.0    | 4.1     | PF   | E31  | UNIT SHUTDOWN. TURBINE TESTING  |
| 16 Nov | 122.0  | 14.1    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 21 Nov | 40.0   | 42.0    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 24 Dec | 182.0  | 18.2    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 480       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1184            |           |          | 1446                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 602                                      |           |          |
| E. Testing of plant systems or components  | 1               |           |          | 6  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           | 68       |  | 3         | 14       |
| Subtotal   | 1185            | 0         | 68       | 2054                                     | 487       | 14       |
| Total  |                 | 1253      |          |  | 2555      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 13                                       |
| 13. Reactor Auxiliary Systems                  |                 | 0  |
| 15. Reactor Cooling Systems                    |                 | 11                                       |
| 16. Steam generation systems                   |                 | 292                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 45                                       |
| 32. Feedwater and Main Steam System            |                 | 9  |
| 35. All other I&C Systems                      |                 | 9  |
| 41. Main Generator Systems                     |                 | 79                                       |
| 42. Electrical Power Supply Systems            |                 | 4  |
| Total  | 0               | 463                                      |

## UA-78 ZAPOROZHE-3

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)

**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6308.7 GW(e).h  
**Energy Availability Factor:** 75.5%  
**Load Factor:** 75.6%  
**Operating Factor:** 83.9%  
**Energy Unavailability Factor:** 24.5%  
**Total Off-line Time:** 1413 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 703.3 | 622.8 | 642.1 | 434.5 | 625.5 | 547.0 | 671.5 | 671.2 | 388.5 | 0.0   | 299.3 | 703.1 | 6308.7 |
| <b>EAF (%)</b>  | 99.4  | 94.2  | 91.0  | 63.5  | 88.5  | 80.0  | 95.0  | 95.0  | 56.8  | 0.0   | 43.8  | 98.5  | 75.5   |
| <b>UCF (%)</b>  | 99.4  | 99.8  | 99.7  | 99.5  | 99.0  | 98.5  | 97.9  | 97.0  | 57.5  | 0.0   | 79.1  | 98.5  | 85.4   |
| <b>LF (%)</b>   | 99.5  | 94.2  | 90.8  | 63.6  | 88.5  | 80.0  | 95.0  | 95.0  | 56.8  | 0.0   | 43.8  | 99.5  | 75.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 60.0  | 0.0   | 47.2  | 100.0 | 83.9   |
| <b>EUF (%)</b>  | 0.6   | 5.8   | 9.0   | 36.5  | 11.5  | 20.0  | 5.0   | 5.0   | 43.2  | 100.0 | 56.2  | 1.5   | 24.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 40.4  | 100.0 | 19.9  | 0.0   | 13.4   |
| <b>UCLF (%)</b> | 0.6   | 0.2   | 0.3   | 0.5   | 1.0   | 1.5   | 2.1   | 3.0   | 2.1   | 0.0   | 0.9   | 1.6   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 5.6   | 8.7   | 36.0  | 10.5  | 18.5  | 2.9   | 2.1   | 0.7   | 0.0   | 35.4  | 0.0   | 9.9    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: REPLACEMENT OF THE NEUTRON FLUX MONITORING SYSTEM EQUIPMENT; MODERNIZATION OF SG BLOWDOWN SYSTEM; DISPATCH OF 24 SPENT FUEL ASSEMBLIES TO SPENT FUEL PIT BUILDING.

### 5. Historical Summary

**Date of Construction Start:** 01 Apr 1982      **Lifetime Generation:** 100080.9 GW(e).h  
**Date of First Criticality:** 04 Dec 1986      **Cumulative Energy Availability Factor:** 66.4%  
**Date of Grid Connection:** 10 Dec 1986      **Cumulative Load Factor:** 65.9%  
**Date of Commercial Operation:** 05 Mar 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 33.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 109.8          | 950.0          | 0.0  | 0.0    | 1.3                               | 100.0  | 1.3                | 0.0    | 346                | 3.9    |
| 1987 | 6691.0         | 1000.0         | 0.0  | 0.0    | 83.5                              | 100.0  | 76.4               | 0.0    | 7222               | 82.4   |
| 1988 | 6414.3         | 950.0          | 81.3   | 81.3   | 81.3                              | 81.3   | 76.9               | 76.9   | 7077               | 80.6   |
| 1989 | 6614.4         | 950.0          | 80.8   | 81.1   | 80.9                              | 81.1   | 79.5               | 78.2   | 7373               | 84.2   |
| 1990 | 5625.3         | 950.0          | 68.1   | 76.8   | 67.7                              | 76.6   | 67.6               | 74.6   | 6166               | 70.4   |
| 1991 | 4958.8         | 950.0          | 61.1   | 72.8   | 59.9                              | 72.4   | 59.6               | 70.9   | 5877               | 67.1   |
| 1992 | 4140.9         | 950.0          | 54.0   | 69.1   | 50.5                              | 68.1   | 49.6               | 66.6   | 5274               | 60.0   |
| 1993 | 5416.6         | 950.0          | 67.6   | 68.8   | 66.0                              | 67.7   | 65.1               | 66.4   | 7263               | 82.9   |
| 1994 | 4273.7         | 950.0          | 52.5   | 66.5   | 52.5                              | 65.5   | 51.4               | 64.2   | 6068               | 69.3   |
| 1995 | 4027.8         | 950.0          | 49.7   | 64.4   | 48.4                              | 63.4   | 48.4               | 62.2   | 5804               | 66.3   |
| 1996 | 4940.2         | 950.0          | 62.3   | 64.2   | 59.2                              | 62.9   | 59.2               | 61.9   | 6096               | 69.4   |
| 1997 | 4869.8         | 950.0          | 70.1   | 64.8   | 58.5                              | 62.5   | 58.5               | 61.6   | 6544               | 74.7   |
| 1998 | 4953.2         | 950.0          | 63.1   | 64.6   | 59.5                              | 62.2   | 59.5               | 61.4   | 6316               | 72.1   |
| 1999 | 5114.5         | 950.0          | 64.8   | 64.6   | 61.5                              | 62.2   | 61.5               | 61.4   | 6162               | 70.3   |
| 2000 | 6123.2         | 950.0          | 76.6   | 65.5   | 73.0                              | 63.0   | 73.4               | 62.3   | 6875               | 78.3   |
| 2001 | 6307.8         | 950.0          | 80.8   | 66.6   | 75.7                              | 63.9   | 75.6               | 63.3   | 7027               | 80.0   |
| 2002 | 6602.0         | 950.0          | 84.4   | 67.8   | 79.2                              | 64.9   | 79.3               | 64.3   | 7470               | 85.3   |
| 2003 | 6588.9         | 950.0          | 81.9   | 68.7   | 79.0                              | 65.8   | 79.2               | 65.3   | 7236               | 82.6   |
| 2004 | 6308.7         | 950.0          | 85.4   | 69.7   | 75.5                              | 66.4   | 75.6               | 65.9   | 7371               | 83.9   |

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### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 7371.0 | 152.3   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS              |
| 01 Jan | 7391.0 | 92.5    | UP1  | A31  | OPERATION AT REDUCED POWER. CONDENSER PROBLEM                             |
| 09 Feb | 102.0  | 33.7    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 20 Mar | 180.0  | 39.7    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 29 Mar | 56.0   | 16.6    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 01 Apr | 504.0  | 155.2   | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 01 Apr | 192.0  | 73.9    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 03 May | 183.0  | 54.3    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 01 Jun | 136.0  | 15.9    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 11 Jun | 292.0  | 84.6    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |
| 19 Sep | 1153.0 | 1120.4  | PF   | C    | UNIT SHUTDOWN. INTERMEDIATE OUTAGE: MAINTENANCE COMBINED WITH REFUELLING. |
| 06 Nov | 260.0  | 228.0   | XF3  | R    | EXTENSION OF PLANNED OUTAGE DUE TO FUEL CONDITION                         |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 111       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1153            |           |          | 1491  |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 270   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 25  | 4         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 13       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 2   | 5         |          |
| R. External restrictions on supply and services (lack of funds due to delayed payments from customers, disputes in fuel industries, fuel-rationing, labour strike outside the plant , spare part delivery problems etc.) |                 |           | 260      |   |           |          |
| Subtotal   | 1153            | 0         | 260      | 1788  | 130       | 13       |
| Total  |                 | 1413      |          |   | 1931      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1987 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 3   |
| 13. Reactor Auxiliary Systems       |                    | 4   |
| 14. Safety Systems                  |                    | 7   |
| 15. Reactor Cooling Systems         |                    | 0   |
| 16. Steam generation systems        |                    | 17  |
| 31. Turbine and auxiliaries         |                    | 6   |
| 32. Feedwater and Main Steam System |                    | 16  |
| 33. Circulating Water System        |                    | 1   |
| 35. All other I&C Systems           |                    | 2   |
| 41. Main Generator Systems          |                    | 35  |
| 42. Electrical Power Supply Systems |                    | 6   |
| XX. Miscellaneous Systems           |                    | 0   |
| Total                               | 0                  | 97  |

# UA-79 ZAPOROZHE-4

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)  
**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6537.6 GW(e).h  
**Energy Availability Factor:** 78.3%  
**Load Factor:** 78.3%  
**Operating Factor:** 82.5%  
**Energy Unavailability Factor:** 21.7%  
**Total Off-line Time:** 1537 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 450.4 | 675.5 | 104.1 | 615.5 | 636.0 | 692.3 | 690.8 | 634.5 | 710.0 | 687.8 | 640.6 | 6537.6 |
| <b>EAF (%)</b>  | 0.0   | 68.1  | 95.7  | 15.1  | 87.1  | 93.0  | 97.9  | 97.7  | 92.8  | 100.0 | 100.0 | 90.6  | 78.3   |
| <b>UCF (%)</b>  | 0.0   | 69.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.5  | 100.0 | 100.0 | 97.8  | 88.5   |
| <b>LF (%)</b>   | 0.0   | 68.1  | 95.6  | 15.2  | 87.1  | 93.0  | 97.9  | 97.7  | 92.8  | 100.3 | 100.5 | 90.6  | 78.3   |
| <b>OF (%)</b>   | 0.0   | 70.1  | 99.9  | 30.0  | 94.1  | 100.0 | 100.0 | 100.0 | 94.9  | 100.0 | 100.0 | 100.0 | 82.5   |
| <b>EUF (%)</b>  | 100.0 | 31.9  | 4.3   | 84.9  | 12.9  | 7.0   | 2.1   | 2.3   | 7.2   | 0.0   | 0.0   | 9.4   | 21.7   |
| <b>PUF (%)</b>  | 100.0 | 30.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.5   | 0.0   | 0.0   | 0.0   | 11.3   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.2   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 1.5   | 4.3   | 84.9  | 12.9  | 7.0   | 2.1   | 2.3   | 1.8   | 0.0   | 0.0   | 7.1   | 10.2   |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: SG BLOWDOWN SYSTEM RECONSTRUCTION; CONTROL ROD DRIVE MECHANISM REPLACEMENT; CHECK VALVES TX60,80S07 REPLACEMENT ON STEAM PIPES; REPLACEMENT OF THE NEUTRON FLUX MONITORING SYSTEM EQUIPMENT

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1983      **Lifetime Generation:** 100970.2 GW(e).h  
**Date of First Criticality:** 15 Dec 1987      **Cumulative Energy Availability Factor:** 70.7%  
**Date of Grid Connection:** 18 Dec 1987      **Cumulative Load Factor:** 70.6%  
**Date of Commercial Operation:** 14 Apr 1988      **Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 29.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 116.4          | 954.0          | 0.0  | 0.0    | 1.5                               | 100.0  | 1.5                | 0.0    | 238                | 2.9    |
| 1988 | 6431.4         | 950.0          | 0.0  | 0.0    | 80.8                              | 100.0  | 77.1               | 0.0    | 7143               | 81.3   |
| 1989 | 5828.1         | 950.0          | 73.1   | 73.1   | 73.1                              | 73.1   | 70.0               | 70.0   | 6613               | 75.5   |
| 1990 | 6637.3         | 950.0          | 79.8   | 76.4   | 78.9                              | 76.0   | 79.8               | 74.9   | 7393               | 84.4   |
| 1991 | 4259.5         | 950.0          | 51.3   | 68.0   | 51.1                              | 67.7   | 51.2               | 67.0   | 5114               | 58.4   |
| 1992 | 6962.3         | 1000.0         | 78.8   | 70.8   | 78.6                              | 70.5   | 79.3               | 70.2   | 6961               | 79.2   |
| 1993 | 6118.8         | 950.0          | 74.1   | 71.5   | 73.4                              | 71.1   | 73.5               | 70.8   | 6821               | 77.9   |
| 1994 | 5888.7         | 950.0          | 71.4   | 71.5   | 71.3                              | 71.1   | 70.8               | 70.8   | 6718               | 76.7   |
| 1995 | 4717.1         | 950.0          | 58.4   | 69.6   | 56.7                              | 69.1   | 56.7               | 68.8   | 5902               | 67.4   |
| 1996 | 5372.2         | 950.0          | 66.3   | 69.2   | 64.4                              | 68.5   | 64.4               | 68.3   | 6372               | 72.5   |
| 1997 | 6284.4         | 950.0          | 79.9   | 70.4   | 75.5                              | 69.3   | 75.5               | 69.1   | 7060               | 80.6   |
| 1998 | 6022.0         | 950.0          | 74.0   | 70.8   | 72.4                              | 69.6   | 72.4               | 69.4   | 6839               | 78.1   |
| 1999 | 3921.3         | 950.0          | 49.8   | 68.9   | 47.1                              | 67.5   | 47.1               | 67.4   | 4630               | 52.9   |
| 2000 | 6708.4         | 950.0          | 83.8   | 70.1   | 80.3                              | 68.6   | 80.4               | 68.5   | 7423               | 84.5   |
| 2001 | 6091.2         | 950.0          | 89.8   | 71.6   | 73.1                              | 68.9   | 73.0               | 68.8   | 7884               | 89.8   |
| 2002 | 6337.1         | 950.0          | 78.5   | 72.1   | 76.1                              | 69.5   | 76.1               | 69.3   | 6895               | 78.7   |
| 2003 | 6736.3         | 950.0          | 82.5   | 72.8   | 80.9                              | 70.2   | 80.9               | 70.1   | 7248               | 82.7   |
| 2004 | 6537.6         | 950.0          | 88.5   | 73.8   | 78.3                              | 70.7   | 78.3               | 70.6   | 7247               | 82.5   |



## UA-79 ZAPOROZHE-4

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 951.0  | 907.3   | PF   | C    | UNIT SHUTDOWN. OVERHAUL: MAINTENANCE COMBINED WITH REFUELLING.    |
| 09 Feb | 7247.0 | 177.7   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS      |
| 09 Feb | 55.0   | 33.7    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.         |
| 20 Mar | 499.0  | 55.6    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                  |
| 30 Mar | 240.0  | 66.1    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.         |
| 10 Apr | 548.0  | 523.5   | XF   | K    | RESERVE SHUTDOWN DUE TO REDUCED ENERGY DEMAND                     |
| 02 May | 207.0  | 41.9    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                  |
| 01 Jun | 136.0  | 16.0    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                  |
| 11 Jun | 59.0   | 19.8    | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.         |
| 24 Sep | 38.0   | 37.4    | PF   | D31  | UNIT SHUTDOWN. MOISTURE SEPARATOR REPAIR                          |
| 06 Dec | 574.0  | 15.8    | UP1  | A32  | OPERATION AT REDUCED POWER. HIGH PRESSURE FEEDWATER HEATER REPAIR |
| 14 Dec | 432.0  | 42.2    | XP   | S    | OPERATION AT REDUCED POWER. COASTDOWN OPERATION.                  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 180       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 37        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 951             |           |          | 1540  |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 38              |           |          | 160   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 21  | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           | 548      |   |           |          |
| Subtotal   | 989             | 0         | 548      | 1721  | 217       | 0        |
| Total  |                 | 1537      |          |   | 1938      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 8   |
| 12. Reactor I&C Systems                        |                    | 11  |
| 13. Reactor Auxiliary Systems                  |                    | 6   |
| 14. Safety Systems                             |                    | 2   |
| 15. Reactor Cooling Systems                    |                    | 12  |
| 16. Steam generation systems                   |                    | 22  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 12  |
| 32. Feedwater and Main Steam System            |                    | 6   |
| 35. All other I&C Systems                      |                    | 0   |
| 41. Main Generator Systems                     |                    | 87  |
| 42. Electrical Power Supply Systems            |                    | 5   |
| XX. Miscellaneous Systems                      |                    | 1   |
| Total  | 0                  | 174   |

## UA-126 ZAPOROZHE-5

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)

**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

### 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 40000 MW.d/t

### 2. Production Summary 2004

**Energy Production:** 6826.7 GW(e).h  
**Energy Availability Factor:** 81.6%  
**Load Factor:** 81.8%  
**Operating Factor:** 86.0%  
**Energy Unavailability Factor:** 18.4%  
**Total Off-line Time:** 1233 hours

### 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 717.4 | 666.6 | 699.0 | 683.9 | 697.6 | 664.2 | 611.2 | 0.0   | 260.1 | 706.0 | 619.1 | 501.7 | 6826.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.0  | 100.0 | 98.7  | 97.1  | 86.5  | 0.0   | 38.0  | 99.7  | 90.5  | 71.0  | 81.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 99.8  | 99.5  | 89.3  | 0.0   | 40.4  | 99.9  | 99.9  | 99.0  | 85.6   |
| <b>LF (%)</b>   | 101.5 | 100.8 | 98.9  | 100.1 | 98.7  | 97.1  | 86.5  | 0.0   | 38.0  | 99.7  | 90.5  | 71.0  | 81.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.9  | 100.1 | 100.0 | 100.0 | 90.3  | 0.0   | 42.1  | 100.0 | 100.0 | 100.0 | 86.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 1.0   | 0.0   | 1.3   | 2.9   | 13.5  | 100.0 | 62.0  | 0.3   | 9.5   | 29.0  | 18.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.9   | 100.0 | 59.4  | 0.0   | 0.0   | 0.0   | 14.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.2   | 0.5   | 0.8   | 0.0   | 0.1   | 0.1   | 0.1   | 1.0   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 1.0   | 0.0   | 1.1   | 2.4   | 2.8   | 0.0   | 2.4   | 0.2   | 9.3   | 28.1  | 4.0    |

UCLF replaces previously used UUF.

### 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE. MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: MODERNIZATION OF SG BLOWDOWN SYSTEM; DISPATCH OF 48 SPENT FUEL ASSEMBLIES TO SPENT FUEL PIT BUILDING; CONTROL VALVE VF40S05 REPLACEMENT; REPLACEMENT THE TUBING ELBOWS IN HIGH PRESSURE FEED WATER HEATERS-6A, 7A.

### 5. Historical Summary

**Date of Construction Start:** 01 Nov 1985      **Lifetime Generation:** 91438.5 GW(e).h  
**Date of First Criticality:** 20 Jul 1989      **Cumulative Energy Availability Factor:** 71.2%  
**Date of Grid Connection:** 14 Aug 1989      **Cumulative Load Factor:** 71.2%  
**Date of Commercial Operation:** 27 Oct 1989      **Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 28.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 2147.5         | 950.0          | 0.0  | 0.0    | 92.6                              | 100.0  | 25.8               | 0.0    | 2938               | 33.5   |
| 1990 | 4678.7         | 950.0          | 57.9   | 57.9   | 56.6                              | 56.6   | 56.2               | 56.2   | 6002               | 68.5   |
| 1991 | 6554.9         | 950.0          | 79.5   | 68.7   | 78.4                              | 67.5   | 78.8               | 67.5   | 7319               | 83.6   |
| 1992 | 6898.8         | 1000.0         | 80.1   | 72.7   | 79.2                              | 71.5   | 78.5               | 71.3   | 7032               | 80.1   |
| 1993 | 5661.8         | 950.0          | 68.9   | 71.7   | 68.3                              | 70.7   | 68.0               | 70.5   | 6735               | 76.9   |
| 1994 | 4858.9         | 950.0          | 59.1   | 69.2   | 59.1                              | 68.4   | 58.4               | 68.1   | 6779               | 77.4   |
| 1995 | 5391.9         | 950.0          | 66.0   | 68.7   | 64.7                              | 67.8   | 64.8               | 67.6   | 6506               | 74.3   |
| 1996 | 6126.0         | 950.0          | 74.1   | 69.5   | 73.4                              | 68.6   | 73.4               | 68.4   | 6799               | 77.4   |
| 1997 | 6381.5         | 950.0          | 76.2   | 70.3   | 75.8                              | 69.5   | 76.7               | 69.4   | 6705               | 76.5   |
| 1998 | 5856.2         | 950.0          | 70.7   | 70.4   | 70.1                              | 69.6   | 70.4               | 69.5   | 6249               | 71.3   |
| 1999 | 5070.2         | 950.0          | 63.0   | 69.6   | 60.6                              | 68.7   | 60.9               | 68.7   | 5525               | 63.1   |
| 2000 | 6286.6         | 950.0          | 77.9   | 70.4   | 74.9                              | 69.2   | 75.3               | 69.3   | 6928               | 78.9   |
| 2001 | 5890.8         | 950.0          | 76.2   | 70.8   | 70.7                              | 69.4   | 70.6               | 69.4   | 6751               | 76.9   |
| 2002 | 6222.5         | 950.0          | 80.8   | 71.6   | 74.5                              | 69.8   | 74.8               | 69.8   | 6983               | 79.7   |
| 2003 | 6585.5         | 950.0          | 80.2   | 72.2   | 79.0                              | 70.4   | 79.1               | 70.5   | 7107               | 81.1   |
| 2004 | 6826.7         | 950.0          | 85.6   | 73.1   | 81.6                              | 71.2   | 81.8               | 71.2   | 7551               | 86.0   |

**UA-126 ZAPOROZHE-5****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 7551.0 | 113.0   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS              |
| 27 Mar | 61.0   | 13.1    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 26 Jul | 56.0   | 2.2     | XP   | S    | OPERATION AT REDUCED POWER. COASTDOWN OPERATION.                          |
| 29 Jul | 1233.0 | 1183.0  | PF   | C    | UNIT SHUTDOWN. INTERMEDIATE OUTAGE: MAINTENANCE COMBINED WITH REFUELLING. |
| 17 Nov | 105.0  | 19.1    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 21 Nov | 800.0  | 232.6   | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 112       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1233            |           |          | 1355  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 274   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 30  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 2         | 11       |
| Subtotal   | 1233            | 0         | 0        | 1659  | 124       | 11       |
| Total  |                 | 1233      |          |   | 1794      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 8   |
| 14. Safety Systems                             |                    | 1   |
| 15. Reactor Cooling Systems                    |                    | 8   |
| 16. Steam generation systems                   |                    | 53  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 10  |
| 32. Feedwater and Main Steam System            |                    | 9   |
| 41. Main Generator Systems                     |                    | 9   |
| 42. Electrical Power Supply Systems            |                    | 7   |
| Total  | 0                  | 107   |

# UA-127 ZAPOROZHE-6

**Operator:** NNEGC (NATIONAL NUCLEAR ENERGY GENERATING COMPANY <ENERGOATOM>)  
**Contractor:** PAIP (PRODUCTION AMALGAMATION IZHORSKY PLANT ATOMMASH,VOLGODONSK,RUSSIA)

## 1. Station Details

**Type:** WWER  
**Net Reference Unit Power at the beginning of 2004:** 950.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** —

## 2. Production Summary 2004

**Energy Production:** 6867.8 GW(e).h  
**Energy Availability Factor:** 81.7%  
**Load Factor:** 82.3%  
**Operating Factor:** 87.8%  
**Energy Unavailability Factor:** 18.3%  
**Total Off-line Time:** 1069 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 722.6 | 292.5 | 38.4 | 692.7 | 606.7 | 531.1 | 701.6 | 701.8 | 689.1 | 723.8 | 647.5 | 519.9 | 6867.8 |
| <b>EAF (%)</b>  | 100.0 | 44.0  | 5.6  | 100.0 | 85.8  | 77.6  | 99.3  | 99.3  | 100.0 | 100.0 | 94.7  | 73.6  | 81.7   |
| <b>UCF (%)</b>  | 100.0 | 44.0  | 7.2  | 100.0 | 96.5  | 99.9  | 99.9  | 100.0 | 100.0 | 100.0 | 99.5  | 100.0 | 87.4   |
| <b>LF (%)</b>   | 102.2 | 44.2  | 5.4  | 101.4 | 85.8  | 77.6  | 99.3  | 99.3  | 100.7 | 102.3 | 94.7  | 73.6  | 82.3   |
| <b>OF (%)</b>   | 100.0 | 44.8  | 7.8  | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.8   |
| <b>EUF (%)</b>  | 0.0   | 56.0  | 94.4 | 0.0   | 14.2  | 22.4  | 0.7   | 0.7   | 0.0   | 0.0   | 5.3   | 26.4  | 18.3   |
| <b>PUF (%)</b>  | 0.0   | 55.7  | 92.8 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.3   |
| <b>UCLF (%)</b> | 0.0   | 0.3   | 0.0  | 0.0   | 3.5   | 0.1   | 0.1   | 0.0   | 0.0   | 0.0   | 0.5   | 0.0   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 1.6  | 0.0   | 10.6  | 22.3  | 0.7   | 0.7   | 0.0   | 0.0   | 4.9   | 26.4  | 5.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

THERE WAS THE NPP OPERATION AT FULL POWER IN BASE LOAD MODE.MAJOR ACHIEVEMENTS LEADING TO INCREASED AVAILABILITY: MODERNIZATION OF SG BLOWDOWN SYSTEM; CHECK VALVES REPLACEMENT ON STEAM PIPES.

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1986      **Lifetime Generation:** 58301.9 GW(e).h  
**Date of First Criticality:** 06 Oct 1995      **Cumulative Energy Availability Factor:** 76.7%  
**Date of Grid Connection:** 19 Oct 1995      **Cumulative Load Factor:** 77.2%  
**Date of Commercial Operation:** 16 Sep 1996      **Cumulative Unit Capability Factor:** 82.2%  
**Cumulative Energy Unavailability Factor:** 23.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1995 | 422.8          | 950.0          | 0.0  | 0.0    | 5.1                               | 100.0  | 5.1                | 0.0    | 1518               | 17.3   |
| 1996 | 6403.5         | 950.0          | 0.0  | 0.0    | 76.7                              | 100.0  | 76.7               | 0.0    | 7871               | 89.6   |
| 1997 | 6332.7         | 950.0          | 75.5   | 75.5   | 75.2                              | 75.2   | 76.1               | 76.1   | 6640               | 75.8   |
| 1998 | 6132.2         | 950.0          | 76.2   | 75.8   | 73.4                              | 74.3   | 73.7               | 74.9   | 6766               | 77.2   |
| 1999 | 6165.4         | 950.0          | 78.4   | 76.7   | 74.1                              | 74.2   | 74.1               | 74.6   | 6934               | 79.2   |
| 2000 | 5844.2         | 950.0          | 70.1   | 75.0   | 69.3                              | 73.0   | 70.0               | 73.5   | 6191               | 70.5   |
| 2001 | 6336.2         | 950.0          | 80.1   | 76.1   | 75.2                              | 73.4   | 75.9               | 74.0   | 7118               | 81.0   |
| 2002 | 6790.6         | 950.0          | 83.4   | 77.3   | 81.0                              | 74.7   | 81.6               | 75.2   | 7393               | 84.4   |
| 2003 | 7006.4         | 950.0          | 86.3   | 78.6   | 83.5                              | 75.9   | 84.2               | 76.5   | 7590               | 86.6   |
| 2004 | 6867.8         | 950.0          | 87.3   | 79.7   | 81.7                              | 76.7   | 82.3               | 77.2   | 7715               | 87.8   |

**UA-127 ZAPOROZHE-6****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 7715.0 | 134.7   | XP1  | N    | OPERATION AT REDUCED POWER. COOLING WATER TEMPERATURE LIMITS              |
| 14 Feb | 1069.0 | 1024.0  | PF   | C    | UNIT SHUTDOWN. INTERMEDIATE OUTAGE: MAINTENANCE COMBINED WITH REFUELLING. |
| 03 May | 187.0  | 75.5    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 04 May | 92.0   | 24.1    | UP1  | A33  | OPERATION AT REDUCED POWER. CIRCULATING PUMP SWITCH OFF                   |
| 01 Jun | 136.0  | 22.2    | XP   | K    | REDUCED POWER UPON THE GRID DISPATCHER'S REQUEST                          |
| 11 Jun | 312.0  | 121.2   | XP   | J    | OPERATION AT REDUCED POWER. TRANSMISSION LINE LIMITATION.                 |

**7. Full Outages, Analysis by Cause**

| Outage Cause  | 2004 Hours Lost |           |          | 1995 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                                    |                 |           |          |   | 36        |          |
| C. Inspection, maintenance or repair combined with refuelling | 1069            |           |          | 1186  |           |          |
| D. Inspection, maintenance or repair without refuelling       |                 |           |          | 103   |           |          |
| E. Testing of plant systems or components                     |                 |           |          | 45  |           |          |
| Subtotal  | 1069            | 0         | 0        | 1334  | 36        | 0        |
| Total   |                 | 1069      |          |   | 1370      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1995 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 15. Reactor Cooling Systems                    |                    | 4   |
| 16. Steam generation systems                   |                    | 5   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 14  |
| 32. Feedwater and Main Steam System            |                    | 0   |
| 35. All other I&C Systems                      |                    | 1   |
| 41. Main Generator Systems                     |                    | 1   |
| 42. Electrical Power Supply Systems            |                    | 2   |
| XX. Miscellaneous Systems                      |                    | 2   |
| Total  | 0                  | 31  |

# GB-9A DUNGENESS-A1

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)  
**Contractor:** TNPG (THE NUCLEAR POWER GROUP LTD.)

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 225.0 MW(e)  
**Design Net RUP:** 275.0 MW(e)  
**Design Discharge Burnup:** 2970 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1197.0 GW(e).h  
**Energy Availability Factor:** 60.5%  
**Load Factor:** 60.7%  
**Operating Factor:** 68.6%  
**Energy Unavailability Factor:** 39.5%  
**Total Off-line Time:** 2751 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul  | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 157.4 | 142.3 | 156.0 | 72.6 | 0.0   | 0.0   | 0.7  | 127.8 | 142.0 | 96.7 | 148.8 | 152.7 | 1197.0 |
| <b>EAF (%)</b>  | 94.0  | 90.5  | 93.2  | 44.8 | 0.0   | 0.0   | 0.4  | 76.3  | 87.7  | 57.8 | 91.8  | 91.2  | 60.5   |
| <b>UCF (%)</b>  | 94.0  | 90.6  | 93.2  | 44.8 | 0.0   | 0.0   | 0.4  | 76.3  | 87.7  | 57.8 | 91.8  | 91.2  | 60.5   |
| <b>LF (%)</b>   | 94.0  | 94.1  | 93.2  | 44.9 | 0.0   | 0.0   | 0.4  | 76.3  | 87.7  | 57.7 | 91.8  | 91.2  | 60.7   |
| <b>OF (%)</b>   | 100.0 | 103.6 | 100.0 | 52.2 | 0.0   | 0.0   | 0.9  | 100.0 | 100.0 | 69.1 | 100.0 | 100.0 | 68.6   |
| <b>EUF (%)</b>  | 6.0   | 9.5   | 6.8   | 55.2 | 100.0 | 100.0 | 99.6 | 23.7  | 12.3  | 42.2 | 8.2   | 8.8   | 39.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 48.0 | 100.0 | 93.3  | 0.0  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 20.1   |
| <b>UCLF (%)</b> | 6.0   | 9.5   | 6.8   | 7.3  | 0.0   | 6.7   | 99.6 | 23.7  | 12.3  | 42.2 | 8.2   | 8.8   | 19.4   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 THERE WAS A STATUTORY OUTAGE OF ABOUT 75 DAYS DURATION COMMENCING ON 16 APRIL. THERE WAS ABOUT A 33 DAY DURATION OVERRUN DUE TO BOTH A DELAY ON COMPONENTS AND A CLEARANCE FROM THE SAFETY REGULATOR ON A SPECIFIC SAFETY CASE. THERE WAS ONE MANUAL SCRAM OF ABOUT 10 DAYS DURATION COMMENCING ON 07 OCTOBER DUE TO A FUELLING HOIST PROBLEM.

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1960      **Lifetime Generation:** 84482.6 GW(e).h  
**Date of First Criticality:** 01 Jun 1965      **Cumulative Energy Availability Factor:** 74.3%  
**Date of Grid Connection:** 21 Sep 1965      **Cumulative Load Factor:** 66.5%  
**Date of Commercial Operation:** 28 Oct 1965      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 25.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1977 | 2819.0         | 410.0          | 100.0  | 99.1   | 78.9                              | 83.9   | 78.7               | 64.6   | 8736               | 100.0  |
| 1978 | 2667.0         | 410.0          | 100.0  | 99.2   | 74.7                              | 83.1   | 74.5               | 65.4   | 8731               | 99.9   |
| 1979 | 1169.0         | 410.0          | 100.0  | 99.3   | 39.5                              | 79.8   | 32.6               | 62.9   | 6905               | 79.0   |
| 1980 | 69.0           | 410.0          | 2.1  | 92.4   | 2.1                               | 74.3   | 1.9                | 58.6   | 540                | 6.2    |
| 1981 | 120.0          | 410.0          | 2.4  | 86.3   | 2.4                               | 69.5   | 3.3                | 54.9   | 840                | 9.4    |
| 1982 | 2590.0         | 410.0          | 72.3   | 85.5   | 72.3                              | 69.6   | 72.3               | 56.0   | 8666               | 99.2   |
| 1983 | 2962.0         | 410.0          | 82.4   | 85.3   | 82.4                              | 70.4   | 82.7               | 57.5   | 8736               | 100.0  |
| 1984 | 2914.0         | 410.0          | 80.9   | 85.0   | 80.9                              | 71.0   | 81.4               | 58.8   | 8736               | 100.0  |
| 1985 | 3336.3         | 424.0          | 91.8   | 85.4   | 90.6                              | 72.0   | 90.1               | 60.5   | 8716               | 99.8   |
| 1986 | 2626.4         | 424.0          | 71.7   | 84.7   | 70.2                              | 71.9   | 70.9               | 61.1   | 8678               | 99.3   |
| 1987 | 3054.8         | 424.0          | 87.6   | 84.8   | 81.3                              | 72.4   | 80.9               | 62.0   | 8796               | 98.8   |
| 1988 | 2084.8         | 424.0          | 62.6   | 83.8   | 61.7                              | 71.9   | 56.3               | 61.8   | 8568               | 98.1   |
| 1989 | 2203.0         | 424.0          | 60.1   | 82.8   | 59.4                              | 71.3   | 59.5               | 61.7   | 8736               | 100.0  |
| 1990 | 2995.3         | 424.0          | 81.0   | 82.7   | 81.0                              | 71.8   | 80.9               | 62.5   | 8711               | 99.7   |
| 1991 | 3200.4         | 424.0          | 91.0   | 83.0   | 90.5                              | 72.5   | 86.4               | 63.5   | 8695               | 99.5   |
| 1992 | 3745.7         | 428.0          | 95.9   | 83.5   | 95.9                              | 73.5   | 98.3               | 64.9   | 8905               | 100.0  |
| 1993 | 3219.4         | 440.0          | 83.9   | 83.6   | 83.4                              | 73.8   | 83.8               | 65.6   | 8697               | 99.6   |
| 1994 | 3540.7         | 440.0          | 93.2   | 83.9   | 92.0                              | 74.5   | 92.1               | 66.6   | 8101               | 92.7   |
| 2004 | 1197.0         | 225.0          | 60.5   | 83.5   | 60.5                              | 74.3   | 60.7               | 66.5   | 6009               | 68.6   |

# GB-9A DUNGENESS-A1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 744.0 | 7.0     | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Jan | 744.0 | 3.0     | UP2  | A34  | REACTIVITY RESTRICTIONS   |
| 01 Feb | 696.0 | 8.3     | UP2  | A34  | REACTIVITY RESTRICTIONS   |
| 01 Feb | 696.0 | 6.0     | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Mar | 744.0 | 9.0     | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Mar | 744.0 | 2.4     | UP2  | A34  | REACTIVITY RESTRICTIONS   |
| 01 Apr | 720.0 | 3.7     | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Apr | 720.0 | 8.1     | UP2  | A34  | REACTIVITY RESTRICTIONS   |
| 16 Apr | 345.0 | 77.6    | PF   | C    | MAINTENANCE OUTAGE WITH REFUELLING  |
| 01 May | 744.0 | 167.4   | PF   | C    | MAINTENANCE OUTAGE WITH REFUELLING  |
| 01 Jun | 672.0 | 151.2   | PF   | C    | MAINTENANCE OUTAGE WITH REFUELLING  |
| 29 Jun | 785.0 | 176.6   | UF3  | H    | OUTAGE EXTENSION DUE TO BOTH A DELAY ON COMPONENTS AND A CLEARANCE FROM THE SAFETY REGULATOR ON A SPECIFIC SAFETY CASE. |
| 31 Jul | 7.0   | 0.9     | UP2  | A34  | REACTIVITY RESTRICTIONS   |
| 01 Aug | 744.0 | 35.6    | UP2  | A34  | REACTIVITY RESTRICTIONS   |
| 01 Aug | 744.0 | 4.0     | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Sep | 720.0 | 10.0    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Sep | 720.0 | 10.0    | UP2  | A34  | REACTIVITY RESTRICTIONS   |
| 01 Oct | 744.0 | 19.2    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 07 Oct | 229.0 | 51.5    | UF5  | A21  | MANUAL SCRAM FUELLING HOIST PROBLEM   |
| 01 Nov | 720.0 | 13.2    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Dec | 744.0 | 12.7    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Dec | 744.0 | 2.0     | UP2  | A34  | REACTIVITY RESTRICTIONS   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 229       |          |  | 388       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1761            |           |          |  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 885                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 7         |          |
| H. Nuclear regulatory requirements   |                 | 785       |          |  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 15       |
| Subtotal   | 1761            | 1014      | 0        | 885                                      | 398       | 17       |
| Total  |                 | 2775      |          |  | 1300      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 0  |
| 12. Reactor I&C Systems                  |                 | 9  |
| 13. Reactor Auxiliary Systems            |                 | 2  |
| 14. Safety Systems                       |                 | 0  |
| 15. Reactor Cooling Systems              |                 | 7  |
| 21. Fuel Handling and Storage Facilities | 229             | 8  |
| 31. Turbine and auxiliaries              |                 | 19                                       |
| 32. Feedwater and Main Steam System      |                 | 0  |
| 33. Circulating Water System             |                 | 0  |
| 41. Main Generator Systems               |                 | 4  |
| 42. Electrical Power Supply Systems      |                 | 2  |
| Total                                    | 229             | 51                                       |

# GB-9B DUNGENESS-A2

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)  
**Contractor:** TNPG (THE NUCLEAR POWER GROUP LTD.)

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 225.0 MW(e)  
**Design Net RUP:** 275.0 MW(e)  
**Design Discharge Burnup:** 2970 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1674.6 GW(e).h  
**Energy Availability Factor:** 84.7%  
**Load Factor:** 85.0%  
**Operating Factor:** 94.5%  
**Energy Unavailability Factor:** 15.3%  
**Total Off-line Time:** 480 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 154.1 | 136.4 | 149.5 | 154.6 | 151.9 | 147.9 | 151.6 | 136.1 | 145.9 | 121.1 | 73.1 | 152.1 | 1674.6 |
| <b>EAF (%)</b>  | 92.1  | 86.7  | 89.3  | 95.4  | 90.8  | 91.3  | 90.6  | 81.3  | 90.1  | 72.4  | 45.1 | 90.9  | 84.7   |
| <b>UCF (%)</b>  | 92.1  | 86.7  | 89.3  | 95.4  | 90.8  | 91.3  | 90.6  | 81.3  | 90.1  | 72.4  | 45.1 | 90.9  | 84.7   |
| <b>LF (%)</b>   | 92.1  | 90.2  | 89.3  | 95.5  | 90.8  | 91.3  | 90.6  | 81.3  | 90.1  | 72.3  | 45.1 | 90.9  | 85.0   |
| <b>OF (%)</b>   | 100.0 | 103.6 | 100.0 | 100.1 | 100.0 | 100.0 | 100.0 | 93.8  | 100.0 | 80.9  | 56.0 | 100.0 | 94.5   |
| <b>EUF (%)</b>  | 7.9   | 13.3  | 10.7  | 4.6   | 9.2   | 8.7   | 9.4   | 18.7  | 9.9   | 27.6  | 54.9 | 9.1   | 15.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 7.9   | 13.3  | 10.7  | 4.6   | 9.2   | 8.7   | 9.4   | 18.7  | 10.0  | 27.6  | 54.9 | 9.1   | 15.3   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 THERE WERE THREE MANUAL SCRAMS. FIRST OUTAGE WAS OF ABOUT TWO DAYS DURATION COMMENCING ON 09 AUGUST 2004 AND DUE TO BLOWER OIL LEAK. SECOND OUTAGE WAS OF ABOUT THREE DAYS DURATION COMMENCING ON 11 OCTOBER AND INITIATED BY A GRID SYSTEM FAILURE. THIRD OUTAGE WAS OF ABOUT 17 DAYS DURATION COMMENCING ON 28 OCTOBER DUE TO A FUEL ROUTE PROBLEM.

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1960      **Lifetime Generation:** 57614.0 GW(e).h  
**Date of First Criticality:** 01 Sep 1965      **Cumulative Energy Availability Factor:** 84.7%  
**Date of Grid Connection:** 01 Nov 1965      **Cumulative Load Factor:** 85.0%  
**Date of Commercial Operation:** 30 Dec 1965      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 15.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 1674.6         | 225.0          | 84.7   | 84.7   | 84.7                              | 84.7   | 85.0               | 85.0   | 8280               | 94.5   |



## GB-9B DUNGENESS-A2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 744.0 | 13.3    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Feb | 696.0 | 20.2    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Mar | 744.0 | 17.9    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Apr | 720.0 | 7.4     | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 May | 744.0 | 15.5    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Jun | 720.0 | 14.1    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Jul | 744.0 | 15.8    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Aug | 698.0 | 20.9    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 09 Aug | 46.0  | 10.4    | UF5  | A15  | MANUAL SCRAM DUE TO BLOWER OIL LEAK                                     |
| 01 Sep | 720.0 | 16.1    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Oct | 603.0 | 14.5    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 11 Oct | 76.8  | 17.3    | UF5  | A42  | MANUAL SCRAM INITIATED BY A GRID SYSTEM FAILURE                         |
| 28 Oct | 64.2  | 14.5    | UF5  | A21  | MANUAL SCRAM DUE TO A FUEL ROUTE PROBLEM                                |
| 01 Nov | 317.0 | 71.3    | UF2  | A21  | CONTINUATION OF OUTAGES WITH A MANUAL SCRAM DUE TO A FUEL ROUTE PROBLEM |
| 01 Nov | 403.0 | 17.5    | UP2  | S    | REACTIVITY RESTRICTIONS   |
| 01 Dec | 744.0 | 15.3    | UP2  | S    | REACTIVITY RESTRICTIONS   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 504       |          |   | 379       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 0         |          |
| D. Inspection, maintenance or repair without refuelling                              | 832             |           |          |   |           |          |
| E. Testing of plant systems or components  | 0               |           |          |   | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 9        |
| Subtotal   | 0               | 504       | 0        | 832   | 379       | 9        |
| Total  |                 | 504       |          |   | 1220      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|--|-----------------|---|
| 11. Reactor and Accessories              |                 | 4   |
| 12. Reactor I&C Systems                  |                 | 9   |
| 15. Reactor Cooling Systems              | 46              | 43  |
| 21. Fuel Handling and Storage Facilities | 381             | 0   |
| 31. Turbine and auxiliaries              |                 | 1   |
| 32. Feedwater and Main Steam System      |                 | 5   |
| 33. Circulating Water System             |                 | 1   |
| 42. Electrical Power Supply Systems      | 76              | 1   |
| Total                                    | 503             | 64  |

# GB-11A OLDBURY-A1

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)  
**Contractor:** TNPG (THE NUCLEAR POWER GROUP LTD.)

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 217.0 MW(e)  
**Design Net RUP:** 300.0 MW(e)  
**Design Discharge Burnup:** 3600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 723.8 GW(e).h  
**Energy Availability Factor:** 37.8%  
**Load Factor:** 38.1%  
**Operating Factor:** 39.2%  
**Energy Unavailability Factor:** 62.2%  
**Total Off-line Time:** 5330 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 159.2 | 147.4 | 160.1 | 151.3 | 105.8 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 723.8  |
| <b>EAF (%)</b>  | 98.6  | 97.5  | 99.2  | 96.8  | 65.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1  | 0.0   | 0.0   | 37.8   |
| <b>UCF (%)</b>  | 98.6  | 97.5  | 99.2  | 96.8  | 65.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.1  | 0.0   | 0.0   | 37.8   |
| <b>LF (%)</b>   | 98.6  | 101.1 | 99.2  | 97.0  | 65.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 38.1   |
| <b>OF (%)</b>   | 100.0 | 103.6 | 100.0 | 100.1 | 70.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 39.2   |
| <b>EUF (%)</b>  | 1.4   | 2.5   | 0.8   | 3.2   | 34.5  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9 | 100.0 | 100.0 | 62.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 29.3  | 100.0 | 100.0 | 100.0 | 100.0 | 99.9 | 100.0 | 100.0 | 61.1   |
| <b>UCLF (%)</b> | 1.4   | 2.5   | 0.8   | 3.2   | 5.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 1.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 THERE WAS A STATUTORY OUTAGE OF ABOUT 46 DAYS DURATION COMMENCING ON 22 MAY. THE REACTOR REMAINED OUT OF SERVICE FOR THE REST OF 2004 WHILE TWO SAFETY CASES WERE DISCUSSED WITH THE SAFETY REGULATOR.

## 5. Historical Summary

**Date of Construction Start:** 01 May 1962      **Lifetime Generation:** 83452.4 GW(e).h  
**Date of First Criticality:** 01 Aug 1967      **Cumulative Energy Availability Factor:** 80.5%  
**Date of Grid Connection:** 07 Nov 1967      **Cumulative Load Factor:** 78.3%  
**Date of Commercial Operation:** 31 Dec 1967      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 19.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1976 | 3017.0         | 416.0          | 100.0  | 95.9   | 80.2                              | 74.1   | 81.5               | 63.5   | 8714               | 97.9   |
| 1977 | 3110.0         | 416.0          | 100.0  | 96.3   | 85.5                              | 75.3   | 85.6               | 65.8   | 8736               | 100.0  |
| 1978 | 3067.0         | 416.0          | 100.0  | 96.7   | 84.5                              | 76.2   | 84.4               | 67.5   | 8736               | 100.0  |
| 1979 | 3184.0         | 416.0          | 100.0  | 96.9   | 88.1                              | 77.2   | 87.6               | 69.3   | 8736               | 100.0  |
| 1980 | 3296.0         | 416.0          | 87.5   | 96.2   | 86.2                              | 77.9   | 90.7               | 71.0   | 8736               | 100.0  |
| 1981 | 3376.0         | 416.0          | 87.4   | 95.5   | 85.5                              | 78.5   | 91.1               | 72.5   | 8904               | 100.0  |
| 1982 | 3434.0         | 416.0          | 89.2   | 95.1   | 86.0                              | 79.0   | 94.5               | 74.0   | 8736               | 100.0  |
| 1983 | 3013.0         | 434.0          | 77.8   | 93.9   | 77.4                              | 78.9   | 79.5               | 74.4   | 8566               | 98.1   |
| 1984 | 3041.0         | 434.0          | 77.7   | 92.9   | 77.7                              | 78.8   | 80.2               | 74.8   | 8736               | 100.0  |
| 1985 | 3322.1         | 434.0          | 83.2   | 92.3   | 83.2                              | 79.1   | 87.6               | 75.5   | 8701               | 99.6   |
| 1986 | 3308.6         | 434.0          | 87.0   | 92.0   | 85.0                              | 79.4   | 87.3               | 76.2   | 8650               | 99.0   |
| 1987 | 3222.9         | 434.0          | 84.1   | 91.6   | 82.9                              | 79.6   | 83.4               | 76.6   | 8904               | 100.0  |
| 1988 | 3375.2         | 434.0          | 90.8   | 91.6   | 85.9                              | 79.9   | 89.0               | 77.2   | 8530               | 97.6   |
| 1989 | 2915.2         | 434.0          | 86.5   | 91.3   | 82.0                              | 80.0   | 76.9               | 77.2   | 8644               | 98.9   |
| 1990 | 2915.1         | 434.0          | 76.1   | 90.6   | 76.1                              | 79.9   | 76.9               | 77.2   | 8713               | 99.7   |
| 1991 | 3184.2         | 434.0          | 84.3   | 90.4   | 84.3                              | 80.0   | 84.0               | 77.5   | 8736               | 100.0  |
| 1992 | 3412.1         | 434.0          | 88.6   | 90.3   | 88.6                              | 80.4   | 88.3               | 77.9   | 8857               | 99.5   |
| 1993 | 3541.3         | 434.0          | 92.9   | 90.4   | 92.5                              | 80.9   | 93.4               | 78.5   | 8736               | 100.0  |
| 1994 | 3486.8         | 434.0          | 91.6   | 90.5   | 91.6                              | 81.3   | 92.0               | 79.0   | 8318               | 95.2   |
| 2004 | 723.8          | 217.0          | 37.8   | 89.5   | 37.8                              | 80.5   | 38.1               | 78.3   | 3430               | 39.2   |

**GB-11A OLDBURY-A1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 744.0 | 2.3     | UP2  | S    | REACTOR TRIMMING LOSSES                                     |
| 01 Feb | 696.0 | 3.6     | UP2  | S    | REACTOR TRIMMING LOSSES                                     |
| 01 Mar | 744.0 | 1.3     | UP2  | S    | REACTOR TRIMMING LOSSES                                     |
| 01 Apr | 720.0 | 5.0     | UP2  | S    | REACTOR TRIMMING LOSSES                                     |
| 01 May | 526.0 | 8.3     | UP2  | S    | REACTOR TRIMMING LOSSES                                     |
| 22 May | 218.0 | 47.3    | PF   | C    | STATUTORY OUTAGE WITH REFUELLING                            |
| 01 Jun | 720.0 | 156.2   | PF   | C    | STATUTORY OUTAGE WITH REFUELLING                            |
| 01 Jul | 168.0 | 36.5    | PF   | C    | STATUTORY OUTAGE WITH REFUELLING                            |
| 08 Jul | 576.0 | 125.0   | PF   | E11  | A NEW NII GRAPHITE SAFETY CASE REQUIRED INCLUDING SAMPLING. |
| 01 Aug | 744.0 | 161.4   | PF   | E11  | A NEW NII GRAPHITE SAFETY CASE REQUIRED INCLUDING SAMPLING. |
| 01 Sep | 720.0 | 156.2   | PF   | E11  | A NEW NII GRAPHITE SAFETY CASE REQUIRED INCLUDING SAMPLING. |
| 01 Oct | 744.0 | 161.4   | PF   | E11  | A NEW NII GRAPHITE SAFETY CASE REQUIRED INCLUDING SAMPLING. |
| 01 Nov | 720.0 | 156.2   | PF   | E11  | A NEW NII GRAPHITE SAFETY CASE REQUIRED INCLUDING SAMPLING. |
| 01 Dec | 744.0 | 161.4   | PF   | E11  | A NEW NII GRAPHITE SAFETY CASE REQUIRED INCLUDING SAMPLING. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          | 1   | 272       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1106            |           |          |   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 541   |           |          |
| E. Testing of plant systems or components  | 4248            |           |          |   |           | 0        |
| H. Nuclear regulatory requirements   |                 |           |          | 35  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 4        |
| Subtotal   | 5354            | 0         | 0        | 577   | 274       | 4        |
| Total  |                 | 5354      |          |   | 855       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                                   | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 6   |
| 12. Reactor I&C Systems                  |                    | 10  |
| 15. Reactor Cooling Systems              |                    | 37  |
| 21. Fuel Handling and Storage Facilities |                    | 1   |
| 31. Turbine and auxiliaries              |                    | 28  |
| 32. Feedwater and Main Steam System      |                    | 11  |
| 41. Main Generator Systems               |                    | 167   |
| 42. Electrical Power Supply Systems      |                    | 6   |
| Total                                    | 0                  | 266   |

# GB-11B OLDBURY-A2

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)  
**Contractor:** TNPG (THE NUCLEAR POWER GROUP LTD.)

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 217.0 MW(e)  
**Design Net RUP:** 300.0 MW(e)  
**Design Discharge Burnup:** 3600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1686.4 GW(e).h  
**Energy Availability Factor:** 88.4%  
**Load Factor:** 88.7%  
**Operating Factor:** 93.5%  
**Energy Unavailability Factor:** 11.6%  
**Total Off-line Time:** 573 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 142.5 | 120.9 | 161.1 | 154.0 | 136.7 | 111.3 | 153.9 | 122.5 | 141.3 | 130.0 | 153.9 | 158.2 | 1686.4 |
| <b>EAF (%)</b>  | 88.3  | 79.4  | 99.8  | 98.6  | 84.7  | 71.2  | 95.3  | 75.9  | 90.5  | 80.6  | 98.5  | 98.0  | 88.4   |
| <b>UCF (%)</b>  | 88.3  | 79.4  | 99.8  | 98.6  | 84.7  | 71.2  | 95.4  | 75.9  | 90.5  | 80.6  | 98.5  | 98.0  | 88.4   |
| <b>LF (%)</b>   | 88.3  | 82.9  | 99.8  | 98.7  | 84.7  | 71.2  | 95.3  | 75.9  | 90.5  | 80.4  | 98.5  | 98.0  | 88.7   |
| <b>OF (%)</b>   | 88.6  | 87.6  | 100.0 | 100.1 | 92.6  | 74.7  | 100.0 | 89.8  | 100.0 | 87.5  | 100.0 | 100.0 | 93.5   |
| <b>EUF (%)</b>  | 11.7  | 20.6  | 0.2   | 1.4   | 15.3  | 28.8  | 4.7   | 24.1  | 9.5   | 19.4  | 1.5   | 2.0   | 11.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 11.7  | 20.6  | 0.2   | 1.4   | 15.3  | 28.8  | 4.7   | 24.1  | 9.6   | 19.4  | 1.5   | 2.0   | 11.6   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 THERE WAS ONE AUTOMATIC SCRAM OF ABOUT THREE DAYS DURATION COMMENCING ON 15 AUGUST DUE TO A CONTROL ROD DROP. THERE WERE FOUR MANUAL OUTAGES. THE FIRST WAS OF ABOUT 4 DAYS DURATION COMMENCING ON 28 JANUARY DUE TO CIRCULATOR MAINTENANCE. THE SECOND WAS OF ABOUT 4 DAYS DURATION COMMENCING ON 02 FEBRUARY DUE TO A FEED MAIN AND CIRCULATOR REPAIR. THE THIRD OUTAGE WAS OF ABOUT 10 DAYS DURATION COMMENCING ON 29 MAY DUE TO LINE GUARD FAULT. THE FOURTH OUTAGE WAS OF ABOUT 4 DAYS DURATION COMMENCING 16 OCTOBER DUE BOILER FLUSHING.

## 5. Historical Summary

**Date of Construction Start:** 01 May 1962      **Lifetime Generation:** 1686.4 GW(e).h  
**Date of First Criticality:** 01 Dec 1967      **Cumulative Energy Availability Factor:** 88.4%  
**Date of Grid Connection:** 06 Apr 1968      **Cumulative Load Factor:** 88.7%  
**Date of Commercial Operation:** 30 Sep 1968      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 11.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 1686.4         | 217.0          | 88.4   | 88.4   | 88.4                              | 88.4   | 88.7               | 88.7   | 8187               | 93.5   |

## GB-11B OLDBURY-A2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 744.0 | 0.5     | UP2  | Z    | UNKNOWN LOSS  |
| 28 Jan | 85.0  | 18.4    | UF5  | A16  | MANUAL SCRAM AND FOLLOWING CIRCULATOR MAINTENANCE                           |
| 01 Feb | 12.0  | 2.6     | UF2  | A16  | CIRCULATOR MAINTENANCE  |
| 02 Feb | 95.0  | 20.6    | UF5  | A32  | MANUAL SCRAM AND FOLLOWING LP FEED MAIN AND CIRCULATOR REPAIR               |
| 15 Feb | 72.0  | 6.9     | UP2  | A16  | CIRCULATOR SEAL OIL PUMP REPAIRS  |
| 01 Mar | 744.0 | 0.4     | UP2  | S    | TRIMMING LOSSES   |
| 01 Apr | 720.0 | 2.3     | UP2  | S    | TRIMMING LOSSES   |
| 01 May | 689.0 | 12.8    | UP2  | S    | TRIMMING LOSSES   |
| 29 May | 55.0  | 11.9    | UF5  | A17  | MANUAL SCRAM DUE TO LINE GUARD (CIES/OLG) FAULT                             |
| 01 Jun | 182.0 | 39.5    | UF5  | A17  | CONTINUATION OF OUTAGE WITH MANUAL SCRAM DUE TO LINE GUARD (CIES/OLG) FAULT |
| 01 Jun | 538.0 | 5.5     | UP2  | S    | TRIMMING LOSSES   |
| 01 Jul | 744.0 | 7.5     | UP2  | S    | TRIMMING LOSSES   |
| 01 Aug | 668.0 | 14.0    | UP2  | S    | TRIMMING LOSSES   |
| 01 Aug | 300.0 | 8.4     | UP2  | A31  | TURBINE 2 CONDENSER LEAK  |
| 15 Aug | 76.0  | 16.5    | UF4  | A12  | AUTOMATIC SCRAM DUE TO CONTROL ROD DROP                                     |
| 01 Sep | 720.0 | 14.9    | UP2  | S    | TRIMMING LOSSES   |
| 01 Oct | 200.0 | 11.5    | UP2  | A16  | STEAM LEAK  |
| 16 Oct | 92.0  | 20.0    | UF2  | A16  | BOILER FLUSHING   |
| 01 Nov | 720.0 | 2.4     | UP2  | S    | TRIMMING LOSSES   |
| 01 Dec | 744.0 | 3.2     | UP2  | S    | TRIMMING LOSSES   |

### 7. Full Outages, Analysis by Cause

| Outage Cause  | 2004 Hours Lost |           |          | 1972 to 2004<br>Average Hours Lost Per Year |           |          |
|---|-----------------|-----------|----------|---|-----------|----------|
|   | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure                              |                 | 597       |          |   | 40        | 1        |
| D. Inspection, maintenance or repair without refuelling |                 |           |          | 415   |           |          |
| H. Nuclear regulatory requirements                      |                 |           |          | 79  |           |          |
| Subtotal  | 0               | 597       | 0        | 494   | 40        | 1        |
| Total   |                 | 597       |          |   | 535       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 4  |
| 12. Reactor I&C Systems                        | 76              | 10                                       |
| 15. Reactor Cooling Systems                    |                 | 4  |
| 16. Steam generation systems                   | 189             |  |
| 17. Safety I&C Systems (excluding reactor I&C) | 237             |  |
| 21. Fuel Handling and Storage Facilities       |                 | 7  |
| 31. Turbine and auxiliaries                    |                 | 6  |
| 32. Feedwater and Main Steam System            | 95              | 1  |
| 41. Main Generator Systems                     |                 | 1  |
| 42. Electrical Power Supply Systems            |                 | 4  |
| Total  | 597             | 37                                       |

# GB-10A SIZEWELL-A1

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)

**Contractor:** EE/B&W/T (THE ENGLISH ELECTRIC CO. LTD / BABCOCK & WILCOX CO. / TAYLOR WOODROW CONSTRUCTION

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 210.0 MW(e)  
**Design Net RUP:** 290.0 MW(e)  
**Design Discharge Burnup:** 3600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 526.5 GW(e).h  
**Energy Availability Factor:** 28.3%  
**Load Factor:** 28.6%  
**Operating Factor:** 28.6%  
**Energy Unavailability Factor:** 71.7%  
**Total Off-line Time:** 6253 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 156.2 | 146.2 | 90.1 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 134.0 | 526.5  |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 57.7 | -0.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1  | 0.0   | 85.8  | 28.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 57.7 | -0.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1  | 0.0   | 85.8  | 28.4   |
| <b>LF (%)</b>   | 100.0 | 103.6 | 57.7 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 85.8  | 28.6   |
| <b>OF (%)</b>   | 100.0 | 103.6 | 57.7 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 85.8  | 28.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 42.3 | 100.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9 | 100.0 | 14.2  | 71.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0  | 50.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9 | 6.7   | 0.0   | 55.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 42.3 | 49.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 93.3  | 14.2  | 16.6   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 THERE WAS ONE MANUAL OUTAGE COMMENCING ON 18 MARCH. THIS WAS DUE TO A GENERATOR TRANSFORMER REPLACEMENT. THE DURATION THAT THE REACTOR WAS OUT OF SERVICE WAS ABOUT 262 DAYS. WITHIN THIS OUTAGE A STATUTORY OUTAGE WAS CARRIED OUT.

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1961      **Lifetime Generation:** 84338.7 GW(e).h  
**Date of First Criticality:** 01 Jun 1965      **Cumulative Energy Availability Factor:** 76.8%  
**Date of Grid Connection:** 21 Jan 1966      **Cumulative Load Factor:** 70.9%  
**Date of Commercial Operation:** 25 Mar 1966      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 23.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1976 | 3403.0         | 420.0          | 100.0  | 98.0   | 89.9                              | 84.6   | 91.0               | 68.3   | 8904               | 100.0  |
| 1977 | 3324.0         | 420.0          | 100.0  | 98.2   | 90.1                              | 85.1   | 90.6               | 70.4   | 8736               | 100.0  |
| 1978 | 3372.0         | 420.0          | 100.0  | 98.3   | 90.9                              | 85.6   | 91.9               | 72.3   | 8736               | 100.0  |
| 1979 | 3310.0         | 420.0          | 91.0   | 97.7   | 90.9                              | 86.0   | 90.2               | 73.8   | 8736               | 100.0  |
| 1980 | 2792.0         | 420.0          | 77.5   | 96.2   | 77.5                              | 85.4   | 76.1               | 73.9   | 8694               | 99.5   |
| 1981 | 2131.0         | 420.0          | 55.3   | 93.3   | 55.3                              | 83.3   | 57.0               | 72.7   | 8735               | 98.1   |
| 1982 | 1889.0         | 420.0          | 56.1   | 90.9   | 56.1                              | 81.5   | 51.5               | 71.4   | 8659               | 99.1   |
| 1983 | 3151.0         | 420.0          | 92.4   | 91.0   | 92.4                              | 82.2   | 85.9               | 72.2   | 8736               | 100.0  |
| 1984 | 1845.0         | 420.0          | 49.2   | 88.6   | 49.2                              | 80.3   | 50.3               | 71.0   | 7256               | 83.1   |
| 1985 | 2688.8         | 420.0          | 78.6   | 88.1   | 71.1                              | 79.8   | 73.3               | 71.1   | 8691               | 99.5   |
| 1986 | 1990.5         | 420.0          | 58.8   | 86.6   | 53.2                              | 78.4   | 54.3               | 70.2   | 8660               | 99.1   |
| 1987 | 2760.0         | 420.0          | 80.2   | 86.2   | 73.1                              | 78.2   | 73.8               | 70.4   | 8904               | 100.0  |
| 1988 | 2672.6         | 420.0          | 76.1   | 85.8   | 72.0                              | 77.9   | 72.8               | 70.5   | 8530               | 97.6   |
| 1989 | 2595.0         | 420.0          | 70.8   | 85.1   | 70.0                              | 77.5   | 70.7               | 70.5   | 8433               | 96.5   |
| 1990 | 2691.7         | 420.0          | 72.9   | 84.6   | 72.9                              | 77.3   | 73.4               | 70.7   | 8016               | 91.8   |
| 1991 | 2746.4         | 420.0          | 78.7   | 84.3   | 78.7                              | 77.4   | 74.9               | 70.8   | 8655               | 99.1   |
| 1992 | 2266.8         | 420.0          | 67.0   | 83.7   | 66.9                              | 77.0   | 60.6               | 70.4   | 8077               | 90.7   |
| 1993 | 3023.4         | 420.0          | 84.8   | 83.7   | 82.0                              | 77.2   | 82.4               | 70.9   | 8730               | 99.9   |
| 1994 | 3375.7         | 420.0          | 91.7   | 84.0   | 91.7                              | 77.7   | 92.0               | 71.6   | 8125               | 93.0   |
| 2004 | 526.5          | 210.0          | 28.4   | 83.0   | 28.3                              | 76.8   | 28.6               | 70.9   | 2507               | 28.6   |

## GB-10A SIZEWELL-A1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 18 Mar | 315.0 | 66.2    | UF5  | A42  | GENERATOR TRANSFORMER FAULT                                      |
| 01 Apr | 357.0 | 75.0    | UF2  | A42  | GENERATOR TRANSFORMER FAULT                                      |
| 14 Apr | 363.0 | 76.2    | PF   | G42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME                      |
| 01 May | 744.0 | 156.2   | PF   | G42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME                      |
| 01 Jun | 720.0 | 151.2   | PF   | G42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME                      |
| 01 Jul | 744.0 | 156.2   | PF   | G42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME                      |
| 01 Aug | 744.0 | 156.2   | PF   | F42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME AND STATUTORY OUTAGE |
| 01 Sep | 720.0 | 151.2   | PF   | F42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME AND STATUTORY OUTAGE |
| 01 Oct | 744.0 | 156.2   | PF   | G42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME AND STATUTORY OUTAGE |
| 01 Nov | 48.0  | 10.1    | PF   | G42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME AND STATUTORY OUTAGE |
| 03 Nov | 672.0 | 141.1   | UF3  | A42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME OVERRUN              |
| 01 Dec | 105.8 | 22.2    | UF3  | A42  | GENERATOR TRANSFORMER REPLACEMENT PROGRAMME OVERRUN              |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 1449      |          | 21  | 396       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 577   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 7   | 1         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         | 1464            |           |          |   |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      | 3363            |           |          |   | 0         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   |           | 12       |
| Subtotal   | 4827            | 1449      | 0        | 605   | 399       | 12       |
| Total  |                 | 6276      |          |   | 1016      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|--|-----------------|---|
| 11. Reactor and Accessories              |                 | 69  |
| 12. Reactor I&C Systems                  |                 | 12  |
| 13. Reactor Auxiliary Systems            |                 | 21  |
| 14. Safety Systems                       |                 | 4   |
| 15. Reactor Cooling Systems              |                 | 67  |
| 16. Steam generation systems             |                 | 5   |
| 21. Fuel Handling and Storage Facilities |                 | 3   |
| 31. Turbine and auxiliaries              |                 | 13  |
| 32. Feedwater and Main Steam System      |                 | 26  |
| 33. Circulating Water System             |                 | 17  |
| 41. Main Generator Systems               |                 | 91  |
| 42. Electrical Power Supply Systems      | 1449            | 3   |
| XX. Miscellaneous Systems                |                 | 7   |
| Total                                    | 1449            | 338   |

# GB-10B SIZEWELL-A2

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)

**Contractor:** EE/B&W/T (THE ENGLISH ELECTRIC CO. LTD / BABCOCK & WILCOX CO. / TAYLOR WOODROW CONSTRUCTION

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 210.0 MW(e)  
**Design Net RUP:** 290.0 MW(e)  
**Design Discharge Burnup:** 3600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 1710.6 GW(e).h  
**Energy Availability Factor:** 92.7%  
**Load Factor:** 93.0%  
**Operating Factor:** 98.3%  
**Energy Unavailability Factor:** 7.3%  
**Total Off-line Time:** 152 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 156.2 | 146.2 | 155.3 | 130.6 | 153.9 | 145.2 | 142.6 | 138.7 | 119.5 | 134.7 | 133.4 | 154.4 | 1710.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.4  | 86.3  | 98.5  | 96.0  | 91.3  | 88.8  | 79.1  | 86.2  | 88.2  | 98.8  | 92.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 99.4  | 86.8  | 98.5  | 96.1  | 95.9  | 94.1  | 81.0  | 88.2  | 92.2  | 98.8  | 94.3   |
| <b>LF (%)</b>   | 100.0 | 103.6 | 99.4  | 86.5  | 98.5  | 96.0  | 91.3  | 88.8  | 79.1  | 86.1  | 88.2  | 98.8  | 93.0   |
| <b>OF (%)</b>   | 100.0 | 103.6 | 100.0 | 87.9  | 100.0 | 100.0 | 100.0 | 100.0 | 87.8  | 99.9  | 100.0 | 100.0 | 98.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.6   | 13.7  | 1.5   | 4.0   | 8.7   | 11.2  | 20.9  | 13.8  | 11.8  | 1.2   | 7.3    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.6   | 13.2  | 1.5   | 4.0   | 4.1   | 5.9   | 19.0  | 11.8  | 7.8   | 1.2   | 5.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.4   | 0.0   | 0.0   | 4.7   | 5.3   | 2.0   | 1.9   | 4.0   | 0.0   | 1.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 THERE WERE TWO OUTAGES. THE FIRST WAS ABOUT 4 DAYS DURATION COMMENCING ON 19 APRIL DUE TO A LIGHTNING STRIKE ON AN OVERHEAD LINE. THE SECOND OUTAGE WAS ABOUT 4 DAYS COMMENCING ON 24 SEPTEMBER DUE TO ALTERNATOR PROTECTION.

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1961      **Lifetime Generation:** 1710.6 GW(e).h  
**Date of First Criticality:** 01 Dec 1965      **Cumulative Energy Availability Factor:** 92.7%  
**Date of Grid Connection:** 09 Apr 1966      **Cumulative Load Factor:** 93.0%  
**Date of Commercial Operation:** 15 Sep 1966      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 7.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 1710.6         | 210.0          | 94.3   | 94.3   | 92.7                              | 92.7   | 93.0               | 93.0   | 8608               | 98.3   |



## GB-10B SIZEWELL-A2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Mar | 744.0 | 0.9     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Apr | 720.0 | 1.5     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Apr | 720.0 | 0.6     | XP   | N33  | COOLING WATER LIMITATION                                    |
| 19 Apr | 88.0  | 18.5    | UF5  | A42  | MANUAL SCRAM DUE TO A LIGHTNING STRIKE ON AN OVERHEAD LINE. |
| 01 May | 744.0 | 2.4     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Jun | 720.0 | 6.0     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Jul | 744.0 | 6.3     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Jul | 744.0 | 7.3     | XP   | N33  | COOLING WATER LIMITATION                                    |
| 01 Aug | 744.0 | 9.2     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Aug | 744.0 | 8.3     | XP   | N33  | COOLING WATER LIMITATION                                    |
| 01 Sep | 720.0 | 3.2     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Sep | 720.0 | 3.0     | XP   | N33  | COOLING WATER LIMITATION                                    |
| 01 Sep | 720.0 | 7.0     | UP2  | A16  | BOILER CIRCUIT REPAIRS                                      |
| 24 Sep | 88.0  | 18.5    | UF5  | A41  | MANUAL SCRAM DUE TO ALTERNATOR PROTECTION FAULT             |
| 01 Oct | 744.0 | 14.0    | UP2  | A16  | BOILER CIRCUIT REPAIRS                                      |
| 01 Oct | 744.0 | 4.5     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Oct | 744.0 | 3.0     | XP   | N33  | COOLING WATER LIMITATION                                    |
| 01 Nov | 720.0 | 6.8     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |
| 01 Nov | 720.0 | 6.0     | XP   | N33  | COOLING WATER LIMITATION                                    |
| 01 Nov | 720.0 | 5.0     | UP2  | A16  | BOILER CIRCUIT REPAIRS                                      |
| 01 Dec | 744.0 | 1.9     | UP2  | S    | REACTIVITY RESTRICTIONS                                     |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 176       |          |  | 227       |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 629                                      | 1         |          |
| E. Testing of plant systems or components  |                 |           |          |  |           | 0        |
| H. Nuclear regulatory requirements   |                 |           |          | 37                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1         | 6        |
| Subtotal   | 0               | 176       | 0        | 666                                      | 229       | 6        |
| Total  |                 | 176       |          |  | 901       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 1  |
| 12. Reactor I&C Systems                        |                 | 6  |
| 15. Reactor Cooling Systems                    |                 | 26                                       |
| 16. Steam generation systems                   |                 | 17                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 6  |
| 32. Feedwater and Main Steam System            |                 | 9  |
| 33. Circulating Water System                   |                 | 5  |
| 41. Main Generator Systems                     | 88              | 4  |
| 42. Electrical Power Supply Systems            | 88              | 2  |
| Total  | 176             | 78                                       |

# GB-13A WYLFA 1

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)

**Contractor:** EE/B&W/T (THE ENGLISH ELECTRIC CO. LTD / BABCOCK & WILCOX CO. / TAYLOR WOODROW CONSTRUCTION

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 490.0 MW(e)  
**Design Net RUP:** 550.0 MW(e)  
**Design Discharge Burnup:** 3600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4144.3 GW(e).h  
**Energy Availability Factor:** 96.1%  
**Load Factor:** 96.3%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 3.9%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 354.5 | 346.7 | 367.6 | 350.2 | 338.2 | 346.0 | 347.9 | 340.6 | 334.0 | 333.2 | 333.1 | 352.3 | 4144.3 |
| <b>EAF (%)</b>  | 97.3  | 100.0 | 100.0 | 99.3  | 92.8  | 98.1  | 95.4  | 93.4  | 94.7  | 91.4  | 94.4  | 96.6  | 96.1   |
| <b>UCF (%)</b>  | 97.3  | 100.0 | 100.0 | 99.3  | 92.8  | 98.7  | 97.7  | 96.2  | 97.1  | 93.1  | 95.6  | 97.2  | 97.0   |
| <b>LF (%)</b>   | 97.3  | 101.7 | 100.8 | 99.3  | 92.8  | 98.1  | 95.4  | 93.4  | 94.7  | 91.4  | 94.4  | 96.6  | 96.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 2.7   | 0.0   | 0.0   | 0.7   | 7.2   | 1.9   | 4.6   | 6.6   | 5.3   | 8.6   | 5.6   | 3.4   | 3.9    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 2.8   | 0.0   | 0.0   | 0.8   | 7.2   | 1.3   | 2.3   | 3.8   | 2.9   | 7.0   | 4.5   | 2.8   | 3.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 2.2   | 2.7   | 2.4   | 1.6   | 1.1   | 0.5   | 0.9    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 THE REACTOR WAS ALWAYS CRITICAL AND ON LINE.

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1963      **Lifetime Generation:** 130357.6 GW(e).h  
**Date of First Criticality:** 01 Nov 1969      **Cumulative Energy Availability Factor:** 71.8%  
**Date of Grid Connection:** 24 Jan 1971      **Cumulative Load Factor:** 72.3%  
**Date of Commercial Operation:** 01 Nov 1971      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 28.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1974 | 4364.0         | 840.0          | 100.0  | 100.0  | 59.5                              | 41.3   | 59.5               | 41.3   | 8568               | 98.1   |
| 1975 | 1583.0         | 840.0          | 100.0  | 100.0  | 21.6                              | 36.6   | 21.6               | 36.6   | 4437               | 50.8   |
| 1976 | 4818.0         | 840.0          | 100.0  | 100.0  | 66.8                              | 42.5   | 64.4               | 42.0   | 8633               | 97.0   |
| 1977 | 4984.0         | 840.0          | 100.0  | 100.0  | 70.0                              | 46.9   | 67.9               | 46.2   | 8008               | 91.7   |
| 1978 | 3801.0         | 840.0          | 100.0  | 100.0  | 52.5                              | 47.7   | 51.8               | 47.0   | 7739               | 88.6   |
| 1979 | 5200.0         | 840.0          | 100.0  | 100.0  | 74.9                              | 51.0   | 70.9               | 49.9   | 8694               | 99.5   |
| 1980 | 5764.0         | 840.0          | 78.2   | 97.6   | 78.1                              | 54.0   | 78.5               | 53.0   | 8609               | 98.5   |
| 1981 | 6234.0         | 840.0          | 83.3   | 96.2   | 83.2                              | 56.9   | 83.3               | 56.0   | 8823               | 99.1   |
| 1982 | 6040.0         | 840.0          | 81.8   | 94.9   | 81.7                              | 59.1   | 81.4               | 58.3   | 8700               | 98.5   |
| 1983 | 6296.0         | 840.0          | 84.7   | 94.1   | 83.9                              | 61.1   | 85.8               | 60.6   | 8715               | 99.8   |
| 1984 | 6757.0         | 840.0          | 89.5   | 93.7   | 89.5                              | 63.3   | 92.1               | 62.9   | 8728               | 99.9   |
| 1985 | 6682.5         | 840.0          | 88.5   | 93.4   | 88.4                              | 65.1   | 91.1               | 64.9   | 8736               | 100.0  |
| 1986 | 4099.9         | 840.0          | 62.1   | 91.3   | 61.9                              | 64.8   | 55.7               | 64.3   | 7939               | 90.6   |
| 1987 | 4499.4         | 840.0          | 59.1   | 89.3   | 58.8                              | 64.5   | 60.2               | 64.1   | 8611               | 96.7   |
| 1988 | 6172.4         | 840.0          | 84.3   | 89.0   | 83.8                              | 65.6   | 84.1               | 65.2   | 8530               | 97.6   |
| 1989 | 6614.0         | 840.0          | 86.9   | 88.9   | 86.9                              | 66.8   | 89.6               | 66.6   | 8572               | 97.6   |
| 1990 | 6746.4         | 840.0          | 89.9   | 88.9   | 89.9                              | 68.0   | 91.9               | 67.9   | 8549               | 97.9   |
| 1991 | 7451.3         | 840.0          | 91.5   | 89.1   | 89.7                              | 69.0   | 101.5              | 69.5   | 8374               | 95.9   |
| 1992 | 7795.2         | 950.0          | 92.3   | 89.2   | 92.1                              | 70.3   | 92.2               | 70.8   | 8904               | 100.0  |
| 1993 | 7215.2         | 950.0          | 87.0   | 89.1   | 86.8                              | 71.1   | 86.9               | 71.6   | 8477               | 97.0   |
| 1994 | 6111.0         | 950.0          | 76.1   | 88.5   | 72.4                              | 71.2   | 73.6               | 71.7   | 6933               | 79.4   |
| 2004 | 4144.3         | 490.0          | 97.0   | 88.7   | 96.1                              | 71.8   | 96.3               | 72.3   | 8784               | 100.0  |

# GB-13A WYLFA 1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                   |
|--------|-------|---------|------|------|---|
| 01 Jan | 96.0  | 10.0    | UP2  | A16  | BOILER LEAK SEARCH AND REPAIR.                |
| 01 Apr | 48.0  | 2.6     | UP2  | A16  | BOILER LEAK SEARCH AND REPAIR.                |
| 01 May | 168.0 | 7.1     | UP2  | A31  | TURBINE 1 TRIP GLAND STEAM CONTROLLER FAULT   |
| 01 May | 36.0  | 3.1     | UP2  | A31  | TURBINE 2 TRIP EARTH FAULT, STATOR WATER LEAK |
| 01 May | 168.0 | 16.2    | UP2  | A16  | BOILER LEAK SEARCH AND REPAIR.                |
| 01 Jun | 720.0 | 2.1     | XP   | N33  | COOLING WATER TEMPERATURE LOSSES              |
| 01 Jun | 168.0 | 2.4     | UP2  | A31  | TURBINE 2 WEED IN CONDENSER                   |
| 01 Jun | 96.0  | 2.3     | UP2  | A31  | CONDENSER PASS OUTAGES                        |
| 01 Jul | 744.0 | 8.2     | XP   | N33  | CW TEMPERATURE LOSSES                         |
| 01 Jul | 48.0  | 1.2     | UP2  | A31  | CONDENSER PASS LOSSES                         |
| 01 Jul | 48.0  | 7.3     | UP2  | A31  | TURBINE 2 SPEEDER GEAR FAULT                  |
| 01 Aug | 48.0  | 2.5     | UP2  | A31  | CONDENSER PASS LOSSES                         |
| 01 Aug | 744.0 | 10.0    | XP   | N33  | COOLING WATER LOSSES                          |
| 01 Aug | 72.0  | 8.0     | UP2  | A16  | BOILER LEAK SEARCH LOSSES                     |
| 01 Aug | 744.0 | 3.5     | UP   | A31  | TURBINE 2 OVERDOSING                          |
| 01 Sep | 48.0  | 2.0     | UP2  | A31  | CONDENSER PASS LOSSES                         |
| 01 Sep | 720.0 | 8.5     | XP   | N33  | COOLING WATER TEMPERATURE LOSSES              |
| 01 Sep | 48.0  | 4.0     | UP2  | A16  | BOILER LEAK SEARCH AND REPAIR LOSSES          |
| 01 Sep | 720.0 | 4.3     | UP   | A31  | TURBINE 2 OVERDOSING                          |
| 01 Oct | 744.0 | 6.0     | XP   | N33  | COOLING WATER TEMPERATURE LOSSES              |
| 01 Oct | 744.0 | 4.0     | UP   | A33  |   |
| 01 Oct | 120.0 | 19.3    | UP2  | A16  | BOILER LEAK SEARCH AND REPAIR LOSSES          |
| 01 Oct | 744.0 | 2.0     | UP   | A31  | TURBINE 2 OVERDOSING                          |
| 01 Nov | 720.0 | 3.0     | UP   | A31  | TURBINE 2 OVERDOSING                          |
| 01 Nov | 96.0  | 12.7    | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIR.              |
| 01 Nov | 720.0 | 4.0     | XP   | N33  | COOLING WATER TEMPERATURE LOSSES              |
| 01 Dec | 72.0  | 8.2     | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS.             |
| 01 Dec | 744.0 | 2.0     | XP   | N33  | COOLING WATER TEMPERATURE LOSSES              |
| 01 Dec | 744.0 | 2.0     | UP   | A31  | TURBINE 2 OVERDOSING                          |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 438       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 34                                       | 9         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 549                                      |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 19                                       | 9         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         | 16       |
| Subtotal   | 0               | 0         | 0        | 602                                      | 458       | 18       |
| Total  |                 | 0         |          |  | 1078      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 10                                       |
| 12. Reactor I&C Systems                  |                 | 33                                       |
| 13. Reactor Auxiliary Systems            |                 | 0  |
| 14. Safety Systems                       |                 | 4  |
| 15. Reactor Cooling Systems              |                 | 25                                       |
| 16. Steam generation systems             |                 | 35                                       |
| 21. Fuel Handling and Storage Facilities |                 | 15                                       |
| 31. Turbine and auxiliaries              |                 | 114                                      |
| 32. Feedwater and Main Steam System      |                 | 35                                       |
| 41. Main Generator Systems               |                 | 0  |
| 42. Electrical Power Supply Systems      |                 | 4  |
| Total                                    | 0               | 275                                      |

# GB-13B WYLFA 2

**Operator:** BNFL (BRITISH NUCLEAR FUELS PLC)

**Contractor:** EE/B&W/T (THE ENGLISH ELECTRIC CO. LTD / BABCOCK & WILCOX CO. / TAYLOR WOODROW CONSTRUCTION

## 1. Station Details

**Type:** GCR  
**Net Reference Unit Power at the beginning of 2004:** 490.0 MW(e)  
**Design Net RUP:** 550.0 MW(e)  
**Design Discharge Burnup:** 3600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3247.0 GW(e).h  
**Energy Availability Factor:** 75.4%  
**Load Factor:** 75.6%  
**Operating Factor:** 83.3%  
**Energy Unavailability Factor:** 24.6%  
**Total Off-line Time:** 1464 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 346.9 | 330.0 | 355.0 | 19.6 | 10.7 | 297.1 | 331.4 | 328.0 | 331.0 | 272.5 | 287.5 | 337.3 | 3247.0 |
| <b>EAF (%)</b>  | 95.2  | 96.7  | 97.4  | 5.4  | 2.9  | 84.2  | 90.9  | 90.0  | 93.8  | 74.8  | 81.5  | 92.5  | 75.4   |
| <b>UCF (%)</b>  | 95.2  | 96.7  | 97.4  | 5.4  | 2.9  | 84.2  | 90.9  | 90.0  | 93.8  | 74.8  | 81.5  | 92.5  | 75.4   |
| <b>LF (%)</b>   | 95.2  | 100.2 | 97.4  | 5.6  | 2.9  | 84.2  | 90.9  | 90.0  | 93.8  | 74.6  | 81.5  | 92.5  | 75.6   |
| <b>OF (%)</b>   | 100.0 | 103.6 | 100.0 | 5.6  | 5.8  | 100.0 | 100.0 | 100.0 | 100.0 | 85.5  | 100.0 | 100.0 | 83.3   |
| <b>EUF (%)</b>  | 4.8   | 3.3   | 2.6   | 94.6 | 97.1 | 15.8  | 9.1   | 10.0  | 6.2   | 25.2  | 18.5  | 7.5   | 24.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 94.6 | 83.9 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 14.9   |
| <b>UCLF (%)</b> | 4.8   | 3.3   | 2.6   | 0.0  | 13.2 | 15.8  | 9.1   | 10.0  | 6.2   | 25.2  | 18.5  | 7.5   | 9.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

DURING 2004 A STATUTORY OUTAGE OF ABOUT 54 DAYS DURATION COMMENCED ON 02 APRIL. THERE WAS AN OVERRUN OF ABOUT 3 DAYS DURATION. THE MANUAL OUTAGE OF ABOUT 4 DAYS DURATION COMMENCED ON 24 OCTOBER DUE TO ROTOR BLADE TIP.

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1963      **Lifetime Generation:** 3247.0 GW(e).h  
**Date of First Criticality:** 01 Sep 1970      **Cumulative Energy Availability Factor:** 75.4%  
**Date of Grid Connection:** 21 Jul 1971      **Cumulative Load Factor:** 75.6%  
**Date of Commercial Operation:** 03 Jan 1972      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 24.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 2004 | 3247.0         | 490.0          | 75.4   | 75.4   | 75.4                              | 75.4   | 75.6               | 75.6   | 7296               | 83.3   |

## GB-13B WYLFA 2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                       |
|--------|-------|---------|------|------|-----------------------------------|
| 01 Jan | 168.0 | 17.6    | UP2  | A16  | BOILER LEAK SEARCH AND REPAIRS    |
| 01 Feb | 120.0 | 11.0    | UP2  | A16  | BOILER LEAK SEARCH AND REPAIRS    |
| 01 Mar | 96.0  | 9.5     | UP2  | A16  | BOILER LEAK SEARCH AND REPAIRS    |
| 02 Apr | 680.0 | 333.2   | PF   | C    | STATUTORY OUTAGE                  |
| 01 May | 624.0 | 305.8   | PF   | C    | CONTINUATION OF STATUTORY OUTAGE  |
| 27 May | 77.0  | 37.7    | UF3  | A    | OVERRUN TO STATUTORY OUTAGE       |
| 30 May | 43.0  | 10.4    | UP   | S    | LOSSES ON RETURNING TO POWER      |
| 01 Jun | 300.0 | 50.7    | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS  |
| 01 Jun | 720.0 | 5.0     | XP   | N33  | COOLING WATER LOSSES              |
| 01 Jul | 175.0 | 20.2    | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS  |
| 01 Jul | 744.0 | 5.0     | XP   | N33  | COOLING WATER LOSSES              |
| 01 Jul | 744.0 | 8.0     | UP2  | A31  | TURBINE OVERDOSING                |
| 01 Aug | 150.0 | 16.6    | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS  |
| 01 Aug | 744.0 | 10.0    | XP   | N33  | COOLING WATER LOSSES              |
| 01 Aug | 744.0 | 10.0    | UP2  | A31  | TURBINE OVERDOSING                |
| 01 Sep | 72.0  | 5.8     | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS  |
| 01 Sep | 720.0 | 7.0     | XP   | N33  | COOLING WATER LOSSES              |
| 01 Sep | 720.0 | 9.0     | UP2  | A31  | TURBINE OVERDOSING                |
| 01 Oct | 600.0 | 39.7    | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS. |
| 24 Oct | 107.0 | 52.4    | UF5  | A31  | TURBINE 4 LOSS OF BLADE TIP.      |
| 01 Nov | 700.0 | 65.3    | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS  |
| 01 Dec | 192.0 | 22.3    | UP2  | A16  | BOILER LEAK SEARCHES AND REPAIRS  |
| 01 Dec | 744.0 | 5.0     | UP2  | A31  | TURBINE OVERDOSING                |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 184       |          |  | 323       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1304            |           |          | 4  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 546                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          |  | 2         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  |           | 16       |
| Subtotal   | 1304            | 184       | 0        | 550                                      | 333       | 16       |
| Total  |                 | 1488      |          |  | 899       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 16                                       |
| 12. Reactor I&C Systems                        |                 | 13                                       |
| 14. Safety Systems                             |                 | 2  |
| 15. Reactor Cooling Systems                    |                 | 53                                       |
| 16. Steam generation systems                   |                 | 115                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 9  |
| 21. Fuel Handling and Storage Facilities       |                 | 1  |
| 31. Turbine and auxiliaries                    | 107             | 86                                       |
| 32. Feedwater and Main Steam System            |                 | 12                                       |
| 41. Main Generator Systems                     |                 | 4  |
| 42. Electrical Power Supply Systems            |                 | 6  |
| Total  | 107             | 317                                      |

# US-313 ARKANSAS ONE-1

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** B&W (BABCOCK & WILCOX CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 836.0 MW(e)  
**Design Net RUP:** 850.0 MW(e)  
**Design Discharge Burnup:** 29133 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6827.6 GW(e).h  
**Energy Availability Factor:** 91.6%  
**Load Factor:** 93.0%  
**Operating Factor:** 91.6%  
**Energy Unavailability Factor:** 8.4%  
**Total Off-line Time:** 739 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 639.8 | 598.2 | 639.4 | 404.6 | 349.2 | 435.9 | 629.3 | 629.2 | 611.0 | 637.7 | 619.3 | 633.9 | 6827.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 63.1  | 62.6  | 72.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 63.1  | 62.6  | 72.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.6   |
| <b>LF (%)</b>   | 102.9 | 102.8 | 102.8 | 67.3  | 56.1  | 72.4  | 101.2 | 101.2 | 101.5 | 102.4 | 102.9 | 101.9 | 93.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 66.2  | 59.7  | 72.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 36.9  | 37.4  | 27.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.4    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 36.9  | 37.4  | 27.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.4    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1968  
**Date of First Criticality:** 06 Aug 1974  
**Date of Grid Connection:** 17 Aug 1974  
**Date of Commercial Operation:** 19 Dec 1974

**Lifetime Generation:** 159513.7 GW(e).h  
**Cumulative Energy Availability Factor:** 77.4%  
**Cumulative Load Factor:** 72.6%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 22.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3220.6         | 836.0          | 48.3   | 63.1   | 48.3                              | 61.8   | 44.0               | 58.1   | 4191               | 47.8   |
| 1984 | 4604.1         | 836.0          | 70.1   | 63.8   | 70.1                              | 62.7   | 62.7               | 58.5   | 6150               | 70.0   |
| 1985 | 5190.4         | 836.0          | 78.3   | 65.1   | 78.3                              | 64.1   | 70.9               | 59.6   | 6852               | 78.2   |
| 1986 | 3589.9         | 836.0          | 62.2   | 64.8   | 62.2                              | 63.9   | 49.0               | 58.8   | 5446               | 62.2   |
| 1987 | 4763.3         | 836.0          | 88.2   | 66.7   | 88.2                              | 65.8   | 65.0               | 59.2   | 7720               | 88.1   |
| 1988 | 3963.2         | 836.0          | 68.3   | 66.8   | 68.3                              | 66.0   | 54.0               | 58.9   | 5996               | 68.3   |
| 1989 | 3377.0         | 836.0          | 67.1   | 66.8   | 67.1                              | 66.0   | 46.1               | 58.0   | 5871               | 67.0   |
| 1990 | 4145.8         | 836.0          | 75.9   | 67.4   | 75.9                              | 66.7   | 56.6               | 57.9   | 6437               | 73.5   |
| 1991 | 6540.5         | 836.0          | 91.3   | 68.8   | 91.3                              | 68.1   | 89.3               | 59.8   | 7991               | 91.2   |
| 1992 | 5833.1         | 836.0          | 80.7   | 69.4   | 80.7                              | 68.8   | 79.4               | 60.9   | 7088               | 80.7   |
| 1993 | 6126.5         | 836.0          | 85.9   | 70.3   | 85.9                              | 69.7   | 83.7               | 62.1   | 7520               | 85.8   |
| 1994 | 7198.6         | 836.0          | 98.7   | 71.7   | 98.7                              | 71.2   | 98.3               | 63.9   | 8643               | 98.7   |
| 1995 | 5978.2         | 836.0          | 85.6   | 72.4   | 85.6                              | 71.9   | 81.6               | 64.7   | 7493               | 85.5   |
| 1996 | 6287.0         | 836.0          | 86.7   | 73.0   | 86.7                              | 72.5   | 85.6               | 65.7   | 7613               | 86.7   |
| 1997 | 7251.1         | 836.0          | 99.6   | 74.2   | 99.6                              | 73.7   | 99.0               | 67.1   | 8723               | 99.6   |
| 1998 | 6216.8         | 836.0          | 84.1   | 74.6   | 84.1                              | 74.1   | 84.9               | 67.9   | 7364               | 84.1   |
| 1999 | 6714.7         | 836.0          | 90.3   | 75.2   | 90.3                              | 74.8   | 91.7               | 68.8   | 7907               | 90.3   |
| 2000 | 6410.1         | 836.0          | 88.2   | 75.7   | 88.2                              | 75.3   | 87.3               | 69.5   | 7748               | 88.2   |
| 2001 | 6875.5         | 836.0          | 91.8   | 76.3   | 91.8                              | 75.9   | 93.9               | 70.4   | 8100               | 92.5   |
| 2002 | 6568.6         | 836.0          | 89.2   | 76.8   | 89.1                              | 76.4   | 89.7               | 71.1   | 7820               | 89.3   |
| 2003 | 6794.3         | 836.0          | 91.8   | 77.3   | 91.8                              | 76.9   | 92.8               | 71.9   | 8050               | 91.9   |
| 2004 | 6827.6         | 836.0          | 91.6   | 77.8   | 91.6                              | 77.4   | 93.0               | 72.6   | 8045               | 91.6   |

**US-313 ARKANSAS ONE-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 20 Apr | 541.7 | 455.0   | PF   | C21  | REFUELLING OUTAGE.  |
| 11 Jun | 195.7 | 164.4   | PF   | D31  | SHUTDOWN TO REPAIR A MAIN LP TURBINE DIAPHRAGM GASKET LEAK. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 666       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 541             |           |          | 924   |           |          |
| D. Inspection, maintenance or repair without refuelling  | 195             |           |          | 150   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3   | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   |           | 53       |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 63  | 4         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |   | 2         |          |
| Subtotal   | 736             | 0         | 0        | 1140  | 680       | 54       |
| Total  |                 | 736       |          |   | 1874      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1975 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 98  |
| 12. Reactor I&C Systems                        |                    | 38  |
| 13. Reactor Auxiliary Systems                  |                    | 16  |
| 14. Safety Systems                             |                    | 31  |
| 15. Reactor Cooling Systems                    |                    | 51  |
| 16. Steam generation systems                   |                    | 57  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 23  |
| 31. Turbine and auxiliaries                    |                    | 122   |
| 32. Feedwater and Main Steam System            |                    | 77  |
| 33. Circulating Water System                   |                    | 11  |
| 35. All other I&C Systems                      |                    | 1   |
| 41. Main Generator Systems                     |                    | 95  |
| 42. Electrical Power Supply Systems            |                    | 39  |
| XX. Miscellaneous Systems                      |                    | 0   |
| Total  | 0                  | 659   |

# US-368 ARKANSAS ONE-2

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 858.0 MW(e)  
**Design Net RUP:** 912.0 MW(e)  
**Design Discharge Burnup:** 34400 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8627.6 GW(e).h  
**Energy Availability Factor:** 97.3%  
**Load Factor:** 114.5%  
**Operating Factor:** 97.7%  
**Energy Unavailability Factor:** 2.7%  
**Total Off-line Time:** 204 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 755.3 | 619.0 | 753.6 | 727.2 | 749.4 | 722.6 | 745.2 | 719.4 | 651.4 | 702.9 | 728.2 | 753.5 | 8627.6 |
| <b>EAF (%)</b>  | 100.0 | 87.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.3  | 88.3  | 94.4  | 100.0 | 100.0 | 97.3   |
| <b>UCF (%)</b>  | 100.0 | 87.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.3  | 88.3  | 94.4  | 100.0 | 100.0 | 97.3   |
| <b>LF (%)</b>   | 118.3 | 103.6 | 118.1 | 117.9 | 117.4 | 117.0 | 116.7 | 112.7 | 105.4 | 110.0 | 117.9 | 118.0 | 114.5  |
| <b>OF (%)</b>   | 100.0 | 88.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.7  | 90.1  | 94.8  | 100.0 | 100.0 | 97.7   |
| <b>EUF (%)</b>  | 0.0   | 12.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.7   | 11.7  | 5.6   | 0.0   | 0.0   | 2.7    |
| <b>PUF (%)</b>  | 0.0   | 11.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.0    |
| <b>UCLF (%)</b> | 0.0   | 1.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 11.7  | 5.6   | 0.0   | 0.0   | 1.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1971      **Lifetime Generation:** 153726.3 GW(e).h  
**Date of First Criticality:** 05 Dec 1978      **Cumulative Energy Availability Factor:** 81.4%  
**Date of Grid Connection:** 26 Dec 1978      **Cumulative Load Factor:** 82.7%  
**Date of Commercial Operation:** 26 Mar 1980      **Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 18.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4427.9         | 858.0          | 61.5   | 61.5   | 61.5                              | 61.5   | 58.9               | 55.7   | 5380               | 61.4   |
| 1984 | 6203.6         | 858.0          | 84.7   | 67.3   | 84.7                              | 67.3   | 82.3               | 62.4   | 7439               | 84.7   |
| 1985 | 4701.2         | 858.0          | 69.2   | 67.7   | 69.0                              | 67.7   | 62.5               | 62.4   | 6040               | 68.9   |
| 1986 | 5314.3         | 858.0          | 71.7   | 68.4   | 71.6                              | 68.3   | 70.7               | 63.8   | 6274               | 71.6   |
| 1987 | 6605.2         | 858.0          | 87.7   | 71.1   | 87.7                              | 71.1   | 87.9               | 67.2   | 7678               | 87.6   |
| 1988 | 4952.9         | 858.0          | 66.8   | 70.6   | 66.8                              | 70.6   | 65.7               | 67.0   | 5867               | 66.8   |
| 1989 | 5472.2         | 858.0          | 74.4   | 71.0   | 74.4                              | 71.0   | 72.8               | 67.7   | 6514               | 74.4   |
| 1990 | 7129.6         | 858.0          | 93.8   | 73.3   | 93.8                              | 73.3   | 94.9               | 70.4   | 8211               | 93.7   |
| 1991 | 6123.3         | 858.0          | 82.0   | 74.1   | 82.1                              | 74.1   | 81.5               | 71.4   | 7187               | 82.0   |
| 1992 | 5504.8         | 858.0          | 72.8   | 74.0   | 72.8                              | 74.0   | 73.0               | 71.5   | 6390               | 72.7   |
| 1993 | 7344.7         | 858.0          | 95.3   | 75.6   | 95.3                              | 75.6   | 97.7               | 73.6   | 8346               | 95.3   |
| 1994 | 6724.9         | 858.0          | 88.0   | 76.5   | 88.0                              | 76.5   | 89.5               | 74.7   | 7707               | 88.0   |
| 1995 | 5694.5         | 858.0          | 75.9   | 76.5   | 75.9                              | 76.4   | 75.8               | 74.8   | 6644               | 75.8   |
| 1996 | 7063.9         | 858.0          | 91.6   | 77.4   | 91.6                              | 77.4   | 93.7               | 75.9   | 8049               | 91.6   |
| 1997 | 6957.0         | 858.0          | 91.5   | 78.2   | 91.5                              | 78.2   | 92.6               | 76.9   | 8013               | 91.5   |
| 1998 | 6877.3         | 858.0          | 91.3   | 79.0   | 91.3                              | 78.9   | 91.5               | 77.7   | 7995               | 91.3   |
| 1999 | 6226.9         | 858.0          | 82.4   | 79.1   | 82.4                              | 79.1   | 82.8               | 78.0   | 7219               | 82.4   |
| 2000 | 5265.3         | 858.0          | 69.2   | 78.6   | 69.2                              | 78.6   | 69.9               | 77.6   | 6077               | 69.2   |
| 2001 | 7917.0         | 858.0          | 96.8   | 79.5   | 96.8                              | 79.5   | 105.3              | 78.9   | 8498               | 97.0   |
| 2002 | 8002.2         | 858.0          | 93.1   | 80.1   | 93.1                              | 80.1   | 106.5              | 80.2   | 8203               | 93.6   |
| 2003 | 7925.7         | 858.0          | 92.5   | 80.7   | 92.5                              | 80.7   | 105.5              | 81.3   | 8156               | 93.1   |
| 2004 | 8627.6         | 858.0          | 97.3   | 81.4   | 97.3                              | 81.4   | 114.5              | 82.7   | 8580               | 97.7   |



## US-368 ARKANSAS ONE-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 Feb | 65.7  | 65.7    | PF   | D15  | SCHEDULED OUTAGE TO PERFORM MAINTENANCE ON A REACTOR COOLANT PUMP MOTOR. THE SCHEDULED OUTAGE WAS EXTENDED WHEN THE MAIN TURBINE GENERATOR AUTOMATICALLY TRIPPED ON ANTI-MOTERING AFTER BEING TIED TO THE GRID. THE REACTOR REMAINED CRITICAL. |
| 09 Feb | 10.7  | 10.7    | UF3  | Z    |  |
| 29 Aug | 12.9  | 12.9    | PF   | D41  | MAIN TURBINE GENERATOR TAKEN OFF LINE TO REPLACE GENERATOR STATOR COOLING STRAINER. REACTOR REMAINED CRITICAL.   |
| 29 Aug | 4.1   | 4.1     | UF2  | A31  | MAIN TURBINE ANTI-MOTERING TRIP. REACTOR REMAINED CRITICAL.  |
| 28 Sep | 108.2 | 108.2   | UF2  | A32  | FORCED SHUTDOWN TO REPAIR A MAIN FEEDWATER VENT STACK WELD.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 112       |          |  | 577       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 916                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 78              |           |          | 145                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 14                                       | 23        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 17       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  | 4         | 0        |
| Z. Others  |                 | 10        |          |  |           |          |
| Subtotal   | 78              | 122       | 0        | 1075                                     | 618       | 17       |
| Total  |                 | 200       |          |  | 1710      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 7  |
| 12. Reactor I&C Systems                        |                 | 71                                       |
| 13. Reactor Auxiliary Systems                  |                 | 23                                       |
| 14. Safety Systems                             |                 | 104                                      |
| 15. Reactor Cooling Systems                    |                 | 171                                      |
| 16. Steam generation systems                   |                 | 30                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    | 4               | 52                                       |
| 32. Feedwater and Main Steam System            | 108             | 58                                       |
| 33. Circulating Water System                   |                 | 3  |
| 41. Main Generator Systems                     |                 | 11                                       |
| 42. Electrical Power Supply Systems            |                 | 34                                       |
| Total  | 112             | 565                                      |

# US-334 BEAVER VALLEY-1

**Operator:** FENOC (FIRST ENERGY NUCLEAR OPERATING CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 821.0 MW(e)  
**Design Net RUP:** 835.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6678.5 GW(e).h  
**Energy Availability Factor:** 92.4%  
**Load Factor:** 92.6%  
**Operating Factor:** 92.4%  
**Energy Unavailability Factor:** 7.6%  
**Total Off-line Time:** 665 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 623.0 | 588.1 | 591.0 | 602.1 | 621.3 | 601.2 | 617.1 | 619.2 | 600.9 | 327.9 | 257.0 | 629.8 | 6678.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 54.9  | 54.4  | 100.0 | 92.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 54.9  | 54.4  | 100.0 | 92.4   |
| <b>LF (%)</b>   | 102.0 | 102.9 | 96.7  | 102.0 | 101.7 | 101.7 | 101.0 | 101.4 | 101.7 | 53.6  | 43.5  | 103.1 | 92.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 54.8  | 54.4  | 100.0 | 92.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 45.1  | 45.6  | 0.0   | 7.6    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 45.1  | 45.6  | 0.0   | 7.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1970  
**Date of First Criticality:** 10 May 1976  
**Date of Grid Connection:** 14 Jun 1976  
**Date of Commercial Operation:** 01 Oct 1976

**Lifetime Generation:** 131537.7 GW(e).h  
**Cumulative Energy Availability Factor:** 69.0%  
**Cumulative Load Factor:** 65.7%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 31.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4682.2         | 810.0          | 68.5   | 41.5   | 68.5                              | 41.5   | 66.0               | 39.1   | 5976               | 68.2   |
| 1984 | 4756.8         | 810.0          | 71.8   | 45.3   | 71.8                              | 45.3   | 66.9               | 42.5   | 6301               | 71.7   |
| 1985 | 5901.5         | 810.0          | 91.9   | 50.4   | 91.9                              | 50.4   | 83.2               | 47.0   | 8046               | 91.8   |
| 1986 | 4784.2         | 810.0          | 70.7   | 52.4   | 70.7                              | 52.4   | 67.4               | 49.0   | 6195               | 70.7   |
| 1987 | 5620.9         | 810.0          | 84.0   | 55.3   | 84.0                              | 55.3   | 79.2               | 51.8   | 7320               | 83.6   |
| 1988 | 4993.6         | 810.0          | 79.6   | 57.3   | 79.6                              | 57.3   | 70.2               | 53.3   | 6989               | 79.6   |
| 1989 | 3794.3         | 810.0          | 66.5   | 58.0   | 66.5                              | 58.0   | 53.5               | 53.3   | 5822               | 66.5   |
| 1990 | 6167.1         | 810.0          | 92.2   | 60.5   | 92.2                              | 60.5   | 86.9               | 55.7   | 8074               | 92.2   |
| 1991 | 3710.9         | 810.0          | 55.8   | 60.1   | 55.8                              | 60.1   | 52.3               | 55.5   | 4883               | 55.7   |
| 1992 | 6298.4         | 810.0          | 93.6   | 62.2   | 93.6                              | 62.2   | 88.5               | 57.6   | 8218               | 93.6   |
| 1993 | 4359.8         | 810.0          | 67.3   | 62.5   | 67.3                              | 62.5   | 61.4               | 57.8   | 5891               | 67.2   |
| 1994 | 5504.4         | 810.0          | 79.9   | 63.5   | 79.9                              | 63.5   | 77.6               | 58.9   | 6991               | 79.8   |
| 1995 | 5449.2         | 810.0          | 77.8   | 64.2   | 77.8                              | 64.2   | 76.8               | 59.8   | 6813               | 77.8   |
| 1996 | 5698.1         | 810.0          | 81.3   | 65.1   | 81.3                              | 65.1   | 80.1               | 60.8   | 7132               | 81.2   |
| 1997 | 4025.8         | 810.0          | 56.8   | 64.7   | 56.8                              | 64.7   | 56.7               | 60.6   | 4972               | 56.8   |
| 1998 | 2829.3         | 810.0          | 40.4   | 63.6   | 40.4                              | 63.6   | 39.9               | 59.7   | 3557               | 40.6   |
| 1999 | 6106.2         | 810.0          | 88.5   | 64.7   | 88.5                              | 64.7   | 86.1               | 60.8   | 7746               | 88.4   |
| 2000 | 5883.0         | 810.0          | 84.6   | 65.5   | 84.6                              | 65.5   | 82.7               | 61.8   | 7430               | 84.6   |
| 2001 | 5991.0         | 812.0          | 84.6   | 66.3   | 84.6                              | 66.3   | 84.2               | 62.7   | 7407               | 84.6   |
| 2002 | 6989.9         | 821.0          | 97.0   | 67.5   | 97.0                              | 67.5   | 97.2               | 64.0   | 8490               | 96.9   |
| 2003 | 5985.4         | 821.0          | 84.1   | 68.1   | 84.1                              | 68.1   | 83.2               | 64.7   | 7359               | 84.0   |
| 2004 | 6678.5         | 821.0          | 92.4   | 69.0   | 92.4                              | 69.0   | 92.6               | 65.7   | 8119               | 92.4   |

**US-334 BEAVER VALLEY-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description        |
|--------|-------|---------|------|------|--------------------|
| 18 Oct | 664.7 | 545.7   | PF   | C21  | REFUELLING OUTAGE. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 761       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 664             |           |          | 1231  | 6         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 119   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 11  | 23        |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 134       |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 23  | 210       | 2        |
| Z. Others  |                 |           |          |   | 2         |          |
| Subtotal   | 664             | 0         | 0        | 1384  | 1152      | 2        |
| Total  |                 | 664       |          |   | 2538      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1976 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 8   |
| 13. Reactor Auxiliary Systems                  |                    | 37  |
| 14. Safety Systems                             |                    | 21  |
| 15. Reactor Cooling Systems                    |                    | 191   |
| 16. Steam generation systems                   |                    | 2   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 4   |
| 31. Turbine and auxiliaries                    |                    | 21  |
| 32. Feedwater and Main Steam System            |                    | 149   |
| 35. All other I&C Systems                      |                    | 1   |
| 41. Main Generator Systems                     |                    | 25  |
| 42. Electrical Power Supply Systems            |                    | 169   |
| XX. Miscellaneous Systems                      |                    | 66  |
| Total  | 0                  | 694   |

# US-412 BEAVER VALLEY-2

**Operator:** FENOC (FIRST ENERGY NUCLEAR OPERATING CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 831.0 MW(e)  
**Design Net RUP:** 836.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7314.8 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 100.2%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 628.7 | 589.8 | 629.4 | 586.5 | 604.0 | 599.8 | 603.7 | 615.8 | 595.0 | 624.3 | 607.4 | 630.4 | 7314.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 101.7 | 102.0 | 101.8 | 98.2  | 97.7  | 100.3 | 97.6  | 99.6  | 99.4  | 100.8 | 101.5 | 102.0 | 100.2  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1974  
**Date of First Criticality:** 04 Aug 1987  
**Date of Grid Connection:** 17 Aug 1987  
**Date of Commercial Operation:** 17 Nov 1987

**Lifetime Generation:** 99241.7 GW(e).h  
**Cumulative Energy Availability Factor:** 84.4%  
**Cumulative Load Factor:** 80.2%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 15.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 738.1          | 822.0          | 0.0  | 0.0    | 13.0                              | 100.0  | 10.7               | 0.0    | 950                | 11.4   |
| 1988 | 6477.1         | 833.0          | 93.8   | 93.8   | 93.8                              | 93.8   | 88.5               | 88.5   | 8224               | 93.6   |
| 1989 | 4557.1         | 833.0          | 71.7   | 82.8   | 71.7                              | 82.7   | 62.5               | 75.5   | 6245               | 71.3   |
| 1990 | 4291.6         | 827.0          | 77.1   | 80.9   | 77.1                              | 80.9   | 59.2               | 70.1   | 6734               | 76.9   |
| 1991 | 6762.2         | 820.0          | 99.5   | 85.5   | 99.5                              | 85.5   | 94.1               | 76.1   | 8720               | 99.5   |
| 1992 | 5647.1         | 820.0          | 94.8   | 87.3   | 94.8                              | 87.3   | 78.4               | 76.5   | 7342               | 83.6   |
| 1993 | 5212.7         | 820.0          | 77.3   | 85.7   | 77.3                              | 85.7   | 72.6               | 75.9   | 6770               | 77.3   |
| 1994 | 7024.7         | 820.0          | 96.8   | 87.3   | 96.8                              | 87.3   | 97.8               | 79.0   | 8481               | 96.8   |
| 1995 | 6047.0         | 820.0          | 87.0   | 87.2   | 87.0                              | 87.2   | 84.2               | 79.6   | 7616               | 86.9   |
| 1996 | 4788.6         | 820.0          | 70.3   | 85.3   | 70.3                              | 85.4   | 66.5               | 78.2   | 6169               | 70.2   |
| 1997 | 6158.7         | 820.0          | 86.6   | 85.5   | 86.6                              | 85.5   | 85.7               | 78.9   | 7583               | 86.6   |
| 1998 | 1808.7         | 820.0          | 25.1   | 80.0   | 25.1                              | 80.0   | 25.2               | 74.1   | 2179               | 24.9   |
| 1999 | 5752.5         | 820.0          | 81.7   | 80.2   | 81.7                              | 80.2   | 80.1               | 74.6   | 7155               | 81.7   |
| 2000 | 6227.8         | 820.0          | 88.9   | 80.8   | 88.9                              | 80.8   | 86.5               | 75.5   | 7804               | 88.8   |
| 2001 | 7191.7         | 822.0          | 99.3   | 82.2   | 99.4                              | 82.1   | 99.9               | 77.2   | 8702               | 99.3   |
| 2002 | 6604.3         | 831.0          | 93.0   | 82.9   | 92.9                              | 82.9   | 90.7               | 78.1   | 8133               | 92.8   |
| 2003 | 6637.0         | 831.0          | 91.8   | 83.4   | 91.8                              | 83.4   | 91.2               | 78.9   | 8037               | 91.7   |
| 2004 | 7314.8         | 831.0          | 100.0  | 84.4   | 100.0                             | 84.4   | 100.2              | 80.2   | 8784               | 100.0  |

## US-412 BEAVER VALLEY-2

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 566       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 662   | 4         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 23  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1   | 25        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 82        |          |
| Subtotal   | 0               | 0         | 0        | 686   | 685       | 0        |
| Total  |                 | 0         |          |   | 1371      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 18  |
| 12. Reactor I&C Systems                        |                    | 7   |
| 13. Reactor Auxiliary Systems                  |                    | 51  |
| 14. Safety Systems                             |                    | 17  |
| 15. Reactor Cooling Systems                    |                    | 325   |
| 16. Steam generation systems                   |                    | 32  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 9   |
| 31. Turbine and auxiliaries                    |                    | 29  |
| 32. Feedwater and Main Steam System            |                    | 11  |
| 35. All other I&C Systems                      |                    | 5   |
| 41. Main Generator Systems                     |                    | 4   |
| 42. Electrical Power Supply Systems            |                    | 37  |
| XX. Miscellaneous Systems                      |                    | 13  |
| Total  | 0                  | 558   |

# US-456 BRAIDWOOD-1

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1161.0 MW(e)  
**Design Net RUP:** 1120.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9807.2 GW(e).h  
**Energy Availability Factor:** 94.5%  
**Load Factor:** 96.2%  
**Operating Factor:** 94.6%  
**Energy Unavailability Factor:** 5.5%  
**Total Off-line Time:** 474 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 868.9 | 837.2 | 899.5 | 856.4 | 885.8 | 852.3 | 874.0 | 879.8 | 849.6 | 247.2 | 861.0 | 895.6 | 9807.2 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 35.1  | 100.0 | 100.0 | 94.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 35.1  | 100.0 | 100.0 | 94.5   |
| <b>LF (%)</b>   | 100.6 | 103.6 | 104.1 | 102.6 | 102.5 | 102.0 | 101.2 | 101.8 | 101.6 | 28.6  | 103.0 | 103.7 | 96.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 36.4  | 100.0 | 100.0 | 94.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 64.9  | 0.0   | 0.0   | 5.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 64.9  | 0.0   | 0.0   | 5.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1975  
**Date of First Criticality:** 29 May 1987  
**Date of Grid Connection:** 12 Jul 1987  
**Date of Commercial Operation:** 29 Jul 1988

**Lifetime Generation:** 135258.8 GW(e).h  
**Cumulative Energy Availability Factor:** 85.0%  
**Cumulative Load Factor:** 82.5%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 15.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 1456.6         | 1105.0         | 0.0  | 0.0    | 49.6                              | 100.0  | 15.5               | 0.0    | 2611               | 30.7   |
| 1988 | 3424.2         | 1105.0         | 0.0  | 0.0    | 96.1                              | 100.0  | 38.3               | 0.0    | 3409               | 42.1   |
| 1989 | 4649.1         | 1120.0         | 62.3   | 62.3   | 62.3                              | 62.3   | 47.4               | 47.4   | 5435               | 62.0   |
| 1990 | 8264.6         | 1120.0         | 89.1   | 75.7   | 89.1                              | 75.7   | 84.2               | 65.8   | 7778               | 88.8   |
| 1991 | 5018.6         | 1120.0         | 59.4   | 70.2   | 59.4                              | 70.2   | 51.2               | 60.9   | 5198               | 59.3   |
| 1992 | 7157.9         | 1120.0         | 81.4   | 73.0   | 81.4                              | 73.0   | 72.8               | 63.9   | 7142               | 81.3   |
| 1993 | 8693.1         | 1120.0         | 92.1   | 76.8   | 92.1                              | 76.8   | 88.6               | 68.8   | 8048               | 91.9   |
| 1994 | 7398.2         | 1120.0         | 79.8   | 77.3   | 79.8                              | 77.3   | 75.4               | 69.9   | 6940               | 79.2   |
| 1995 | 6614.3         | 1120.0         | 71.8   | 76.5   | 71.7                              | 76.5   | 67.4               | 69.6   | 6214               | 70.9   |
| 1996 | 7618.9         | 1120.0         | 80.5   | 77.0   | 80.5                              | 77.0   | 77.4               | 70.6   | 7021               | 79.9   |
| 1997 | 8096.3         | 1120.0         | 84.0   | 77.8   | 84.0                              | 77.8   | 82.5               | 71.9   | 7339               | 83.8   |
| 1998 | 7578.8         | 1118.0         | 79.9   | 78.0   | 79.9                              | 78.0   | 77.4               | 72.4   | 6976               | 79.6   |
| 1999 | 9904.8         | 1120.0         | 99.1   | 79.9   | 99.1                              | 79.9   | 101.0              | 75.0   | 8680               | 99.1   |
| 2000 | 9311.3         | 1103.0         | 95.0   | 81.2   | 94.9                              | 81.2   | 96.1               | 76.8   | 8335               | 94.9   |
| 2001 | 9557.9         | 1116.0         | 94.0   | 82.2   | 94.0                              | 82.2   | 97.8               | 78.4   | 8247               | 94.1   |
| 2002 | 10612.2        | 1164.0         | 100.0  | 83.5   | 100.0                             | 83.5   | 104.1              | 80.3   | 8760               | 100.0  |
| 2003 | 10094.8        | 1161.0         | 95.3   | 84.3   | 95.3                              | 84.3   | 99.3               | 81.6   | 8353               | 95.4   |
| 2004 | 9807.2         | 1161.0         | 94.5   | 85.0   | 94.5                              | 85.0   | 96.2               | 82.5   | 8310               | 94.6   |

**US-456 BRAIDWOOD-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                  |
|--------|-------|---------|------|------|------------------------------|
| 04 Oct | 474.0 | 561.7   | PF   | C21  | SCHEDULED REFUELLING OUTAGE. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 346       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 474             |           |          | 701   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 152   | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 2   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 26        |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 5         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0   | 7         |          |
| Subtotal   | 474             | 0         | 0        | 855   | 394       | 0        |
| Total  |                 | 474       |          |   | 1249      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 13. Reactor Auxiliary Systems                  |                    | 5   |
| 14. Safety Systems                             |                    | 6   |
| 15. Reactor Cooling Systems                    |                    | 2   |
| 16. Steam generation systems                   |                    | 28  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 10  |
| 31. Turbine and auxiliaries                    |                    | 2   |
| 32. Feedwater and Main Steam System            |                    | 22  |
| 41. Main Generator Systems                     |                    | 197   |
| 42. Electrical Power Supply Systems            |                    | 14  |
| XX. Miscellaneous Systems                      |                    | 15  |
| Total  | 0                  | 301   |

# US-457 BRAIDWOOD-2

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1154.0 MW(e)  
**Design Net RUP:** 1120.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10201.0 GW(e).h  
**Energy Availability Factor:** 99.7%  
**Load Factor:** 102.7%  
**Operating Factor:** 99.7%  
**Energy Unavailability Factor:** 0.3%  
**Total Off-line Time:** 27 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 869.8 | 819.4 | 875.5 | 844.6 | 866.8 | 829.1 | 857.6 | 861.1 | 832.6 | 873.7 | 846.7 | 824.1 | 10201.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.2  | 99.7    |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.2  | 99.7    |
| <b>LF (%)</b>   | 101.3 | 104.3 | 104.2 | 104.0 | 103.2 | 102.0 | 102.1 | 102.5 | 102.4 | 103.9 | 104.2 | 98.1  | 102.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.4  | 99.7    |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.8   | 0.3     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.8   | 0.3     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1975      **Lifetime Generation:** 137388.2 GW(e).h  
**Date of First Criticality:** 08 Mar 1988      **Cumulative Energy Availability Factor:** 89.3%  
**Date of Grid Connection:** 25 May 1988      **Cumulative Load Factor:** 86.4%  
**Date of Commercial Operation:** 17 Oct 1988      **Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 10.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 1350.9         | 1097.0         | 0.0  | 0.0    | 96.0                              | 100.0  | 14.7               | 0.0    | 1476               | 17.6   |
| 1989 | 7142.0         | 1120.0         | 86.9   | 86.9   | 86.9                              | 86.9   | 72.8               | 72.8   | 7581               | 86.5   |
| 1990 | 6353.6         | 1120.0         | 78.8   | 82.8   | 78.8                              | 82.8   | 64.8               | 68.8   | 6849               | 78.2   |
| 1991 | 6545.5         | 1120.0         | 75.7   | 80.5   | 75.7                              | 80.5   | 66.7               | 68.1   | 6626               | 75.6   |
| 1992 | 8751.1         | 1120.0         | 95.1   | 84.1   | 95.1                              | 84.1   | 89.0               | 73.3   | 8346               | 95.0   |
| 1993 | 7362.3         | 1120.0         | 81.5   | 83.6   | 81.5                              | 83.6   | 75.0               | 73.7   | 7098               | 81.0   |
| 1994 | 6636.1         | 1120.0         | 74.1   | 82.0   | 74.1                              | 82.0   | 67.6               | 72.7   | 6454               | 73.7   |
| 1995 | 9533.0         | 1120.0         | 98.1   | 84.3   | 98.1                              | 84.3   | 97.2               | 76.2   | 8583               | 98.0   |
| 1996 | 8011.8         | 1120.0         | 84.1   | 84.3   | 84.1                              | 84.3   | 81.4               | 76.8   | 7349               | 83.7   |
| 1997 | 8234.7         | 1120.0         | 86.5   | 84.5   | 86.5                              | 84.5   | 83.9               | 77.6   | 7563               | 86.3   |
| 1998 | 9694.6         | 1118.0         | 97.7   | 85.8   | 97.7                              | 85.8   | 99.0               | 79.7   | 8552               | 97.6   |
| 1999 | 9030.9         | 1120.0         | 92.3   | 86.4   | 92.3                              | 86.4   | 92.0               | 80.9   | 8070               | 92.1   |
| 2000 | 9510.9         | 1103.0         | 94.6   | 87.1   | 94.6                              | 87.1   | 98.2               | 82.3   | 8303               | 94.5   |
| 2001 | 9647.9         | 1112.0         | 96.7   | 87.8   | 96.7                              | 87.8   | 99.0               | 83.6   | 8481               | 96.8   |
| 2002 | 9449.5         | 1144.0         | 92.5   | 88.2   | 92.5                              | 88.2   | 94.3               | 84.3   | 8099               | 92.5   |
| 2003 | 9932.2         | 1154.0         | 95.1   | 88.7   | 95.1                              | 88.7   | 98.3               | 85.3   | 8337               | 95.2   |
| 2004 | 10201.0        | 1131.0         | 99.7   | 89.3   | 99.7                              | 89.3   | 102.7              | 86.4   | 8757               | 99.7   |



## US-457 BRAIDWOOD-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 22 Dec | 27.0  | 31.8    | UF4  | A35  | UNIT TRIPPED DUE TO A LEVEL CONTROLLER FAILURE ON THE 2C STEAM GENERATOR. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 27        |          |  | 161       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 15        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 615                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 95                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 22        |          |
| Subtotal   | 0               | 27        | 0        | 710                                      | 198       | 0        |
| Total  |                 | 27        |          |  | 908       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 15                                       |
| 14. Safety Systems                       |                 | 11                                       |
| 15. Reactor Cooling Systems              |                 | 4  |
| 21. Fuel Handling and Storage Facilities |                 | 10                                       |
| 31. Turbine and auxiliaries              |                 | 1  |
| 32. Feedwater and Main Steam System      |                 | 21                                       |
| 35. All other I&C Systems                | 27              | 5  |
| 41. Main Generator Systems               |                 | 8  |
| 42. Electrical Power Supply Systems      |                 | 75                                       |
| Total                                    | 27              | 150                                      |

# US-259 BROWNS FERRY-1

**Operator:** TVA (TENNESSEE VALLEY AUTHORITY)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1065.0 MW(e)  
**Design Net RUP:** 1065.0 MW(e)  
**Design Discharge Burnup:** 19000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 0.0 GW(e).h  
**Energy Availability Factor:** 0.0%  
**Load Factor:** 0.0%  
**Operating Factor:** 0.0%  
**Energy Unavailability Factor:** 100.0%  
**Total Off-line Time:** 8784 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>LF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>OF (%)</b>   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1967  
**Date of First Criticality:** 17 Aug 1973  
**Date of Grid Connection:** 15 Oct 1973  
**Date of Commercial Operation:** 01 Aug 1974

**Lifetime Generation:** 56518.9 GW(e).h  
**Cumulative Energy Availability Factor:** 19.2%  
**Cumulative Load Factor:** 18.2%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 80.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2175.5         | 1065.0         | 26.5   | 52.0   | 26.5                              | 51.9   | 23.3               | 49.5   | 2316               | 26.4   |
| 1984 | 7848.5         | 1065.0         | 90.3   | 55.8   | 90.3                              | 55.8   | 83.9               | 52.9   | 7930               | 90.3   |
| 1985 | 1603.0         | 1065.0         | 18.6   | 52.4   | 18.6                              | 52.4   | 17.2               | 49.7   | 1626               | 18.6   |
| 1986 | 0.0            | 1065.0         | 0.0  | 48.1   | 0.0                               | 48.0   | 0.0                | 45.5   | 0                  | 0.0    |
| 1987 | 0.0            | 1065.0         | 0.0  | 44.4   | 0.0                               | 44.4   | 0.0                | 42.0   | 0                  | 0.0    |
| 1988 | 0.0            | 1065.0         | 0.0  | 41.2   | 0.0                               | 41.2   | 0.0                | 39.0   | 0                  | 0.0    |
| 1989 | 0.0            | 1065.0         | 0.0  | 38.4   | 0.0                               | 38.4   | 0.0                | 36.4   | 0                  | 0.0    |
| 1990 | 0.0            | 1065.0         | 0.0  | 36.0   | 0.0                               | 36.0   | 0.0                | 34.1   | 0                  | 0.0    |
| 1991 | 0.0            | 1065.0         | 0.0  | 33.9   | 0.0                               | 33.9   | 0.0                | 32.1   | 0                  | 0.0    |
| 1992 | 0.0            | 1065.0         | 0.0  | 32.0   | 0.0                               | 32.0   | 0.0                | 30.4   | 0                  | 0.0    |
| 1993 | 0.0            | 1065.0         | 0.0  | 30.4   | 0.0                               | 30.3   | 0.0                | 28.8   | 0                  | 0.0    |
| 1994 | 0.0            | 1065.0         | 0.0  | 28.8   | 0.0                               | 28.8   | 0.0                | 27.3   | 0                  | 0.0    |
| 1995 | 0.0            | 1065.0         | 0.0  | 27.5   | 0.0                               | 27.5   | 0.0                | 26.0   | 0                  | 0.0    |
| 1996 | 0.0            | 1065.0         | 0.0  | 26.2   | 0.0                               | 26.2   | 0.0                | 24.8   | 0                  | 0.0    |
| 1997 | 0.0            | 1065.0         | 0.0  | 25.1   | 0.0                               | 25.1   | 0.0                | 23.8   | 0                  | 0.0    |
| 1998 | 0.0            | 1065.0         | 0.0  | 24.0   | 0.0                               | 24.0   | 0.0                | 22.8   | 0                  | 0.0    |
| 1999 | 0.0            | 1065.0         | 0.0  | 23.1   | 0.0                               | 23.1   | 0.0                | 21.9   | 0                  | 0.0    |
| 2000 | 0.0            | 1065.0         | 0.0  | 22.2   | 0.0                               | 22.2   | 0.0                | 21.0   | 0                  | 0.0    |
| 2001 | 0.0            | 1065.0         | 0.0  | 21.4   | 0.0                               | 21.4   | 0.0                | 20.2   | 0                  | 0.0    |
| 2002 | 0.0            | 1065.0         | 0.0  | 20.6   | 0.0                               | 20.6   | 0.0                | 19.5   | 0                  | 0.0    |
| 2003 | 0.0            | 1065.0         | 0.0  | 19.9   | 0.0                               | 19.9   | 0.0                | 18.8   | 0                  | 0.0    |
| 2004 | 0.0            | 1065.0         | 0.0  | 19.2   | 0.0                               | 19.2   | 0.0                | 18.2   | 0                  | 0.0    |

# US-259 BROWNS FERRY-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 01 Jan | 8784.0 | 9355.0  | PF   | H    | ADMINISTRATIVE HOLD TO RESOLVE VARIOUS TVA AND NRC CONCERNS. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 153       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 4         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 674   | 67        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 50  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 13        |          |
| H. Nuclear regulatory requirements   | 8784            |           |          | 275   | 49        | 0        |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 2465  | 2538      |          |
| Subtotal   | 8784            | 0         | 0        | 3464  | 2824      | 0        |
| Total  |                 | 8784      |          |   | 6288      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1973 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 1   |
| 12. Reactor I&C Systems             |                    | 7   |
| 13. Reactor Auxiliary Systems       |                    | 11  |
| 14. Safety Systems                  |                    | 5   |
| 15. Reactor Cooling Systems         |                    | 50  |
| 31. Turbine and auxiliaries         |                    | 24  |
| 32. Feedwater and Main Steam System |                    | 19  |
| 41. Main Generator Systems          |                    | 3   |
| 42. Electrical Power Supply Systems |                    | 2   |
| XX. Miscellaneous Systems           |                    | 9   |
| Total                               | 0                  | 131   |

# US-260 BROWNS FERRY-2

**Operator:** TVA (TENNESSEE VALLEY AUTHORITY)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1118.0 MW(e)  
**Design Net RUP:** 1065.0 MW(e)  
**Design Discharge Burnup:** 19000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9786.0 GW(e).h  
**Energy Availability Factor:** 99.2%  
**Load Factor:** 99.6%  
**Operating Factor:** 99.2%  
**Energy Unavailability Factor:** 0.8%  
**Total Off-line Time:** 69 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 847.2 | 789.7 | 840.4 | 814.7 | 833.5 | 801.7 | 736.5 | 829.8 | 800.9 | 840.7 | 811.1 | 839.9 | 9786.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.2   |
| <b>LF (%)</b>   | 101.9 | 101.5 | 101.0 | 101.3 | 100.2 | 99.6  | 88.5  | 99.8  | 99.5  | 100.9 | 100.8 | 101.0 | 99.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1967  
**Date of First Criticality:** 20 Jul 1974  
**Date of Grid Connection:** 28 Aug 1974  
**Date of Commercial Operation:** 01 Mar 1975

**Lifetime Generation:** 165397.9 GW(e).h  
**Cumulative Energy Availability Factor:** 62.6%  
**Cumulative Load Factor:** 59.5%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 37.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6385.6         | 1065.0         | 74.8   | 63.4   | 74.8                              | 63.4   | 68.4               | 59.9   | 6514               | 74.4   |
| 1984 | 4044.4         | 1065.0         | 66.5   | 63.8   | 66.5                              | 63.7   | 43.2               | 58.0   | 5844               | 66.5   |
| 1985 | 0.0            | 1065.0         | 0.0  | 57.4   | 0.0                               | 57.4   | 0.0                | 52.2   | 0                  | 0.0    |
| 1986 | 0.0            | 1065.0         | 0.0  | 52.2   | 0.0                               | 52.2   | 0.0                | 47.5   | 0                  | 0.0    |
| 1987 | 0.0            | 1065.0         | 0.0  | 47.8   | 0.0                               | 47.8   | 0.0                | 43.5   | 0                  | 0.0    |
| 1988 | 0.0            | 1065.0         | 0.0  | 44.1   | 0.0                               | 44.1   | 0.0                | 40.2   | 0                  | 0.0    |
| 1989 | 0.0            | 1065.0         | 0.0  | 41.0   | 0.0                               | 41.0   | 0.0                | 37.3   | 0                  | 0.0    |
| 1990 | 0.0            | 1065.0         | 0.0  | 38.3   | 0.0                               | 38.2   | 0.0                | 34.8   | 0                  | 0.0    |
| 1991 | 3804.0         | 1065.0         | 47.1   | 38.8   | 47.1                              | 38.8   | 40.8               | 35.2   | 4125               | 47.1   |
| 1992 | 8388.8         | 1065.0         | 95.7   | 42.2   | 95.7                              | 42.2   | 89.7               | 38.4   | 8401               | 95.6   |
| 1993 | 5776.8         | 1065.0         | 65.7   | 43.5   | 65.7                              | 43.5   | 61.9               | 39.7   | 5753               | 65.7   |
| 1994 | 7345.2         | 1065.0         | 82.6   | 45.5   | 82.6                              | 45.5   | 78.7               | 41.8   | 7234               | 82.6   |
| 1995 | 9197.0         | 1065.0         | 98.5   | 48.2   | 98.5                              | 48.2   | 98.6               | 44.6   | 8629               | 98.5   |
| 1996 | 8046.3         | 1065.0         | 88.7   | 50.1   | 88.7                              | 50.1   | 86.0               | 46.6   | 7795               | 88.7   |
| 1997 | 8372.9         | 1065.0         | 92.8   | 52.1   | 92.8                              | 52.0   | 89.7               | 48.5   | 8130               | 92.8   |
| 1998 | 9301.0         | 1065.0         | 99.7   | 54.1   | 99.7                              | 54.1   | 99.7               | 50.8   | 8730               | 99.7   |
| 1999 | 8586.3         | 1100.0         | 91.0   | 55.7   | 91.0                              | 55.7   | 89.1               | 52.4   | 7985               | 91.2   |
| 2000 | 9733.5         | 1118.0         | 99.4   | 57.5   | 99.4                              | 57.5   | 99.1               | 54.4   | 8727               | 99.4   |
| 2001 | 8414.6         | 1118.0         | 87.2   | 58.7   | 87.2                              | 58.7   | 85.9               | 55.6   | 7636               | 87.2   |
| 2002 | 8911.3         | 1118.0         | 94.4   | 60.1   | 94.4                              | 60.1   | 91.0               | 57.0   | 8269               | 94.4   |
| 2003 | 8369.2         | 1118.0         | 90.1   | 61.2   | 90.1                              | 61.2   | 85.5               | 58.0   | 7888               | 90.0   |
| 2004 | 9786.0         | 1118.0         | 99.2   | 62.6   | 99.2                              | 62.6   | 99.6               | 59.5   | 8715               | 99.2   |

## US-260 BROWNS FERRY-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 08 Jul | 48.0  | 53.7    | UF4  | A31  | UNIT 2 AUTOMATICALLY TRIPPED DUE TO A TURBINE GENERATOR SPURIOUS LOAD REJECTION SIGNAL.  |
| 10 Jul | 21.0  | 23.5    | UF4  | A12  | DURING STARTUP PRIOR TO CLOSURE OF THE GENERATOR BREAKER, THE UNIT 2 REACTOR TRIPPED DUE TO AN UPSCALE TRIP IN BOTH RPS CHANNELS DURING POST MAINTENANCE TESTING ON THE C IRM. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 69        |          |  | 192       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 25        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 958                                      | 69        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 67                                       | 3         |          |
| E. Testing of plant systems or components  |                 |           |          | 8  | 3         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1902      |          |
| Subtotal   | 0               | 69        | 0        | 1033                                     | 2194      | 0        |
| Total  |                 | 69        |          |  | 3227      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 6  |
| 12. Reactor I&C Systems             | 21              | 28                                       |
| 13. Reactor Auxiliary Systems       |                 | 11                                       |
| 14. Safety Systems                  |                 | 7  |
| 15. Reactor Cooling Systems         |                 | 27                                       |
| 31. Turbine and auxiliaries         | 48              | 54                                       |
| 32. Feedwater and Main Steam System |                 | 10                                       |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 9  |
| 42. Electrical Power Supply Systems |                 | 27                                       |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 69              | 180                                      |

# US-296 BROWNS FERRY-3

**Operator:** TVA (TENNESSEE VALLEY AUTHORITY)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1118.0 MW(e)  
**Design Net RUP:** 1065.0 MW(e)  
**Design Discharge Burnup:** 19760 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8701.8 GW(e).h  
**Energy Availability Factor:** 91.1%  
**Load Factor:** 88.6%  
**Operating Factor:** 91.1%  
**Energy Unavailability Factor:** 8.9%  
**Total Off-line Time:** 784 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 839.3 | 680.4 | 1.2  | 784.9 | 825.5 | 789.3 | 801.4 | 792.5 | 799.7 | 835.1 | 716.2 | 836.4 | 8701.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 2.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.4  | 100.0 | 91.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 2.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.4  | 100.0 | 91.1   |
| <b>LF (%)</b>   | 100.9 | 87.4  | 0.1  | 97.6  | 99.2  | 98.1  | 96.3  | 95.3  | 99.3  | 100.3 | 89.0  | 100.6 | 88.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 3.0  | 99.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.4  | 100.0 | 91.1   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 97.5 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.6   | 0.0   | 8.9    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 97.5 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.3    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.6   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1968  
**Date of First Criticality:** 08 Aug 1976  
**Date of Grid Connection:** 12 Sep 1976  
**Date of Commercial Operation:** 01 Mar 1977

**Lifetime Generation:** 126924.1 GW(e).h  
**Cumulative Energy Availability Factor:** 48.1%  
**Cumulative Load Factor:** 46.5%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 51.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5394.3         | 1065.0         | 61.9   | 65.0   | 61.9                              | 64.9   | 57.8               | 61.6   | 5417               | 61.8   |
| 1984 | 290.5          | 1065.0         | 5.8  | 56.5   | 5.7                               | 56.4   | 3.1                | 53.3   | 503                | 5.7    |
| 1985 | 1526.5         | 1065.0         | 17.1   | 51.6   | 17.1                              | 51.5   | 16.4               | 48.7   | 1496               | 17.1   |
| 1986 | 0.0            | 1065.0         | 0.0  | 45.9   | 0.0                               | 45.8   | 0.0                | 43.3   | 0                  | 0.0    |
| 1987 | 0.0            | 1065.0         | 0.0  | 41.3   | 0.0                               | 41.2   | 0.0                | 38.9   | 0                  | 0.0    |
| 1988 | 0.0            | 1065.0         | 0.0  | 37.5   | 0.0                               | 37.5   | 0.0                | 35.4   | 0                  | 0.0    |
| 1989 | 0.0            | 1065.0         | 0.0  | 34.4   | 0.0                               | 34.4   | 0.0                | 32.4   | 0                  | 0.0    |
| 1990 | 0.0            | 1065.0         | 0.0  | 31.8   | 0.0                               | 31.7   | 0.0                | 29.9   | 0                  | 0.0    |
| 1991 | 0.0            | 1065.0         | 0.0  | 29.5   | 0.0                               | 29.5   | 0.0                | 27.8   | 0                  | 0.0    |
| 1992 | 0.0            | 1065.0         | 0.0  | 27.5   | 0.0                               | 27.5   | 0.0                | 26.0   | 0                  | 0.0    |
| 1993 | 0.0            | 1065.0         | 0.0  | 25.8   | 0.0                               | 25.8   | 0.0                | 24.3   | 0                  | 0.0    |
| 1994 | 0.0            | 1065.0         | 0.0  | 24.3   | 0.0                               | 24.3   | 0.0                | 22.9   | 0                  | 0.0    |
| 1995 | 764.6          | 1065.0         | 9.8  | 23.5   | 9.8                               | 23.5   | 8.6                | 22.1   | 810                | 9.7    |
| 1996 | 8803.5         | 1065.0         | 95.8   | 27.3   | 95.8                              | 27.3   | 94.1               | 26.0   | 8412               | 95.8   |
| 1997 | 8523.4         | 1065.0         | 94.8   | 30.7   | 94.8                              | 30.7   | 91.4               | 29.2   | 8302               | 94.8   |
| 1998 | 7884.9         | 1078.0         | 89.9   | 33.6   | 89.9                              | 33.5   | 83.5               | 31.8   | 7863               | 89.8   |
| 1999 | 9730.6         | 1118.0         | 100.0  | 36.7   | 100.0                             | 36.7   | 99.4               | 35.1   | 8760               | 100.0  |
| 2000 | 9097.4         | 1118.0         | 94.6   | 39.4   | 94.6                              | 39.4   | 92.6               | 37.7   | 8311               | 94.6   |
| 2001 | 9803.4         | 1118.0         | 100.0  | 42.0   | 100.0                             | 42.0   | 100.1              | 40.4   | 8760               | 100.0  |
| 2002 | 9260.1         | 1118.0         | 96.0   | 44.3   | 96.0                              | 44.2   | 94.6               | 42.7   | 8407               | 96.0   |
| 2003 | 9325.7         | 1118.0         | 96.6   | 46.4   | 96.6                              | 46.3   | 95.2               | 44.8   | 8463               | 96.6   |
| 2004 | 8701.8         | 1118.0         | 91.1   | 48.1   | 91.1                              | 48.1   | 88.6               | 46.5   | 8000               | 91.1   |

## US-296 BROWNS FERRY-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Mar | 717.5 | 799.3   | PF   | C21  | BEGAN REFUELLING OUTAGE.  |
| 31 Mar | 10.7  | 11.9    | PF   | D41  | MAIN TURBINE WAS SHUTDOWN AFTER LOAD WAS REMOVED FROM THE MAIN GENERATOR TO SUPPORT BALANCE WEIGHT INSTALLATION.                |
| 23 Nov | 55.0  | 61.3    | UF4  | Z    | UNIT 3 TURBINE TRIPPED DUE TO A LOSS OF TURBINE SPEED FEEDBACK SIGNAL AND THE REACTOR SCRAMMED AS A RESULT OF THE TURBINE TRIP. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 202       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 717             |           |          | 537                                      | 278       |          |
| D. Inspection, maintenance or repair without refuelling                              | 10              |           |          | 18                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 5  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 536       | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 576                                      | 2209      |          |
| Z. Others  |                 | 55        |          |  |           |          |
| Subtotal   | 727             | 55        | 0        | 1136                                     | 3231      | 1        |
| Total  |                 | 782       |          |  | 4368      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             |                 | 13                                       |
| 13. Reactor Auxiliary Systems       |                 | 11                                       |
| 14. Safety Systems                  |                 | 17                                       |
| 15. Reactor Cooling Systems         |                 | 42                                       |
| 31. Turbine and auxiliaries         |                 | 54                                       |
| 32. Feedwater and Main Steam System |                 | 25                                       |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 22                                       |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 0               | 186                                      |

# US-325 BRUNSWICK-1

**Operator:** PROGRESS (Progress Energy Corporation)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 872.0 MW(e)  
**Design Net RUP:** 821.0 MW(e)  
**Design Discharge Burnup:** 25000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7093.4 GW(e).h  
**Energy Availability Factor:** 89.4%  
**Load Factor:** 92.6%  
**Operating Factor:** 89.4%  
**Energy Unavailability Factor:** 10.6%  
**Total Off-line Time:** 931 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 646.1 | 523.7 | 0.0   | 550.0 | 708.8 | 668.4 | 684.4 | 565.9 | 682.3 | 687.3 | 688.3 | 688.1 | 7093.4 |
| <b>EAF (%)</b>  | 100.0 | 93.1  | 0.0   | 94.4  | 100.0 | 100.0 | 100.0 | 86.9  | 100.0 | 100.0 | 100.0 | 100.0 | 89.4   |
| <b>UCF (%)</b>  | 100.0 | 93.1  | 0.0   | 94.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.5   |
| <b>LF (%)</b>   | 99.6  | 86.3  | 0.0   | 87.7  | 109.3 | 106.5 | 105.5 | 87.2  | 108.7 | 105.8 | 109.6 | 106.1 | 92.6   |
| <b>OF (%)</b>   | 100.0 | 93.1  | 0.0   | 94.3  | 100.0 | 100.0 | 100.0 | 86.8  | 100.0 | 100.0 | 100.0 | 100.0 | 89.4   |
| <b>EUF (%)</b>  | 0.0   | 6.9   | 100.0 | 5.6   | 0.0   | 0.0   | 0.0   | 13.1  | 0.0   | 0.0   | 0.0   | 0.0   | 10.6   |
| <b>PUF (%)</b>  | 0.0   | 6.9   | 100.0 | 5.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.1  | 0.0   | 0.0   | 0.0   | 0.0   | 1.1    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1969  
**Date of First Criticality:** 08 Oct 1976  
**Date of Grid Connection:** 04 Dec 1976  
**Date of Commercial Operation:** 18 Mar 1977

**Lifetime Generation:** 131627.3 GW(e).h  
**Cumulative Energy Availability Factor:** 71.5%  
**Cumulative Load Factor:** 68.3%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 28.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1419.1         | 790.0          | 26.4   | 54.7   | 26.4                              | 54.7   | 20.5               | 46.1   | 2116               | 24.2   |
| 1984 | 5037.7         | 790.0          | 81.5   | 58.5   | 79.8                              | 58.3   | 72.6               | 49.9   | 6797               | 77.4   |
| 1985 | 1942.5         | 790.0          | 38.9   | 56.0   | 38.9                              | 55.8   | 28.1               | 47.2   | 3247               | 37.1   |
| 1986 | 5973.8         | 790.0          | 92.2   | 60.1   | 92.2                              | 59.9   | 86.3               | 51.5   | 8068               | 92.1   |
| 1987 | 4057.9         | 790.0          | 65.6   | 60.6   | 65.6                              | 60.5   | 58.6               | 52.2   | 5651               | 64.5   |
| 1988 | 4458.4         | 790.0          | 74.5   | 61.9   | 74.5                              | 61.7   | 64.2               | 53.3   | 6514               | 74.2   |
| 1989 | 4193.8         | 790.0          | 64.6   | 62.1   | 64.6                              | 62.0   | 60.6               | 53.9   | 5568               | 63.6   |
| 1990 | 4340.3         | 790.0          | 68.4   | 62.6   | 68.4                              | 62.5   | 62.7               | 54.6   | 5909               | 67.5   |
| 1991 | 4400.3         | 780.0          | 67.3   | 62.9   | 67.3                              | 62.8   | 64.4               | 55.3   | 5849               | 66.8   |
| 1992 | 1874.5         | 767.0          | 28.3   | 60.7   | 28.3                              | 60.6   | 27.8               | 53.5   | 2486               | 28.3   |
| 1993 | 0.0            | 767.0          | 0.0  | 57.0   | 0.0                               | 56.9   | 0.0                | 50.3   | 0                  | 0.0    |
| 1994 | 5956.3         | 767.0          | 88.6   | 58.8   | 88.6                              | 58.7   | 88.7               | 52.5   | 7755               | 88.5   |
| 1995 | 5780.7         | 767.0          | 84.4   | 60.2   | 84.4                              | 60.1   | 86.0               | 54.3   | 7391               | 84.4   |
| 1996 | 5708.2         | 767.0          | 88.6   | 61.6   | 85.3                              | 61.4   | 84.7               | 55.9   | 7490               | 85.3   |
| 1997 | 6857.0         | 767.0          | 97.7   | 63.4   | 97.7                              | 63.2   | 102.1              | 58.1   | 8558               | 97.7   |
| 1998 | 6360.4         | 820.0          | 91.4   | 64.8   | 89.9                              | 64.5   | 88.5               | 59.6   | 7811               | 89.2   |
| 1999 | 6998.2         | 820.0          | 99.0   | 66.4   | 96.8                              | 66.0   | 97.4               | 61.4   | 8481               | 96.8   |
| 2000 | 6746.5         | 820.0          | 92.5   | 67.6   | 92.5                              | 67.2   | 93.7               | 62.9   | 8122               | 92.5   |
| 2001 | 7303.1         | 820.0          | 100.0  | 69.0   | 100.0                             | 68.6   | 101.7              | 64.6   | 8760               | 100.0  |
| 2002 | 6697.3         | 820.0          | 89.9   | 69.9   | 89.9                              | 69.5   | 93.2               | 65.8   | 7874               | 89.9   |
| 2003 | 7701.8         | 872.0          | 98.8   | 71.1   | 98.9                              | 70.8   | 100.8              | 67.2   | 8653               | 98.8   |
| 2004 | 7093.4         | 872.0          | 90.5   | 71.9   | 89.4                              | 71.5   | 92.6               | 68.3   | 7853               | 89.4   |



# US-325 BRUNSWICK-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 28 Feb | 832.9 | 726.3   | PF   | C21  | REFUELLING OUTAGE.  |
| 14 Aug | 97.2  | 84.8    | XF   | N    | SHUTDOWN DUE TO A LOSS OF OFFSITE POWER DURING HURRICANE CHARLEY. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 402       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 45        |          |
| C. Inspection, maintenance or repair combined with refuelling  | 832             |           |          | 1378                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 532                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 7  | 77        |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 2         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 14        | 21       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 97       |  |           |          |
| Subtotal   | 832             | 0         | 97       | 1917                                     | 540       | 26       |
| Total  |                 | 929       |          |  | 2483      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 19                                       |
| 13. Reactor Auxiliary Systems            |                 | 12                                       |
| 14. Safety Systems                       |                 | 29                                       |
| 15. Reactor Cooling Systems              |                 | 75                                       |
| 21. Fuel Handling and Storage Facilities |                 | 7  |
| 31. Turbine and auxiliaries              |                 | 41                                       |
| 32. Feedwater and Main Steam System      |                 | 14                                       |
| 41. Main Generator Systems               |                 | 93                                       |
| 42. Electrical Power Supply Systems      |                 | 52                                       |
| XX. Miscellaneous Systems                |                 | 12                                       |
| Total                                    | 0               | 354                                      |

# US-324 BRUNSWICK-2

**Operator:** PROGRESS (Progress Energy Corporation)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 900.0 MW(e)  
**Design Net RUP:** 821.0 MW(e)  
**Design Discharge Burnup:** 25000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7756.8 GW(e).h  
**Energy Availability Factor:** 98.5%  
**Load Factor:** 98.1%  
**Operating Factor:** 98.3%  
**Energy Unavailability Factor:** 1.5%  
**Total Off-line Time:** 145 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 670.8 | 648.3 | 682.2 | 652.5 | 614.0 | 624.3 | 612.8 | 611.8 | 648.5 | 678.2 | 644.2 | 669.2 | 7756.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 92.7  | 100.0 | 91.3  | 98.7  | 100.0 | 100.0 | 100.0 | 100.0 | 98.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 92.7  | 100.0 | 91.3  | 98.7  | 100.0 | 100.0 | 100.0 | 100.0 | 98.5   |
| <b>LF (%)</b>   | 100.2 | 103.5 | 101.9 | 100.8 | 91.7  | 96.3  | 91.5  | 91.4  | 100.1 | 101.1 | 99.4  | 99.9  | 98.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 91.8  | 100.0 | 92.3  | 96.4  | 100.0 | 100.0 | 100.0 | 100.0 | 98.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 7.3   | 0.0   | 8.7   | 1.3   | 0.0   | 0.0   | 0.0   | 0.0   | 1.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 7.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.7   | 1.3   | 0.0   | 0.0   | 0.0   | 0.0   | 0.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1969  
**Date of First Criticality:** 20 Mar 1975  
**Date of Grid Connection:** 29 Apr 1975  
**Date of Commercial Operation:** 03 Nov 1975

**Lifetime Generation:** 132876.6 GW(e).h  
**Cumulative Energy Availability Factor:** 69.4%  
**Cumulative Load Factor:** 65.4%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 30.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3941.7         | 790.0          | 65.3   | 50.7   | 65.3                              | 50.7   | 57.0               | 44.1   | 5630               | 64.3   |
| 1984 | 1429.0         | 790.0          | 28.9   | 48.3   | 28.9                              | 48.3   | 20.6               | 41.4   | 2236               | 25.5   |
| 1985 | 5021.9         | 790.0          | 84.1   | 51.9   | 80.0                              | 51.5   | 72.6               | 44.6   | 6983               | 79.7   |
| 1986 | 2933.1         | 790.0          | 48.5   | 51.6   | 48.5                              | 51.2   | 42.4               | 44.4   | 4027               | 46.0   |
| 1987 | 5694.1         | 790.0          | 94.0   | 55.1   | 94.0                              | 54.8   | 82.3               | 47.5   | 8203               | 93.6   |
| 1988 | 3929.2         | 790.0          | 62.8   | 55.7   | 62.8                              | 55.4   | 56.6               | 48.2   | 5361               | 61.0   |
| 1989 | 4195.4         | 790.0          | 67.4   | 56.5   | 67.4                              | 56.2   | 60.6               | 49.1   | 5763               | 65.8   |
| 1990 | 4067.4         | 790.0          | 66.1   | 57.2   | 66.1                              | 56.9   | 58.8               | 49.7   | 5616               | 64.1   |
| 1991 | 3664.2         | 775.0          | 57.8   | 57.2   | 57.8                              | 56.9   | 54.0               | 50.0   | 4959               | 56.6   |
| 1992 | 1315.1         | 754.0          | 25.1   | 55.4   | 25.1                              | 55.1   | 19.9               | 48.3   | 2200               | 25.0   |
| 1993 | 4000.9         | 754.0          | 63.1   | 55.8   | 63.1                              | 55.6   | 60.6               | 49.0   | 5525               | 63.1   |
| 1994 | 4823.2         | 754.0          | 73.5   | 56.7   | 73.5                              | 56.5   | 73.0               | 50.2   | 6436               | 73.5   |
| 1995 | 6216.0         | 754.0          | 100.0  | 58.8   | 94.1                              | 58.6   | 94.1               | 52.3   | 8760               | 100.0  |
| 1996 | 5188.1         | 754.0          | 86.9   | 60.1   | 82.9                              | 59.7   | 78.3               | 53.5   | 7277               | 82.8   |
| 1997 | 6055.4         | 754.0          | 89.3   | 61.4   | 89.2                              | 61.0   | 91.7               | 55.2   | 7816               | 89.2   |
| 1998 | 6963.5         | 811.0          | 98.9   | 63.0   | 97.7                              | 62.6   | 98.0               | 57.1   | 8539               | 97.5   |
| 1999 | 6095.2         | 811.0          | 89.2   | 64.2   | 86.5                              | 63.7   | 85.8               | 58.3   | 7577               | 86.5   |
| 2000 | 7055.0         | 811.0          | 98.1   | 65.6   | 98.1                              | 65.1   | 99.0               | 60.0   | 8616               | 98.1   |
| 2001 | 6540.4         | 811.0          | 91.3   | 66.6   | 91.3                              | 66.1   | 92.1               | 61.3   | 7996               | 91.3   |
| 2002 | 7078.6         | 811.0          | 98.3   | 67.8   | 98.3                              | 67.4   | 99.6               | 62.8   | 8609               | 98.3   |
| 2003 | 7028.1         | 811.0          | 91.0   | 68.7   | 91.0                              | 68.2   | 98.9               | 64.1   | 7966               | 90.9   |
| 2004 | 7756.8         | 900.0          | 98.5   | 69.8   | 98.5                              | 69.4   | 98.1               | 65.4   | 8639               | 98.3   |

## US-324 BRUNSWICK-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 29 May | 60.4  | 49.0    | PF   | D11  | UNIT 2 WAS SHUT DOWN TO REPAIR DETECTED LEAKAGE IN THE DRYWELL. THE LEAK WAS A BODY TO BONNET LEAK ON THE RESIDUAL HEAT REMOVAL SYSTEM, LOW PRESSURE COOLANT INJECTION, INJECTION LINE CHECK VALVE 2E11-F050B. |
| 29 Jul | 83.1  | 67.4    | UF2  | A11  | UNIT NO. 2 WAS SHUTDOWN AS REQUIRED BY TECH SPEC DUE TO ONE OF TEN SUPPRESSION CHAMBER-TO-DRYWELL VACUUM BREAKERS BEING OPEN.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 83        |          |  | 728       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 59        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1271                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 60              |           |          | 426                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 15                                       | 4         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 0  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 6         | 35       |
| Subtotal   | 60              | 83        | 0        | 1712                                     | 797       | 35       |
| Total  |                 | 143       |          |  | 2544      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         | 83              | 1  |
| 12. Reactor I&C Systems             |                 | 23                                       |
| 13. Reactor Auxiliary Systems       |                 | 15                                       |
| 14. Safety Systems                  |                 | 42                                       |
| 15. Reactor Cooling Systems         |                 | 291                                      |
| 31. Turbine and auxiliaries         |                 | 101                                      |
| 32. Feedwater and Main Steam System |                 | 55                                       |
| 33. Circulating Water System        |                 | 1  |
| 41. Main Generator Systems          |                 | 36                                       |
| 42. Electrical Power Supply Systems |                 | 63                                       |
| XX. Miscellaneous Systems           |                 | 7  |
| Total                               | 83              | 635                                      |

# US-454 BYRON-1

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1163.0 MW(e)  
**Design Net RUP:** 1120.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10381.3 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 102.2%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 851.7 | 828.5 | 885.9 | 853.9 | 879.8 | 850.0 | 873.3 | 873.2 | 849.6 | 884.2 | 861.2 | 890.1 | 10381.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>LF (%)</b>   | 98.4  | 102.4 | 102.4 | 102.1 | 101.7 | 102.5 | 101.9 | 101.9 | 102.4 | 103.0 | 103.8 | 103.9 | 102.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1975      **Lifetime Generation:** 154323.7 GW(e).h  
**Date of First Criticality:** 02 Feb 1985      **Cumulative Energy Availability Factor:** 86.5%  
**Date of Grid Connection:** 01 Mar 1985      **Cumulative Load Factor:** 81.9%  
**Date of Commercial Operation:** 16 Sep 1985      **Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 13.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 1696.1         | 1124.0         | 0.0  | 0.0    | 83.7                              | 100.0  | 18.0               | 0.0    | 2025               | 24.1   |
| 1986 | 7396.0         | 1129.0         | 89.1   | 89.1   | 89.1                              | 89.1   | 74.8               | 74.8   | 7760               | 88.6   |
| 1987 | 5355.7         | 1125.0         | 69.6   | 79.4   | 68.7                              | 78.9   | 54.3               | 64.6   | 6005               | 68.6   |
| 1988 | 6303.7         | 1112.0         | 72.9   | 77.2   | 72.9                              | 76.9   | 64.5               | 64.6   | 6393               | 72.8   |
| 1989 | 8945.5         | 1105.0         | 99.7   | 82.8   | 99.7                              | 82.6   | 92.4               | 71.4   | 8737               | 99.7   |
| 1990 | 6951.7         | 1105.0         | 80.3   | 82.3   | 80.3                              | 82.1   | 71.8               | 71.5   | 7059               | 80.6   |
| 1991 | 6318.1         | 1105.0         | 81.3   | 82.1   | 81.3                              | 82.0   | 65.3               | 70.5   | 7148               | 81.6   |
| 1992 | 8986.4         | 1105.0         | 99.3   | 84.6   | 99.3                              | 84.5   | 92.6               | 73.6   | 8723               | 99.3   |
| 1993 | 7366.9         | 1105.0         | 80.8   | 84.1   | 80.9                              | 84.0   | 76.1               | 73.9   | 7104               | 81.1   |
| 1994 | 6801.6         | 1105.0         | 81.2   | 83.8   | 81.2                              | 83.7   | 70.3               | 73.5   | 7136               | 81.5   |
| 1995 | 7706.5         | 1105.0         | 82.3   | 83.7   | 82.3                              | 83.6   | 79.6               | 74.1   | 7228               | 82.5   |
| 1996 | 6871.1         | 1105.0         | 74.7   | 82.8   | 74.7                              | 82.8   | 70.8               | 73.8   | 6588               | 75.0   |
| 1997 | 7161.7         | 1105.0         | 76.8   | 82.3   | 76.8                              | 82.3   | 74.0               | 73.8   | 6737               | 76.9   |
| 1998 | 7804.6         | 1105.0         | 81.5   | 82.3   | 81.5                              | 82.2   | 80.6               | 74.4   | 7145               | 81.6   |
| 1999 | 8908.5         | 1105.0         | 90.6   | 82.9   | 90.6                              | 82.8   | 92.0               | 75.6   | 7944               | 90.7   |
| 2000 | 9291.9         | 1105.0         | 94.2   | 83.6   | 94.2                              | 83.6   | 95.7               | 77.0   | 8284               | 94.3   |
| 2001 | 10389.9        | 1138.0         | 100.0  | 84.7   | 100.0                             | 84.6   | 104.2              | 78.7   | 8760               | 100.0  |
| 2002 | 9827.8         | 1163.0         | 94.1   | 85.3   | 94.1                              | 85.2   | 96.5               | 79.8   | 8256               | 94.2   |
| 2003 | 9858.8         | 1163.0         | 94.0   | 85.8   | 94.0                              | 85.7   | 96.8               | 80.8   | 8248               | 94.2   |
| 2004 | 10381.3        | 1156.0         | 100.0  | 86.5   | 100.0                             | 86.5   | 102.2              | 81.9   | 8784               | 100.0  |

# US-454 BYRON-1

## 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 83        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 865                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 213                                      |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 3         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 4  | 6         | 3        |
| Subtotal   | 0               | 0         | 0        | 1082                                     | 103       | 3        |
| Total  | 0               |           |          | 1188                                     |           |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  |                 | 3  |
| 13. Reactor Auxiliary Systems            |                 | 1  |
| 15. Reactor Cooling Systems              |                 | 8  |
| 21. Fuel Handling and Storage Facilities |                 | 25                                       |
| 31. Turbine and auxiliaries              |                 | 19                                       |
| 32. Feedwater and Main Steam System      |                 | 11                                       |
| 41. Main Generator Systems               |                 | 0  |
| 42. Electrical Power Supply Systems      |                 | 6  |
| Total                                    | 0               | 73                                       |

# US-455 BYRON-2

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1131.0 MW(e)  
**Design Net RUP:** 1120.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9623.2 GW(e).h  
**Energy Availability Factor:** 95.0%  
**Load Factor:** 97.2%  
**Operating Factor:** 95.2%  
**Energy Unavailability Factor:** 5.0%  
**Total Off-line Time:** 424 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 860.9 | 807.9 | 600.1 | 566.6 | 861.0 | 827.2 | 854.9 | 857.8 | 826.7 | 863.2 | 832.2 | 864.7 | 9623.2 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 66.9  | 73.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 66.9  | 73.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.0   |
| <b>LF (%)</b>   | 102.3 | 102.6 | 71.3  | 69.7  | 102.3 | 102.1 | 102.1 | 102.5 | 102.1 | 103.0 | 102.7 | 103.3 | 97.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 70.8  | 71.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 33.1  | 26.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 33.1  | 26.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1975  
**Date of First Criticality:** 09 Jan 1987  
**Date of Grid Connection:** 06 Feb 1987  
**Date of Commercial Operation:** 21 Aug 1987

**Lifetime Generation:** 147431.7 GW(e).h  
**Cumulative Energy Availability Factor:** 90.6%  
**Cumulative Load Factor:** 86.7%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 9.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 3876.1         | 1128.0         | 0.0  | 0.0    | 91.4                              | 100.0  | 39.9               | 0.0    | 5071               | 58.8   |
| 1988 | 6357.9         | 1112.0         | 95.9   | 95.9   | 95.9                              | 95.9   | 65.1               | 65.1   | 8419               | 95.8   |
| 1989 | 6069.5         | 1105.0         | 79.5   | 87.7   | 79.5                              | 87.7   | 62.7               | 63.9   | 6981               | 79.7   |
| 1990 | 6052.7         | 1105.0         | 75.0   | 83.5   | 75.0                              | 83.5   | 62.5               | 63.4   | 6598               | 75.3   |
| 1991 | 8772.7         | 1105.0         | 96.9   | 86.8   | 96.9                              | 86.8   | 90.6               | 70.2   | 8489               | 96.9   |
| 1992 | 7000.3         | 1105.0         | 79.8   | 85.4   | 79.8                              | 85.4   | 72.1               | 70.6   | 7027               | 80.0   |
| 1993 | 7622.5         | 1105.0         | 84.3   | 85.2   | 84.3                              | 85.2   | 78.7               | 72.0   | 7399               | 84.5   |
| 1994 | 9504.2         | 1105.0         | 99.4   | 87.2   | 99.4                              | 87.2   | 98.2               | 75.7   | 8704               | 99.4   |
| 1995 | 8183.8         | 1105.0         | 87.9   | 87.3   | 87.9                              | 87.3   | 84.5               | 76.8   | 7710               | 88.0   |
| 1996 | 7830.6         | 1105.0         | 82.0   | 86.7   | 82.0                              | 86.7   | 80.7               | 77.2   | 7225               | 82.3   |
| 1997 | 9102.9         | 1105.0         | 95.2   | 87.6   | 95.2                              | 87.6   | 94.0               | 78.9   | 8344               | 95.3   |
| 1998 | 8592.8         | 1105.0         | 89.5   | 87.8   | 89.5                              | 87.8   | 88.8               | 79.8   | 7855               | 89.7   |
| 1999 | 9174.1         | 1105.0         | 93.3   | 88.2   | 93.3                              | 88.2   | 94.8               | 81.1   | 8182               | 93.4   |
| 2000 | 10005.4        | 1105.0         | 99.3   | 89.1   | 99.3                              | 89.1   | 103.1              | 82.7   | 8724               | 99.3   |
| 2001 | 9826.7         | 1120.0         | 95.3   | 89.5   | 95.3                              | 89.5   | 100.2              | 84.0   | 8353               | 95.4   |
| 2002 | 9537.6         | 1131.0         | 92.3   | 89.7   | 92.3                              | 89.7   | 96.3               | 84.8   | 8119               | 92.7   |
| 2003 | 10298.7        | 1131.0         | 100.0  | 90.4   | 100.0                             | 90.4   | 103.9              | 86.1   | 8760               | 100.0  |
| 2004 | 9623.2         | 1127.0         | 95.0   | 90.7   | 95.0                              | 90.6   | 97.2               | 86.7   | 8360               | 95.2   |

**US-455 BYRON-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description        |
|--------|-------|---------|------|------|--------------------|
| 22 Mar | 423.6 | 492.2   | PF   | C21  | REFUELLING OUTAGE. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          | 10  | 95        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 423             |           |          | 628   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 41  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 9         |          |
| Subtotal   | 423             | 0         | 0        | 679   | 104       | 0        |
| Total  |                 | 423       |          |   | 783       |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 5   |
| 15. Reactor Cooling Systems                    |                    | 13  |
| 16. Steam generation systems                   |                    | 24  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 4   |
| 21. Fuel Handling and Storage Facilities       |                    | 3   |
| 32. Feedwater and Main Steam System            |                    | 4   |
| 35. All other I&C Systems                      |                    | 2   |
| 41. Main Generator Systems                     |                    | 12  |
| 42. Electrical Power Supply Systems            |                    | 1   |
| Total  | 0                  | 68  |

# US-483 CALLAWAY-1

**Operator:** AMEREN (AMEREN)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1125.0 MW(e)  
**Design Net RUP:** 1171.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7842.4 GW(e).h  
**Energy Availability Factor:** 77.9%  
**Load Factor:** 79.4%  
**Operating Factor:** 78.1%  
**Energy Unavailability Factor:** 22.1%  
**Total Off-line Time:** 1928 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 818.8 | 377.1 | 869.1 | 228.2 | 0.0   | 410.6 | 860.4 | 859.8 | 835.9 | 868.5 | 839.9 | 873.9 | 7842.4 |
| <b>EAF (%)</b>  | 95.1  | 49.3  | 100.0 | 29.2  | 0.0   | 58.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.9   |
| <b>UCF (%)</b>  | 95.1  | 49.3  | 100.0 | 29.2  | 0.0   | 58.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.9   |
| <b>LF (%)</b>   | 97.8  | 48.2  | 103.8 | 28.2  | 0.0   | 50.7  | 102.8 | 102.7 | 103.2 | 103.6 | 103.7 | 104.4 | 79.4   |
| <b>OF (%)</b>   | 95.0  | 49.9  | 100.0 | 30.0  | 0.0   | 59.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.1   |
| <b>EUF (%)</b>  | 4.9   | 50.7  | 0.0   | 70.8  | 100.0 | 41.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 70.8  | 100.0 | 41.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 17.6   |
| <b>UCLF (%)</b> | 4.9   | 50.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1975  
**Date of First Criticality:** 02 Oct 1984  
**Date of Grid Connection:** 24 Oct 1984  
**Date of Commercial Operation:** 19 Dec 1984

**Lifetime Generation:** 170630.1 GW(e).h  
**Cumulative Energy Availability Factor:** 88.1%  
**Cumulative Load Factor:** 86.4%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 11.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 577.2          | 1140.0         | 0.0  | 0.0    | 6.5                               | 100.0  | 6.5                | 0.0    | 863                | 11.1   |
| 1985 | 8045.8         | 1120.0         | 90.0   | 90.0   | 90.0                              | 90.0   | 82.0               | 82.0   | 7882               | 90.0   |
| 1986 | 7199.1         | 1120.0         | 81.6   | 85.8   | 81.6                              | 85.8   | 73.4               | 77.7   | 7121               | 81.3   |
| 1987 | 6321.8         | 1120.0         | 70.0   | 80.5   | 70.0                              | 80.5   | 64.4               | 73.3   | 6141               | 70.1   |
| 1988 | 8144.2         | 1120.0         | 92.5   | 83.5   | 92.5                              | 83.5   | 82.8               | 75.7   | 7413               | 84.4   |
| 1989 | 8350.9         | 1118.0         | 84.0   | 83.6   | 84.0                              | 83.6   | 85.3               | 77.6   | 7368               | 84.1   |
| 1990 | 8005.1         | 1125.0         | 81.8   | 83.3   | 81.8                              | 83.3   | 81.2               | 78.2   | 7167               | 81.8   |
| 1991 | 9979.4         | 1125.0         | 99.6   | 85.7   | 99.6                              | 85.7   | 101.3              | 81.5   | 8726               | 99.6   |
| 1992 | 8094.6         | 1125.0         | 82.0   | 85.2   | 82.0                              | 85.2   | 81.9               | 81.5   | 7204               | 82.0   |
| 1993 | 8390.0         | 1120.0         | 85.5   | 85.3   | 85.5                              | 85.2   | 85.5               | 82.0   | 7498               | 85.6   |
| 1994 | 10006.5        | 1115.0         | 99.6   | 86.7   | 99.6                              | 86.7   | 102.4              | 84.0   | 8726               | 99.6   |
| 1995 | 8252.8         | 1125.0         | 84.0   | 86.4   | 84.0                              | 86.4   | 83.7               | 84.0   | 7356               | 84.0   |
| 1996 | 8890.4         | 1125.0         | 89.6   | 86.7   | 89.6                              | 86.7   | 90.0               | 84.5   | 7864               | 89.5   |
| 1997 | 8954.6         | 1125.0         | 100.0  | 87.7   | 90.9                              | 87.7   | 90.9               | 85.0   | 8760               | 100.0  |
| 1998 | 8516.8         | 1125.0         | 90.4   | 87.9   | 90.4                              | 87.9   | 86.4               | 85.1   | 7913               | 90.3   |
| 1999 | 8596.4         | 1125.0         | 87.8   | 87.9   | 87.8                              | 87.9   | 87.2               | 85.2   | 7707               | 88.0   |
| 2000 | 9991.8         | 1125.0         | 100.0  | 88.7   | 99.7                              | 88.6   | 101.1              | 86.2   | 8762               | 99.7   |
| 2001 | 8384.1         | 1125.0         | 85.4   | 88.5   | 85.4                              | 88.5   | 85.1               | 86.2   | 7500               | 85.6   |
| 2002 | 8386.6         | 1125.0         | 85.2   | 88.3   | 85.2                              | 88.3   | 85.1               | 86.1   | 7484               | 85.4   |
| 2003 | 9699.7         | 1125.0         | 95.8   | 88.7   | 95.8                              | 88.7   | 98.4               | 86.8   | 8397               | 95.9   |
| 2004 | 7842.4         | 1125.0         | 77.9   | 88.1   | 77.9                              | 88.1   | 79.4               | 86.4   | 6856               | 78.1   |



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## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 27 Jan | 36.1   | 41.1    | UF4  | A41  | UNEXPECTED TURBINE TRIP, FOLLOWED BY A REACTOR TRIP. IT WAS DETERMINED THAT THE SWITCH YARD OUTPUT BREAKERS OPENED DUE TO A GENERATOR DISTANCE RELAY FAILURE. |
| 03 Feb | 298.4  | 339.2   | UF4  | A42  | REACTOR TRIP WHEN THE SWITCH YARD OUTPUT BREAKERS OPENED DUE TO A PROTECTIVE RELAY FAILURE.   |
| 15 Feb | 50.5   | 57.4    | UF4  | L    | REACTOR TRIP DUE TO LOW STEAM GENERATOR WATER LEVEL.  |
| 10 Apr | 1534.0 | 1744.1  | PF   | C21  | REFUELLING OUTAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 334       |          |  | 130       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1533            |           |          | 638                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 105                                      | 1         |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 0         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         | 1        |
| L. Human factor related  |                 | 50        |          |  |           |          |
| Subtotal   | 1533            | 384       | 0        | 743                                      | 146       | 1        |
| Total  |                 | 1917      |          |  | 890       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 11                                       |
| 15. Reactor Cooling Systems                    |                 | 16                                       |
| 16. Steam generation systems                   |                 | 0  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 15                                       |
| 32. Feedwater and Main Steam System            |                 | 34                                       |
| 33. Circulating Water System                   |                 | 17                                       |
| 35. All other I&C Systems                      |                 | 0  |
| 41. Main Generator Systems                     | 36              | 10                                       |
| 42. Electrical Power Supply Systems            | 298             | 9  |
| Total  | 334             | 113                                      |

# US-317 CALVERT CLIFFS-1

**Operator:** CONST (CONSTELLATION NUCLEAR GROUP)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 825.0 MW(e)  
**Design Net RUP:** 845.0 MW(e)  
**Design Discharge Burnup:** 13775 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6974.0 GW(e).h  
**Energy Availability Factor:** 91.5%  
**Load Factor:** 93.3%  
**Operating Factor:** 91.5%  
**Energy Unavailability Factor:** 8.5%  
**Total Off-line Time:** 750 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 641.2 | 604.3 | 606.1 | 182.9 | 458.9 | 632.3 | 607.1 | 642.8 | 626.2 | 659.6 | 644.8 | 667.7 | 6974.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 95.1  | 24.8  | 74.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 95.1  | 24.8  | 74.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.5   |
| <b>LF (%)</b>   | 104.5 | 105.2 | 98.7  | 30.8  | 74.8  | 100.9 | 93.8  | 99.3  | 100.0 | 101.8 | 102.9 | 103.2 | 93.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 95.2  | 29.6  | 72.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 4.9   | 75.2  | 25.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 75.2  | 25.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 4.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1968  
**Date of First Criticality:** 07 Oct 1974  
**Date of Grid Connection:** 03 Jan 1975  
**Date of Commercial Operation:** 08 May 1975

**Lifetime Generation:** 162360.3 GW(e).h  
**Cumulative Energy Availability Factor:** 74.6%  
**Cumulative Load Factor:** 75.3%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 25.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5570.7         | 825.0          | 77.0   | 74.7   | 77.0                              | 74.1   | 77.1               | 73.0   | 6719               | 76.7   |
| 1984 | 6221.6         | 825.0          | 86.7   | 76.1   | 84.3                              | 75.3   | 85.9               | 74.4   | 7422               | 84.5   |
| 1985 | 4359.7         | 825.0          | 58.8   | 74.3   | 58.8                              | 73.6   | 60.3               | 73.0   | 5186               | 59.2   |
| 1986 | 5830.7         | 825.0          | 78.2   | 74.7   | 78.2                              | 74.0   | 80.7               | 73.7   | 6855               | 78.3   |
| 1987 | 5268.5         | 825.0          | 70.9   | 74.4   | 70.9                              | 73.8   | 72.9               | 73.6   | 6233               | 71.2   |
| 1988 | 5164.2         | 825.0          | 71.0   | 74.1   | 71.0                              | 73.6   | 71.3               | 73.5   | 6263               | 71.3   |
| 1989 | 1345.6         | 825.0          | 18.8   | 70.1   | 18.8                              | 69.6   | 18.6               | 69.5   | 1727               | 19.7   |
| 1990 | 1344.4         | 825.0          | 20.1   | 66.8   | 20.1                              | 66.3   | 18.6               | 66.1   | 1840               | 21.0   |
| 1991 | 5465.3         | 825.0          | 75.5   | 67.3   | 75.5                              | 66.9   | 75.6               | 66.7   | 6638               | 75.8   |
| 1992 | 4113.9         | 825.0          | 55.6   | 66.6   | 55.6                              | 66.2   | 56.8               | 66.1   | 4927               | 56.1   |
| 1993 | 7334.9         | 827.0          | 98.2   | 68.4   | 98.2                              | 68.0   | 101.2              | 68.1   | 8599               | 98.2   |
| 1994 | 4686.4         | 832.0          | 64.6   | 68.2   | 64.5                              | 67.8   | 64.3               | 67.9   | 5656               | 64.6   |
| 1995 | 7030.2         | 835.0          | 96.9   | 69.6   | 96.9                              | 69.3   | 96.1               | 69.3   | 8487               | 96.9   |
| 1996 | 4846.9         | 835.0          | 65.7   | 69.4   | 65.7                              | 69.1   | 66.1               | 69.2   | 5762               | 65.6   |
| 1997 | 7158.4         | 835.0          | 96.0   | 70.7   | 95.9                              | 70.3   | 97.9               | 70.5   | 8400               | 95.9   |
| 1998 | 6116.8         | 835.0          | 82.0   | 71.2   | 82.0                              | 70.9   | 83.6               | 71.1   | 7184               | 82.0   |
| 1999 | 6994.3         | 835.0          | 96.8   | 72.3   | 94.0                              | 71.8   | 95.6               | 72.1   | 8231               | 94.0   |
| 2000 | 6449.6         | 827.0          | 86.2   | 72.8   | 86.2                              | 72.4   | 88.8               | 72.8   | 7580               | 86.3   |
| 2001 | 7454.8         | 825.0          | 99.6   | 73.8   | 99.6                              | 73.5   | 103.2              | 73.9   | 8727               | 99.6   |
| 2002 | 4645.2         | 825.0          | 62.8   | 73.4   | 62.8                              | 73.1   | 64.3               | 73.6   | 5506               | 62.9   |
| 2003 | 7532.5         | 825.0          | 100.0  | 74.4   | 100.0                             | 74.0   | 104.2              | 74.7   | 8760               | 100.0  |
| 2004 | 6974.0         | 851.0          | 91.5   | 75.0   | 91.5                              | 74.6   | 93.3               | 75.3   | 8034               | 91.5   |

# US-317 CALVERT CLIFFS-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 20 Mar | 35.4  | 29.9    | UF4  | A35  | THE REACTOR TRIPPED DUE TO LOW STEAM GENERATOR WATER LEVEL CAUSED BY A SHORT CIRCUIT THAT WAS CREATED WHILE REPLACING A RECORDER IN A CONTROL PANEL.                              |
| 09 Apr | 704.7 | 595.5   | PF   | C21  | REFUELLING OUTAGE.  |
| 09 May | 8.8   | 7.4     | PF   | D31  | THE UNIT WAS REMOVED FROM THE GRID DUE TO HIGH VIBRATION ON THE MAIN TURBINE. MAIN TURBINE WAS TRIPPED AND PLACED ON THE JACKING GEAR THEN PARALLELED TO THE GRID LATER THAT DAY. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 35        |          |  | 324       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 704             |           |          | 1032                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 8               |           |          | 557                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 52                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 7         | 23       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 73        | 14       |
| Subtotal   | 712             | 35        | 0        | 1641                                     | 413       | 37       |
| Total  |                 | 747       |          |  | 2091      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 12                                       |
| 12. Reactor I&C Systems                        |                 | 10                                       |
| 13. Reactor Auxiliary Systems                  |                 | 24                                       |
| 14. Safety Systems                             |                 | 42                                       |
| 15. Reactor Cooling Systems                    |                 | 72                                       |
| 16. Steam generation systems                   |                 | 0  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 72                                       |
| 32. Feedwater and Main Steam System            |                 | 55                                       |
| 33. Circulating Water System                   |                 | 1  |
| 35. All other I&C Systems                      | 35              | 1  |
| 41. Main Generator Systems                     |                 | 2  |
| 42. Electrical Power Supply Systems            |                 | 16                                       |
| XX. Miscellaneous Systems                      |                 | 0  |
| Total  | 35              | 308                                      |

# US-318 CALVERT CLIFFS-2

**Operator:** CONST (CONSTELLATION NUCLEAR GROUP)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 835.0 MW(e)  
**Design Net RUP:** 845.0 MW(e)  
**Design Discharge Burnup:** 13775 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7552.2 GW(e).h  
**Energy Availability Factor:** 99.4%  
**Load Factor:** 101.4%  
**Operating Factor:** 99.4%  
**Energy Unavailability Factor:** 0.6%  
**Total Off-line Time:** 55 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 603.9 | 614.7 | 655.0 | 633.5 | 645.3 | 618.5 | 619.2 | 629.9 | 604.8 | 642.0 | 629.9 | 655.5 | 7552.2 |
| <b>EAF (%)</b>  | 92.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.4   |
| <b>UCF (%)</b>  | 92.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.4   |
| <b>LF (%)</b>   | 97.2  | 105.8 | 105.4 | 105.5 | 103.9 | 100.1 | 97.0  | 98.7  | 97.9  | 100.4 | 102.0 | 102.7 | 101.4  |
| <b>OF (%)</b>   | 92.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.4   |
| <b>EUF (%)</b>  | 7.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 7.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1968      **Lifetime Generation:** 159881.0 GW(e).h  
**Date of First Criticality:** 30 Nov 1976      **Cumulative Energy Availability Factor:** 78.2%  
**Date of Grid Connection:** 07 Dec 1976      **Cumulative Load Factor:** 78.3%  
**Date of Commercial Operation:** 01 Apr 1977      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 21.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6113.1         | 825.0          | 86.4   | 81.5   | 86.4                              | 81.1   | 84.6               | 78.0   | 7567               | 86.4   |
| 1984 | 5338.4         | 825.0          | 73.7   | 80.4   | 73.7                              | 80.0   | 73.7               | 77.4   | 6502               | 74.0   |
| 1985 | 5608.0         | 825.0          | 77.4   | 80.0   | 77.4                              | 79.7   | 77.6               | 77.4   | 6789               | 77.5   |
| 1986 | 7006.7         | 825.0          | 96.0   | 81.8   | 96.0                              | 81.5   | 97.0               | 79.6   | 8405               | 95.9   |
| 1987 | 4832.0         | 825.0          | 66.3   | 80.3   | 66.3                              | 80.0   | 66.9               | 78.3   | 5859               | 66.9   |
| 1988 | 6602.7         | 825.0          | 88.8   | 81.0   | 88.8                              | 80.8   | 91.1               | 79.5   | 7813               | 88.9   |
| 1989 | 1448.5         | 825.0          | 18.3   | 75.8   | 18.3                              | 75.6   | 20.0               | 74.5   | 1731               | 19.8   |
| 1990 | 0.0            | 825.0          | 0.0  | 70.0   | 0.0                               | 69.8   | 0.0                | 68.8   | 0                  | 0.0    |
| 1991 | 3635.6         | 825.0          | 51.3   | 68.6   | 51.3                              | 68.4   | 50.3               | 67.5   | 4515               | 51.5   |
| 1992 | 6590.3         | 825.0          | 89.3   | 70.0   | 89.3                              | 69.8   | 90.9               | 69.0   | 7855               | 89.4   |
| 1993 | 4975.2         | 827.0          | 67.4   | 69.8   | 67.3                              | 69.7   | 68.7               | 69.0   | 5939               | 67.8   |
| 1994 | 6576.5         | 835.0          | 90.6   | 71.1   | 90.5                              | 70.9   | 89.9               | 70.3   | 7925               | 90.5   |
| 1995 | 5911.1         | 840.0          | 81.4   | 71.7   | 81.4                              | 71.5   | 80.3               | 70.8   | 7121               | 81.3   |
| 1996 | 7247.7         | 840.0          | 97.5   | 73.0   | 97.5                              | 72.9   | 98.2               | 72.3   | 8561               | 97.5   |
| 1997 | 5979.9         | 840.0          | 81.1   | 73.5   | 81.1                              | 73.3   | 81.3               | 72.8   | 7100               | 81.1   |
| 1998 | 7225.5         | 840.0          | 95.8   | 74.5   | 95.8                              | 74.4   | 98.2               | 74.0   | 8393               | 95.8   |
| 1999 | 6332.7         | 840.0          | 84.5   | 75.0   | 84.5                              | 74.9   | 86.1               | 74.5   | 7400               | 84.5   |
| 2000 | 7391.0         | 835.0          | 98.0   | 76.0   | 98.1                              | 75.9   | 100.8              | 75.7   | 8614               | 98.1   |
| 2001 | 6201.5         | 835.0          | 83.3   | 76.3   | 83.3                              | 76.2   | 84.8               | 76.1   | 7297               | 83.3   |
| 2002 | 7480.6         | 835.0          | 100.0  | 77.3   | 100.0                             | 77.2   | 102.3              | 77.1   | 8760               | 100.0  |
| 2003 | 6156.9         | 835.0          | 81.4   | 77.4   | 81.4                              | 77.3   | 84.2               | 77.4   | 7124               | 81.3   |
| 2004 | 7552.2         | 848.0          | 99.4   | 78.3   | 99.4                              | 78.2   | 101.4              | 78.3   | 8729               | 99.4   |

## US-318 CALVERT CLIFFS-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 23 Jan | 54.4  | 46.7    | UF4  | A32  | THE UNIT TRIPPED ON LOW STEAM GENERATOR WATER LEVEL CAUSED BY A LOSS OF 22 STEAM GENERATOR FEED PUMP. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 54        |          |  | 258       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1426                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 97                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 11                                       | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 2         | 8        |
| J. Grid failure or grid unavailability   |                 |           |          |  | 0         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 13        |          |
| Subtotal   | 0               | 54        | 0        | 1534                                     | 290       | 8        |
| Total  |                 | 54        |          |  | 1832      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 3  |
| 12. Reactor I&C Systems             |                 | 16                                       |
| 13. Reactor Auxiliary Systems       |                 | 30                                       |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 78                                       |
| 16. Steam generation systems        |                 | 3  |
| 31. Turbine and auxiliaries         |                 | 31                                       |
| 32. Feedwater and Main Steam System | 54              | 49                                       |
| 35. All other I&C Systems           |                 | 3  |
| 41. Main Generator Systems          |                 | 18                                       |
| 42. Electrical Power Supply Systems |                 | 21                                       |
| Total                               | 54              | 254                                      |

# US-413 CATAWBA-1

**Operator:** DUKE (DUKE POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1129.0 MW(e)  
**Design Net RUP:** 1145.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9711.1 GW(e).h  
**Energy Availability Factor:** 98.0%  
**Load Factor:** 97.9%  
**Operating Factor:** 98.0%  
**Energy Unavailability Factor:** 2.0%  
**Total Off-line Time:** 176 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 832.0 | 604.8 | 821.9 | 836.1 | 821.8 | 825.4 | 851.2 | 822.9 | 825.8 | 857.7 | 791.9 | 819.6 | 9711.1 |
| <b>EAF (%)</b>  | 99.8  | 83.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.5  | 95.3  | 98.0   |
| <b>UCF (%)</b>  | 99.8  | 83.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.5  | 95.3  | 98.0   |
| <b>LF (%)</b>   | 99.1  | 77.0  | 97.8  | 103.0 | 97.8  | 101.5 | 101.3 | 98.0  | 101.6 | 102.0 | 97.4  | 97.6  | 97.9   |
| <b>OF (%)</b>   | 99.7  | 83.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.5  | 95.3  | 98.0   |
| <b>EUF (%)</b>  | 0.2   | 16.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.5   | 4.7   | 2.0    |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 16.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.5   | 4.7   | 2.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1974  
**Date of First Criticality:** 07 Jan 1985  
**Date of Grid Connection:** 22 Jan 1985  
**Date of Commercial Operation:** 29 Jun 1985

**Lifetime Generation:** 156993.3 GW(e).h  
**Cumulative Energy Availability Factor:** 82.8%  
**Cumulative Load Factor:** 81.5%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 17.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 3440.5         | 1138.0         | 0.0  | 0.0    | 88.2                              | 100.0  | 37.4               | 0.0    | 3513               | 43.4   |
| 1986 | 5199.1         | 1145.0         | 58.9   | 58.9   | 58.9                              | 58.9   | 51.8               | 51.8   | 5151               | 58.8   |
| 1987 | 6406.0         | 1145.0         | 68.0   | 63.4   | 68.0                              | 63.4   | 63.9               | 57.9   | 5924               | 67.6   |
| 1988 | 7640.0         | 1129.0         | 79.8   | 68.8   | 79.8                              | 68.8   | 77.0               | 64.2   | 7003               | 79.7   |
| 1989 | 7775.4         | 1129.0         | 84.7   | 72.8   | 84.7                              | 72.8   | 78.6               | 67.8   | 7278               | 83.1   |
| 1990 | 6900.5         | 1129.0         | 71.7   | 72.5   | 71.7                              | 72.5   | 69.8               | 68.2   | 6277               | 71.7   |
| 1991 | 6681.1         | 1129.0         | 71.1   | 72.3   | 71.1                              | 72.3   | 67.6               | 68.1   | 6227               | 71.1   |
| 1992 | 7050.9         | 1129.0         | 72.1   | 72.3   | 72.1                              | 72.3   | 71.1               | 68.5   | 6338               | 72.2   |
| 1993 | 7597.1         | 1129.0         | 79.0   | 73.1   | 79.0                              | 73.1   | 76.8               | 69.5   | 6916               | 78.9   |
| 1994 | 9778.8         | 1129.0         | 99.6   | 76.0   | 99.6                              | 76.0   | 98.9               | 72.8   | 8722               | 99.6   |
| 1995 | 8721.6         | 1129.0         | 88.1   | 77.2   | 88.1                              | 77.2   | 88.2               | 74.3   | 7712               | 88.0   |
| 1996 | 6341.1         | 1129.0         | 66.2   | 76.2   | 66.2                              | 76.2   | 63.9               | 73.4   | 5806               | 66.1   |
| 1997 | 9192.5         | 1129.0         | 90.7   | 77.4   | 90.7                              | 77.4   | 92.9               | 75.0   | 7966               | 90.9   |
| 1998 | 8903.7         | 1129.0         | 90.5   | 78.4   | 90.5                              | 78.4   | 90.0               | 76.2   | 7923               | 90.4   |
| 1999 | 9073.7         | 1129.0         | 91.2   | 79.3   | 91.2                              | 79.3   | 91.7               | 77.3   | 7987               | 91.2   |
| 2000 | 8923.0         | 1129.0         | 89.3   | 80.0   | 89.3                              | 80.0   | 90.0               | 78.1   | 7844               | 89.3   |
| 2001 | 9977.0         | 1129.0         | 99.6   | 81.2   | 99.6                              | 81.2   | 100.9              | 79.5   | 8722               | 99.6   |
| 2002 | 9481.6         | 1129.0         | 94.2   | 82.0   | 94.2                              | 82.0   | 95.9               | 80.5   | 8250               | 94.2   |
| 2003 | 8198.5         | 1129.0         | 81.7   | 82.0   | 81.7                              | 82.0   | 82.9               | 80.6   | 7157               | 81.7   |
| 2004 | 9711.1         | 1129.0         | 98.0   | 82.8   | 98.0                              | 82.8   | 97.9               | 81.5   | 8608               | 98.0   |

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## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 1.4   | 1.6     | PF   | E31  | TURBINE OVERSPEED.  |
| 22 Feb | 114.0 | 128.7   | UF2  | A32  | 1B STEAM GENERATOR MAIN FEEDWATER ISOLATION VALVE (1CF42) CLOSURE         |
| 13 Nov | 24.9  | 28.1    | UF2  | A31  | MAIN TURBINE CONTROL SYSTEM SPURIOUS ALARM REPAIR.                        |
| 05 Dec | 34.7  | 39.2    | UF4  | A31  | REACTOR/TURBINE TRIP DUE TO HIGH LEVEL IN 1B MOISTURE SEPARATOR REHEATER. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 173       |          | 3  | 356       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1003                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 71                                       |           |          |
| E. Testing of plant systems or components  | 1               |           |          | 2  | 5         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 6         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 3  | 8         |          |
| Subtotal   | 1               | 173       | 0        | 1082                                     | 383       | 0        |
| Total  |                 | 174       |          |  | 1465      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 7  |
| 12. Reactor I&C Systems             |                 | 37                                       |
| 13. Reactor Auxiliary Systems       |                 | 13                                       |
| 14. Safety Systems                  |                 | 29                                       |
| 15. Reactor Cooling Systems         |                 | 128                                      |
| 16. Steam generation systems        |                 | 1  |
| 31. Turbine and auxiliaries         | 59              | 15                                       |
| 32. Feedwater and Main Steam System | 114             | 72                                       |
| 33. Circulating Water System        |                 | 15                                       |
| 41. Main Generator Systems          |                 | 14                                       |
| 42. Electrical Power Supply Systems |                 | 13                                       |
| XX. Miscellaneous Systems           |                 | 11                                       |
| Total                               | 173             | 355                                      |

# US-414 CATAWBA-2

**Operator:** DUKE (DUKE POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1129.0 MW(e)  
**Design Net RUP:** 1145.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8835.7 GW(e).h  
**Energy Availability Factor:** 87.4%  
**Load Factor:** 89.1%  
**Operating Factor:** 87.3%  
**Energy Unavailability Factor:** 12.6%  
**Total Off-line Time:** 1112 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 870.7 | 814.0 | 868.4 | 837.8 | 860.3 | 827.7 | 854.2 | 856.0 | 270.6 | 100.6 | 806.6 | 868.8 | 8835.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 33.3  | 17.9  | 97.4  | 100.0 | 87.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 33.3  | 18.0  | 97.4  | 100.0 | 87.4   |
| <b>LF (%)</b>   | 103.7 | 103.6 | 103.4 | 103.2 | 102.4 | 101.8 | 101.7 | 101.9 | 33.3  | 12.0  | 99.2  | 103.4 | 89.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 33.9  | 17.2  | 97.4  | 100.0 | 87.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 66.7  | 82.1  | 2.6   | 0.0   | 12.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 66.7  | 76.2  | 0.0   | 0.0   | 11.9   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.9   | 2.6   | 0.0   | 0.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1974  
**Date of First Criticality:** 08 May 1986  
**Date of Grid Connection:** 18 May 1986  
**Date of Commercial Operation:** 19 Aug 1986

**Lifetime Generation:** 148572.9 GW(e).h  
**Cumulative Energy Availability Factor:** 84.2%  
**Cumulative Load Factor:** 82.6%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 15.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1986 | 1324.2         | 1135.0         | 0.0  | 0.0    | 77.1                              | 100.0  | 14.0               | 0.0    | 1325               | 15.9   |
| 1987 | 7169.5         | 1145.0         | 80.2   | 80.2   | 80.2                              | 80.2   | 71.5               | 71.5   | 7014               | 80.1   |
| 1988 | 5435.0         | 1129.0         | 71.8   | 76.0   | 71.8                              | 76.0   | 54.8               | 63.2   | 5571               | 63.4   |
| 1989 | 6527.1         | 1129.0         | 72.0   | 74.7   | 72.0                              | 74.7   | 66.0               | 64.1   | 6302               | 71.9   |
| 1990 | 6503.0         | 1129.0         | 69.0   | 73.3   | 69.0                              | 73.3   | 65.8               | 64.5   | 5984               | 68.3   |
| 1991 | 7274.9         | 1129.0         | 75.6   | 73.7   | 75.6                              | 73.7   | 73.6               | 66.3   | 6621               | 75.6   |
| 1992 | 9273.5         | 1129.0         | 94.3   | 77.2   | 94.3                              | 77.1   | 93.5               | 70.9   | 8281               | 94.3   |
| 1993 | 8177.4         | 1129.0         | 82.6   | 77.9   | 82.6                              | 77.9   | 82.7               | 72.5   | 7233               | 82.6   |
| 1994 | 7691.7         | 1129.0         | 79.8   | 78.2   | 79.7                              | 78.1   | 77.8               | 73.2   | 6978               | 79.7   |
| 1995 | 7960.2         | 1129.0         | 80.8   | 78.4   | 80.8                              | 78.4   | 80.5               | 74.0   | 7074               | 80.8   |
| 1996 | 9233.6         | 1129.0         | 92.3   | 79.8   | 92.3                              | 79.8   | 93.1               | 75.9   | 8107               | 92.3   |
| 1997 | 8593.4         | 1129.0         | 87.1   | 80.5   | 87.1                              | 80.5   | 86.9               | 76.9   | 7623               | 87.0   |
| 1998 | 8672.3         | 1129.0         | 86.5   | 81.0   | 86.5                              | 81.0   | 87.7               | 77.8   | 7580               | 86.5   |
| 1999 | 8855.4         | 1129.0         | 88.2   | 81.5   | 88.2                              | 81.6   | 89.5               | 78.7   | 7727               | 88.2   |
| 2000 | 8981.4         | 1129.0         | 90.3   | 82.2   | 90.3                              | 82.2   | 90.6               | 79.6   | 7928               | 90.3   |
| 2001 | 8574.1         | 1129.0         | 85.7   | 82.4   | 85.7                              | 82.4   | 86.7               | 80.0   | 7507               | 85.7   |
| 2002 | 10172.3        | 1129.0         | 100.0  | 83.5   | 100.0                             | 83.5   | 102.9              | 81.5   | 8760               | 100.0  |
| 2003 | 9318.2         | 1129.0         | 92.7   | 84.0   | 92.7                              | 84.0   | 94.2               | 82.2   | 8117               | 92.7   |
| 2004 | 8835.7         | 1129.0         | 87.4   | 84.2   | 87.4                              | 84.2   | 89.1               | 82.6   | 7672               | 87.3   |



## US-414 CATAWBA-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 11 Sep | 1007.1 | 1137.0  | PF   | C21  | REFUELLING OUTAGE.   |
| 23 Oct | 38.9   | 43.9    | PF   | E16  | OUTAGE EXTENDED DUE TO STEAM GENERATOR EDDY CURRENT TESTING. |
| 24 Oct | 1.8    | 2.0     | PF   | E31  | MAIN TURBINE OVERSPEED TRIP TEST.                            |
| 28 Oct | 43.6   | 49.2    | UF2  | A12  | SHUTDOWN BANK D CONTROL RODS DROPPED INTO CORE.              |
| 09 Nov | 18.8   | 21.2    | UF2  | A31  | TURBINE CONTROL OIL LEAK AT #1 INTERCEPT VALVE.              |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 62        |          | 18  | 436       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1007            |           |          | 796   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 74  | 0         |          |
| E. Testing of plant systems or components  | 40              |           |          | 2   | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 5         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0   | 13        |          |
| Subtotal   | 1047            | 62        | 0        | 890   | 458       | 0        |
| Total  |                 | 1109      |          |   | 1348      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1986 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        | 43                 | 4   |
| 13. Reactor Auxiliary Systems                  |                    | 31  |
| 14. Safety Systems                             |                    | 10  |
| 15. Reactor Cooling Systems                    |                    | 61  |
| 16. Steam generation systems                   |                    | 6   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 18  |
| 31. Turbine and auxiliaries                    | 18                 | 19  |
| 32. Feedwater and Main Steam System            |                    | 109   |
| 41. Main Generator Systems                     |                    | 151   |
| 42. Electrical Power Supply Systems            |                    | 38  |
| Total  | 61                 | 447   |

# US-461 CLINTON-1

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1022.0 MW(e)  
**Design Net RUP:** 950.0 MW(e)  
**Design Discharge Burnup:** 31448 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8000.4 GW(e).h  
**Energy Availability Factor:** 90.0%  
**Load Factor:** 89.1%  
**Operating Factor:** 90.1%  
**Energy Unavailability Factor:** 10.0%  
**Total Off-line Time:** 873 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb  | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 659.1 | 56.8 | 676.9 | 747.3 | 607.1 | 757.0 | 637.0 | 782.4 | 753.8 | 782.1 | 758.5 | 782.5 | 8000.4 |
| <b>EAF (%)</b>  | 100.0 | 15.5 | 91.0  | 100.0 | 87.6  | 100.0 | 82.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.0   |
| <b>UCF (%)</b>  | 100.0 | 15.5 | 91.0  | 100.0 | 87.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.5   |
| <b>LF (%)</b>   | 86.7  | 8.0  | 89.0  | 101.7 | 79.8  | 102.9 | 83.8  | 102.9 | 102.4 | 102.7 | 103.1 | 102.9 | 89.1   |
| <b>OF (%)</b>   | 100.0 | 15.8 | 91.0  | 100.0 | 87.6  | 100.0 | 82.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.1   |
| <b>EUF (%)</b>  | 0.0   | 84.5 | 9.0   | 0.0   | 12.4  | 0.0   | 17.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.0   |
| <b>PUF (%)</b>  | 0.0   | 84.5 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7    |
| <b>UCLF (%)</b> | 0.0   | 0.0  | 9.0   | 0.0   | 12.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 17.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.5    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1975  
**Date of First Criticality:** 27 Feb 1987  
**Date of Grid Connection:** 24 Apr 1987  
**Date of Commercial Operation:** 24 Nov 1987

**Lifetime Generation:** 93471.9 GW(e).h  
**Cumulative Energy Availability Factor:** 69.0%  
**Cumulative Load Factor:** 65.3%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 31.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 1628.8         | 932.0          | 0.0  | 0.0    | 73.7                              | 100.0  | 21.3               | 0.0    | 3264               | 39.8   |
| 1988 | 5860.7         | 930.0          | 82.5   | 82.5   | 82.5                              | 82.5   | 71.7               | 71.7   | 7244               | 82.5   |
| 1989 | 2861.9         | 931.0          | 45.1   | 63.8   | 45.1                              | 63.8   | 35.1               | 53.4   | 3947               | 45.1   |
| 1990 | 3596.6         | 930.0          | 52.6   | 60.1   | 52.6                              | 60.1   | 44.1               | 50.3   | 4604               | 52.6   |
| 1991 | 6048.0         | 930.0          | 79.1   | 64.8   | 79.1                              | 64.8   | 74.2               | 56.3   | 6927               | 79.1   |
| 1992 | 4935.3         | 930.0          | 66.3   | 65.1   | 66.3                              | 65.1   | 60.4               | 57.1   | 5824               | 66.3   |
| 1993 | 5879.2         | 930.0          | 77.1   | 67.1   | 77.1                              | 67.1   | 72.2               | 59.6   | 6750               | 77.1   |
| 1994 | 7410.3         | 930.0          | 93.8   | 70.9   | 93.8                              | 70.9   | 91.0               | 64.1   | 8217               | 93.8   |
| 1995 | 6109.2         | 930.0          | 81.6   | 72.3   | 81.6                              | 72.3   | 75.0               | 65.5   | 7140               | 81.5   |
| 1996 | 5312.9         | 930.0          | 66.5   | 71.6   | 66.5                              | 71.6   | 65.0               | 65.4   | 5833               | 66.4   |
| 1997 | 0.0            | 930.0          | 0.0  | 64.5   | 0.0                               | 64.5   | 0.0                | 58.9   | 0                  | 0.0    |
| 1998 | 0.0            | 930.0          | 0.0  | 58.6   | 0.0                               | 58.6   | 0.0                | 53.5   | 0                  | 0.0    |
| 1999 | 4704.2         | 930.0          | 60.2   | 58.7   | 60.2                              | 58.7   | 57.7               | 53.9   | 5270               | 60.2   |
| 2000 | 6888.8         | 930.0          | 85.9   | 60.8   | 85.9                              | 60.8   | 84.3               | 56.2   | 7542               | 85.9   |
| 2001 | 7877.2         | 930.0          | 97.8   | 63.5   | 97.8                              | 63.5   | 96.7               | 59.1   | 8565               | 97.8   |
| 2002 | 7657.5         | 983.0          | 89.8   | 65.3   | 89.8                              | 65.3   | 88.9               | 61.2   | 7805               | 89.1   |
| 2003 | 8700.8         | 1022.0         | 98.6   | 67.6   | 98.6                              | 67.6   | 97.2               | 63.7   | 8634               | 98.6   |
| 2004 | 8000.4         | 1022.0         | 91.5   | 69.1   | 90.0                              | 69.0   | 89.1               | 65.3   | 7911               | 90.1   |

# US-461 CLINTON-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 02 Feb | 548.0 | 562.3   | PF   | C21  | PLANNED REFUELLING OUTAGE.  |
| 26 Feb | 37.7  | 38.6    | PF   | E31  | REMOVED TURBINE GENERATOR FROM GRID FOR SCHEDULED TURBINE OFF-LINE TESTING AS PART OF POWER ASCENSION FORM C1R09.   |
| 22 Mar | 66.4  | 68.1    | UF4  | A41  | A REACTOR SCRAM OCCURRED FROM 93% POWER DUE TO A TURBINE TRIP CAUSED BY A TRIP OF THE MAIN GENERATOR OVERVOLTAGE RELAY.   |
| 12 May | 91.8  | 94.1    | UF2  | A32  | THE GENERATOR WAS TAKEN OFF LINE TO FACILITATE REPAIRS TO THE 3B FEEDWATER HEATER TUBE FAILURE.   |
| 13 Jul | 127.6 | 130.9   | XF4  | N    | REACTOR SCRAMMED WHEN LIGHTNING STRUCK A 345KV TRANSMISSION LINE NEAR THE PLANT. A RELAY ASSOCIATED WITH THE MAIN POWER TRANSFORMER ACTUATED PREMATURELY DURING THE EVENT, CAUSING A GENERATOR LOAD REJECT. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 158       |          |  | 387       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 23        |          |
| C. Inspection, maintenance or repair combined with refuelling  | 548             |           |          | 1972                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 235                                      |           |          |
| E. Testing of plant systems or components  | 37              |           |          | 1  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 11        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 69        |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 127      |  |           |          |
| Subtotal   | 585             | 158       | 127      | 2208                                     | 490       | 0        |
| Total  |                 | 870       |          |  | 2698      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 7  |
| 14. Safety Systems                             |                 | 11                                       |
| 15. Reactor Cooling Systems                    |                 | 117                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 40                                       |
| 32. Feedwater and Main Steam System            | 91              | 21                                       |
| 41. Main Generator Systems                     | 66              | 1  |
| 42. Electrical Power Supply Systems            |                 | 28                                       |
| Total  | 157             | 227                                      |

**US-397 COLUMBIA**

**Operator:** ENERGINW (Energy Northwest)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

**1. Station Details**

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1107.0 MW(e)  
**Design Net RUP:** 1100.0 MW(e)  
**Design Discharge Burnup:** 28400 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 8981.6 GW(e).h  
**Energy Availability Factor:** 93.6%  
**Load Factor:** 92.4%  
**Operating Factor:** 93.6%  
**Energy Unavailability Factor:** 6.4%  
**Total Off-line Time:** 562 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 798.7 | 780.1 | 830.7 | 799.0 | 786.5 | 770.5 | 771.3 | 206.3 | 791.3 | 821.9 | 796.8 | 828.5 | 8981.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.5  | 31.0  | 100.0 | 100.0 | 100.0 | 100.0 | 93.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.5  | 31.0  | 100.0 | 100.0 | 100.0 | 100.0 | 93.6   |
| <b>LF (%)</b>   | 97.0  | 101.3 | 100.9 | 100.4 | 95.5  | 96.7  | 93.6  | 25.1  | 99.3  | 99.7  | 100.0 | 100.6 | 92.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.8  | 29.7  | 100.0 | 100.0 | 100.0 | 100.0 | 93.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.5   | 69.0  | 0.0   | 0.0   | 0.0   | 0.0   | 6.4    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.5   | 69.0  | 0.0   | 0.0   | 0.0   | 0.0   | 6.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 01 Aug 1972  
**Date of First Criticality:** 19 Jan 1984  
**Date of Grid Connection:** 27 May 1984  
**Date of Commercial Operation:** 13 Dec 1984

**Lifetime Generation:** 133113.0 GW(e).h  
**Cumulative Energy Availability Factor:** 75.0%  
**Cumulative Load Factor:** 68.3%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 25.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 1458.4         | 1104.0         | 0.0  | 0.0    | 99.5                              | 100.0  | 16.9               | 0.0    | 2393               | 30.6   |
| 1985 | 5176.4         | 1100.0         | 77.1   | 77.1   | 77.1                              | 77.1   | 53.7               | 53.7   | 6624               | 75.6   |
| 1986 | 5183.2         | 1095.0         | 74.1   | 75.6   | 74.1                              | 75.6   | 54.0               | 53.9   | 6133               | 70.0   |
| 1987 | 5398.0         | 1095.0         | 67.9   | 73.0   | 67.9                              | 73.1   | 56.3               | 54.7   | 5979               | 68.3   |
| 1988 | 6000.4         | 1095.0         | 68.2   | 71.8   | 68.2                              | 71.8   | 62.4               | 56.6   | 6020               | 68.5   |
| 1989 | 6127.9         | 1095.0         | 76.0   | 72.7   | 76.1                              | 72.7   | 63.9               | 58.1   | 6680               | 76.3   |
| 1990 | 5791.3         | 1095.0         | 65.3   | 71.5   | 65.3                              | 71.5   | 60.4               | 58.4   | 5752               | 65.7   |
| 1991 | 4272.5         | 1090.0         | 47.1   | 68.0   | 47.1                              | 68.0   | 44.7               | 56.5   | 4194               | 47.9   |
| 1992 | 5705.4         | 1085.0         | 62.0   | 67.3   | 62.0                              | 67.2   | 59.9               | 56.9   | 5505               | 62.7   |
| 1993 | 7142.0         | 1107.0         | 77.2   | 68.4   | 77.1                              | 68.4   | 73.6               | 58.8   | 6757               | 77.1   |
| 1994 | 6753.8         | 1086.0         | 73.7   | 68.9   | 73.7                              | 68.9   | 71.0               | 60.0   | 6500               | 74.2   |
| 1995 | 6948.0         | 1091.0         | 76.0   | 69.5   | 76.0                              | 69.5   | 72.7               | 61.2   | 6680               | 76.3   |
| 1996 | 5562.6         | 1106.0         | 79.7   | 70.4   | 68.3                              | 69.4   | 57.3               | 60.8   | 5999               | 68.3   |
| 1997 | 6129.9         | 1107.0         | 77.4   | 70.9   | 71.3                              | 69.6   | 63.2               | 61.0   | 6248               | 71.3   |
| 1998 | 6922.8         | 1107.0         | 72.8   | 71.1   | 72.8                              | 69.8   | 71.4               | 61.8   | 6373               | 72.8   |
| 1999 | 6099.7         | 1107.0         | 68.5   | 70.9   | 68.5                              | 69.7   | 62.9               | 61.8   | 6018               | 68.7   |
| 2000 | 8605.2         | 1107.0         | 95.4   | 72.4   | 95.4                              | 71.3   | 88.5               | 63.5   | 8385               | 95.5   |
| 2001 | 8257.7         | 1107.0         | 86.1   | 73.3   | 86.1                              | 72.2   | 85.2               | 64.8   | 7553               | 86.2   |
| 2002 | 8981.3         | 1107.0         | 97.3   | 74.6   | 97.4                              | 73.6   | 92.6               | 66.4   | 8528               | 97.4   |
| 2003 | 7614.9         | 1107.0         | 80.4   | 74.9   | 80.4                              | 74.0   | 78.5               | 67.0   | 7039               | 80.4   |
| 2004 | 8981.6         | 1107.0         | 93.6   | 75.8   | 93.6                              | 75.0   | 92.4               | 68.3   | 8222               | 93.6   |

# US-397 COLUMBIA

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 30 Jul | 426.4 | 472.5   | UF4  | A31  | AUTO SCRAM FROM HIGH RPV PRESSURE DUE TO A DEH CARD FAILURE AND SUBSEQUENT CLOSURE OF MAIN TURBINE GOVERNOR VALVE 1.  |
| 17 Aug | 134.8 | 149.4   | UF4  | L    | SCRAM WAS IN RESPONSE TO A FEEDWATER PUMP TRIP WHICH WAS DUE TO LOW PUMP SUCTION PRESSURE INDUCED WHEN FEEDWATER HEATERS WERE RAPIDLY FILLED AFTER REPAIRS. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 426       |          |  | 277       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 18        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1205                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 142                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 31                                       | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 49        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 72       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 88                                       | 162       |          |
| L. Human factor related  |                 | 134       |          |  |           |          |
| Subtotal   | 0               | 560       | 0        | 1466                                     | 506       | 72       |
| Total  |                 | 560       |          |  | 2044      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 1  |
| 13. Reactor Auxiliary Systems                  |                 | 3  |
| 14. Safety Systems                             |                 | 21                                       |
| 15. Reactor Cooling Systems                    |                 | 28                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 32                                       |
| 21. Fuel Handling and Storage Facilities       |                 | 18                                       |
| 31. Turbine and auxiliaries                    | 426             | 77                                       |
| 32. Feedwater and Main Steam System            |                 | 37                                       |
| 35. All other I&C Systems                      |                 | 7  |
| 41. Main Generator Systems                     |                 | 1  |
| 42. Electrical Power Supply Systems            |                 | 47                                       |
| Total  | 426             | 272                                      |

# US-445 COMANCHE PEAK-1

**Operator:** TXU (TXU Electric Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1150.0 MW(e)  
**Design Net RUP:** 1150.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9018.1 GW(e).h  
**Energy Availability Factor:** 89.8%  
**Load Factor:** 89.3%  
**Operating Factor:** 89.7%  
**Energy Unavailability Factor:** 10.2%  
**Total Off-line Time:** 907 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 848.8 | 794.7 | 724.3 | 0.0   | 681.7 | 835.9 | 857.3 | 859.5 | 834.1 | 865.4 | 842.6 | 873.9 | 9018.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 84.8  | 0.0   | 91.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 84.8  | 0.0   | 91.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.8   |
| <b>LF (%)</b>   | 99.2  | 99.3  | 84.7  | 0.0   | 79.7  | 101.0 | 100.2 | 100.5 | 100.7 | 101.0 | 101.8 | 102.1 | 89.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 85.5  | 0.0   | 89.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 15.2  | 100.0 | 8.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 15.2  | 100.0 | 8.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1974  
**Date of First Criticality:** 03 Apr 1990  
**Date of Grid Connection:** 24 Apr 1990  
**Date of Commercial Operation:** 13 Aug 1990

**Lifetime Generation:** 118791.0 GW(e).h  
**Cumulative Energy Availability Factor:** 87.5%  
**Cumulative Load Factor:** 81.8%  
**Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 12.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 3335.2         | 1140.0         | 0.0  | 0.0    | 80.2                              | 100.0  | 37.1               | 0.0    | 4399               | 55.7   |
| 1991 | 5360.5         | 1150.0         | 60.5   | 60.5   | 60.5                              | 60.5   | 53.2               | 53.2   | 5341               | 61.0   |
| 1992 | 6937.5         | 1150.0         | 79.1   | 69.8   | 79.1                              | 69.8   | 68.7               | 61.0   | 6947               | 79.1   |
| 1993 | 7150.4         | 1150.0         | 79.1   | 72.9   | 79.1                              | 72.9   | 71.0               | 64.3   | 6932               | 79.1   |
| 1994 | 9367.6         | 1150.0         | 98.8   | 79.4   | 98.8                              | 79.4   | 93.0               | 71.5   | 8653               | 98.8   |
| 1995 | 7803.7         | 1150.0         | 85.0   | 80.5   | 85.0                              | 80.5   | 77.5               | 72.7   | 7444               | 85.0   |
| 1996 | 7756.2         | 1150.0         | 83.0   | 80.9   | 82.7                              | 80.9   | 76.8               | 73.3   | 7265               | 82.7   |
| 1997 | 9478.9         | 1150.0         | 98.8   | 83.5   | 98.8                              | 83.4   | 94.1               | 76.3   | 8656               | 98.8   |
| 1998 | 8506.0         | 1150.0         | 89.6   | 84.2   | 89.6                              | 84.2   | 84.4               | 77.3   | 7848               | 89.6   |
| 1999 | 8601.5         | 1150.0         | 90.4   | 84.9   | 90.4                              | 84.9   | 85.4               | 78.2   | 7922               | 90.4   |
| 2000 | 9619.8         | 1150.0         | 100.0  | 86.4   | 100.0                             | 86.4   | 95.2               | 79.9   | 8784               | 100.0  |
| 2001 | 8444.3         | 1150.0         | 88.9   | 86.7   | 88.9                              | 86.6   | 83.8               | 80.3   | 7781               | 88.8   |
| 2002 | 7785.3         | 1150.0         | 83.0   | 86.3   | 83.0                              | 86.3   | 77.3               | 80.0   | 7213               | 82.3   |
| 2003 | 9626.0         | 1150.0         | 98.8   | 87.3   | 98.9                              | 87.3   | 95.6               | 81.2   | 8653               | 98.8   |
| 2004 | 9018.1         | 1150.0         | 89.8   | 87.5   | 89.8                              | 87.5   | 89.3               | 81.8   | 7877               | 89.7   |

## US-445 COMANCHE PEAK-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description              |
|--------|-------|---------|------|------|--------------------------|
| 27 Mar | 906.1 | 982.2   | PF   | C21  | 1RF10 REFUELLING OUTAGE. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 193       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 22        |          |
| C. Inspection, maintenance or repair combined with refuelling  | 906             |           |          | 701   |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 145   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |   | 3         | 1        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |   | 5         |          |
| Subtotal   | 906             | 0         | 0        | 846   | 223       | 1        |
| Total  |                 | 906       |          |   | 1070      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1990 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 24  |
| 13. Reactor Auxiliary Systems       |                    | 0   |
| 15. Reactor Cooling Systems         |                    | 7   |
| 16. Steam generation systems        |                    | 11  |
| 31. Turbine and auxiliaries         |                    | 48  |
| 32. Feedwater and Main Steam System |                    | 19  |
| 35. All other I&C Systems           |                    | 11  |
| 41. Main Generator Systems          |                    | 24  |
| 42. Electrical Power Supply Systems |                    | 26  |
| Total                               | 0                  | 170   |

# US-446 COMANCHE PEAK-2

**Operator:** TXU (TXU Electric Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1150.0 MW(e)  
**Design Net RUP:** 1150.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10038.9 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 99.4%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 854.6 | 799.3 | 850.6 | 827.2 | 854.4 | 818.5 | 842.0 | 842.9 | 815.8 | 849.4 | 826.0 | 858.1 | 10038.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>LF (%)</b>   | 99.9  | 99.9  | 99.4  | 100.0 | 99.9  | 98.9  | 98.4  | 98.5  | 98.5  | 99.1  | 99.8  | 100.3 | 99.4    |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1974  
**Date of First Criticality:** 24 Mar 1993  
**Date of Grid Connection:** 09 Apr 1993  
**Date of Commercial Operation:** 03 Aug 1993

**Lifetime Generation:** 97797.2 GW(e).h  
**Cumulative Energy Availability Factor:** 89.0%  
**Cumulative Load Factor:** 84.5%  
**Cumulative Unit Capability Factor:** 81.1%  
**Cumulative Energy Unavailability Factor:** 11.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1993 | 4131.7         | 1150.0         | 0.0  | 0.0    | 77.7                              | 100.0  | 41.3               | 0.0    | 4600               | 52.9   |
| 1994 | 5263.2         | 1150.0         | 65.1   | 65.1   | 65.1                              | 65.1   | 52.2               | 52.2   | 5697               | 65.0   |
| 1995 | 9166.6         | 1150.0         | 95.7   | 80.4   | 95.7                              | 80.4   | 91.0               | 71.6   | 8382               | 95.7   |
| 1996 | 7370.4         | 1150.0         | 79.4   | 80.1   | 78.7                              | 79.8   | 73.0               | 72.1   | 6911               | 78.7   |
| 1997 | 8062.1         | 1150.0         | 86.2   | 81.6   | 86.2                              | 81.4   | 80.0               | 74.1   | 7554               | 86.2   |
| 1998 | 9345.3         | 1150.0         | 99.8   | 85.2   | 99.8                              | 85.1   | 92.8               | 77.8   | 8741               | 99.8   |
| 1999 | 8756.0         | 1150.0         | 90.2   | 86.1   | 90.2                              | 85.9   | 86.9               | 79.3   | 7901               | 90.2   |
| 2000 | 8868.0         | 1150.0         | 90.2   | 86.7   | 90.2                              | 86.6   | 87.8               | 80.5   | 7927               | 90.2   |
| 2001 | 9877.9         | 1150.0         | 99.7   | 88.3   | 99.7                              | 88.2   | 98.1               | 82.7   | 8731               | 99.7   |
| 2002 | 8793.8         | 1150.0         | 90.1   | 88.5   | 90.1                              | 88.4   | 87.3               | 83.2   | 7888               | 90.0   |
| 2003 | 8123.4         | 1150.0         | 83.8   | 88.0   | 83.8                              | 87.9   | 80.6               | 83.0   | 7307               | 83.4   |
| 2004 | 10038.9        | 1150.0         | 100.0  | 89.1   | 100.0                             | 89.0   | 99.4               | 84.5   | 8784               | 100.0  |



## US-446 COMANCHE PEAK-2

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1993 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 241       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 0         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 552                                      |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 106                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 86                                       |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 17                                       | 4         | 5        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  | 28        |          |
| Z. Others  |                 |           |          |  | 0         |          |
| Subtotal   | 0               | 0         | 0        | 761                                      | 273       | 5        |
| Total  |                 | 0         |          |  | 1039      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1993 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 2  |
| 13. Reactor Auxiliary Systems       |                 | 2  |
| 14. Safety Systems                  |                 | 57                                       |
| 15. Reactor Cooling Systems         |                 | 76                                       |
| 31. Turbine and auxiliaries         |                 | 21                                       |
| 32. Feedwater and Main Steam System |                 | 62                                       |
| 41. Main Generator Systems          |                 | 7  |
| 42. Electrical Power Supply Systems |                 | 5  |
| Total                               | 0               | 232                                      |

# US-298 COOPER

**Operator:** NPPD (NEBRASKA PUBLIC POWER DISTRICT)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 764.0 MW(e)  
**Design Net RUP:** 778.0 MW(e)  
**Design Discharge Burnup:** 18000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6171.8 GW(e).h  
**Energy Availability Factor:** 94.6%  
**Load Factor:** 92.0%  
**Operating Factor:** 94.5%  
**Energy Unavailability Factor:** 5.4%  
**Total Off-line Time:** 485 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 570.2 | 518.7 | 568.9 | 542.9 | 542.0 | 537.9 | 551.7 | 554.5 | 536.5 | 325.8 | 399.4 | 523.3 | 6171.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 58.5  | 76.5  | 100.0 | 94.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 58.5  | 76.5  | 100.0 | 94.6   |
| <b>LF (%)</b>   | 100.3 | 97.5  | 100.1 | 98.8  | 95.3  | 97.8  | 97.1  | 97.5  | 97.5  | 57.2  | 72.6  | 92.1  | 92.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 58.3  | 75.8  | 100.0 | 94.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 41.5  | 23.5  | 0.0   | 5.4    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 41.5  | 23.5  | 0.0   | 5.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1968  
**Date of First Criticality:** 21 Feb 1974  
**Date of Grid Connection:** 10 May 1974  
**Date of Commercial Operation:** 01 Jul 1974

**Lifetime Generation:** 138985.1 GW(e).h  
**Cumulative Energy Availability Factor:** 72.7%  
**Cumulative Load Factor:** 68.2%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 27.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3343.3         | 764.0          | 62.7   | 67.8   | 62.7                              | 67.6   | 50.0               | 62.5   | 5544               | 63.3   |
| 1984 | 3470.0         | 764.0          | 67.6   | 67.8   | 67.1                              | 67.6   | 51.7               | 61.4   | 5901               | 67.2   |
| 1985 | 1067.7         | 764.0          | 20.1   | 63.4   | 20.1                              | 63.3   | 16.0               | 57.3   | 1884               | 21.5   |
| 1986 | 4052.1         | 764.0          | 74.7   | 64.4   | 74.7                              | 64.2   | 60.5               | 57.6   | 6546               | 74.7   |
| 1987 | 5522.1         | 764.0          | 94.6   | 66.7   | 94.6                              | 66.6   | 82.5               | 59.5   | 8291               | 94.6   |
| 1988 | 4200.6         | 764.0          | 66.5   | 66.7   | 66.5                              | 66.6   | 62.6               | 59.7   | 5887               | 67.0   |
| 1989 | 4790.9         | 764.0          | 74.9   | 67.2   | 74.9                              | 67.1   | 71.6               | 60.5   | 6594               | 75.3   |
| 1990 | 5111.4         | 764.0          | 78.5   | 67.9   | 78.5                              | 67.8   | 76.4               | 61.5   | 6908               | 78.9   |
| 1991 | 4803.8         | 764.0          | 77.9   | 68.5   | 77.9                              | 68.4   | 71.8               | 62.1   | 6830               | 78.0   |
| 1992 | 6227.9         | 764.0          | 96.0   | 70.0   | 96.0                              | 70.0   | 92.8               | 63.8   | 8436               | 96.0   |
| 1993 | 3712.9         | 764.0          | 56.8   | 69.3   | 56.8                              | 69.3   | 55.5               | 63.4   | 5041               | 57.5   |
| 1994 | 2227.3         | 764.0          | 33.4   | 67.5   | 33.4                              | 67.5   | 33.3               | 61.9   | 3033               | 34.6   |
| 1995 | 4127.8         | 764.0          | 64.0   | 67.4   | 64.0                              | 67.3   | 61.7               | 61.9   | 5663               | 64.6   |
| 1996 | 6338.9         | 764.0          | 97.2   | 68.7   | 97.2                              | 68.7   | 94.5               | 63.3   | 8540               | 97.2   |
| 1997 | 5455.7         | 764.0          | 83.6   | 69.4   | 83.6                              | 69.3   | 81.5               | 64.1   | 7336               | 83.7   |
| 1998 | 4869.9         | 764.0          | 74.4   | 69.6   | 74.4                              | 69.5   | 72.8               | 64.5   | 6544               | 74.7   |
| 1999 | 6510.4         | 764.0          | 97.7   | 70.7   | 97.7                              | 70.7   | 97.3               | 65.8   | 8563               | 97.8   |
| 2000 | 4735.9         | 764.0          | 73.1   | 70.8   | 73.1                              | 70.8   | 70.6               | 66.0   | 6414               | 73.0   |
| 2001 | 5206.5         | 764.0          | 80.0   | 71.2   | 79.9                              | 71.1   | 77.8               | 66.4   | 7009               | 80.0   |
| 2002 | 6318.2         | 764.0          | 96.8   | 72.1   | 96.8                              | 72.0   | 94.4               | 67.4   | 8478               | 96.8   |
| 2003 | 4492.3         | 764.0          | 71.3   | 72.0   | 71.3                              | 72.0   | 67.1               | 67.4   | 6236               | 71.2   |
| 2004 | 6171.8         | 764.0          | 94.5   | 72.8   | 94.6                              | 72.7   | 92.0               | 68.2   | 8299               | 94.5   |

# US-298 COOPER

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 19 Oct | 483.6 | 366.1   | UF2  | A31  | MANUAL SHUTDOWN DUE TO HIGH TURBINE BEARING VIBRATION. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 483       |          | 4   | 214       | 1        |
| B. Refuelling without a maintenance  |                 |           |          |   | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1337  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 154   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 5   | 8         | 5        |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 258       | 0        |
| P. Fire  |                 |           |          |   | 3         |          |
| Subtotal   | 0               | 483       | 0        | 1500  | 494       | 8        |
| Total  |                 | 483       |          |   | 2002      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 4   |
| 12. Reactor I&C Systems             |                    | 8   |
| 13. Reactor Auxiliary Systems       |                    | 25  |
| 14. Safety Systems                  |                    | 8   |
| 15. Reactor Cooling Systems         |                    | 15  |
| 31. Turbine and auxiliaries         | 483                | 93  |
| 32. Feedwater and Main Steam System |                    | 13  |
| 35. All other I&C Systems           |                    | 5   |
| 41. Main Generator Systems          |                    | 8   |
| 42. Electrical Power Supply Systems |                    | 13  |
| XX. Miscellaneous Systems           |                    | 7   |
| Total                               | 483                | 199   |

# US-302 CRYSTAL RIVER-3

**Operator:** PROGRESS (Progress Energy Corporation)  
**Contractor:** B&W (BABCOCK & WILCOX CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 838.0 MW(e)  
**Design Net RUP:** 825.0 MW(e)  
**Design Discharge Burnup:** 24200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7303.3 GW(e).h  
**Energy Availability Factor:** 97.7%  
**Load Factor:** 99.2%  
**Operating Factor:** 97.7%  
**Energy Unavailability Factor:** 2.3%  
**Total Off-line Time:** 200 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 642.0 | 600.8 | 563.4 | 620.1 | 635.4 | 605.3 | 625.3 | 626.6 | 497.6 | 628.8 | 620.4 | 637.4 | 7303.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 90.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 82.3  | 100.0 | 100.0 | 100.0 | 97.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 90.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.2   |
| <b>LF (%)</b>   | 103.0 | 103.0 | 90.4  | 102.9 | 101.9 | 100.3 | 100.3 | 100.5 | 82.5  | 100.7 | 102.8 | 102.2 | 99.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 90.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 82.2  | 100.0 | 100.0 | 100.0 | 97.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 9.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 17.7  | 0.0   | 0.0   | 0.0   | 2.3    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 4.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 4.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 17.7  | 0.0   | 0.0   | 0.0   | 1.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1967      **Lifetime Generation:** 135180.4 GW(e).h  
**Date of First Criticality:** 14 Jan 1977      **Cumulative Energy Availability Factor:** 70.3%  
**Date of Grid Connection:** 30 Jan 1977      **Cumulative Load Factor:** 67.8%  
**Date of Commercial Operation:** 13 Mar 1977      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 29.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3772.3         | 806.0          | 59.1   | 56.9   | 59.1                              | 56.8   | 53.4               | 53.8   | 5149               | 58.8   |
| 1984 | 6478.9         | 821.0          | 94.6   | 62.4   | 94.5                              | 62.3   | 89.8               | 59.1   | 8295               | 94.4   |
| 1985 | 2863.6         | 821.0          | 48.2   | 60.6   | 48.2                              | 60.5   | 39.8               | 56.6   | 4171               | 47.6   |
| 1986 | 2653.2         | 821.0          | 42.3   | 58.5   | 42.3                              | 58.5   | 36.9               | 54.4   | 3659               | 41.8   |
| 1987 | 3620.8         | 821.0          | 60.2   | 58.7   | 60.2                              | 58.6   | 50.3               | 54.0   | 5263               | 60.1   |
| 1988 | 5768.1         | 821.0          | 84.1   | 61.0   | 84.1                              | 61.0   | 80.0               | 56.4   | 7375               | 84.0   |
| 1989 | 2930.0         | 821.0          | 48.4   | 60.0   | 48.4                              | 59.9   | 40.7               | 55.1   | 4190               | 47.8   |
| 1990 | 4142.9         | 821.0          | 62.3   | 60.2   | 62.3                              | 60.1   | 57.6               | 55.2   | 5421               | 61.9   |
| 1991 | 5457.2         | 821.0          | 82.3   | 61.8   | 81.5                              | 61.7   | 75.9               | 56.7   | 7136               | 81.5   |
| 1992 | 5315.9         | 821.0          | 75.9   | 62.7   | 75.9                              | 62.6   | 73.7               | 57.9   | 6633               | 75.5   |
| 1993 | 6080.0         | 821.0          | 84.8   | 64.1   | 84.8                              | 64.0   | 84.5               | 59.6   | 7409               | 84.6   |
| 1994 | 5939.9         | 818.0          | 83.4   | 65.3   | 83.4                              | 65.2   | 82.9               | 61.0   | 7292               | 83.2   |
| 1995 | 7234.9         | 818.0          | 99.7   | 67.2   | 99.7                              | 67.1   | 101.0              | 63.2   | 8733               | 99.7   |
| 1996 | 2417.4         | 818.0          | 35.9   | 65.5   | 35.9                              | 65.5   | 33.6               | 61.6   | 3107               | 35.4   |
| 1997 | 0.0            | 818.0          | 0.0  | 62.2   | 0.0                               | 62.2   | 0.0                | 58.5   | 0                  | 0.0    |
| 1998 | 6481.9         | 818.0          | 88.8   | 63.5   | 88.8                              | 63.4   | 90.5               | 60.1   | 7777               | 88.8   |
| 1999 | 6373.1         | 818.0          | 87.6   | 64.6   | 87.6                              | 64.5   | 88.9               | 61.4   | 7677               | 87.6   |
| 2000 | 7197.7         | 843.0          | 97.5   | 66.1   | 97.5                              | 66.0   | 97.2               | 63.0   | 8555               | 97.4   |
| 2001 | 6514.2         | 834.0          | 88.9   | 67.0   | 88.9                              | 67.0   | 89.2               | 64.1   | 7784               | 88.9   |
| 2002 | 7300.3         | 834.0          | 99.2   | 68.4   | 99.2                              | 68.3   | 99.9               | 65.6   | 8692               | 99.2   |
| 2003 | 6579.4         | 834.0          | 90.3   | 69.2   | 90.3                              | 69.2   | 90.1               | 66.5   | 7911               | 90.3   |
| 2004 | 7303.3         | 838.0          | 99.2   | 70.4   | 97.7                              | 70.3   | 99.2               | 67.8   | 8584               | 97.7   |

## US-302 CRYSTAL RIVER-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 03 Mar | 36.5  | 30.6    | PF   | D15  | PLANNED SHUTDOWN TO REPAIR A REACTOR COOLANT PUMP MOTOR OIL LEAK.                      |
| 24 Mar | 35.2  | 29.5    | UF4  | A12  | REACTOR TRIP DUE TO AN ELECTRONIC CARD FAILURE IN THE INTEGRATED CONTROL SYSTEM.       |
| 06 Sep | 127.3 | 106.7   | XF4  | N    | SWITCHYARD BREAKER FLASHOVER DURING HURRICANE FRANCES LED TO AN AUTOMATIC REACTOR TRIP |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 35        |          | 0  | 691       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 972                                      |           |          |
| D. Inspection, maintenance or repair without refuelling  | 36              |           |          | 344                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 23                                       | 386       |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 5  | 94        | 1        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 127      |  |           |          |
| Subtotal   | 36              | 35        | 127      | 1345                                     | 1179      | 3        |
| Total  |                 | 198       |          |  | 2527      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                  | 35              | 76                                       |
| 14. Safety Systems                       |                 | 28                                       |
| 15. Reactor Cooling Systems              |                 | 240                                      |
| 16. Steam generation systems             |                 | 7  |
| 21. Fuel Handling and Storage Facilities |                 | 170                                      |
| 31. Turbine and auxiliaries              |                 | 79                                       |
| 32. Feedwater and Main Steam System      |                 | 53                                       |
| 33. Circulating Water System             |                 | 6  |
| 42. Electrical Power Supply Systems      |                 | 19                                       |
| XX. Miscellaneous Systems                |                 | 1  |
| Total                                    | 35              | 679                                      |

# US-346 DAVIS BESSE-1

**Operator:** FENOC (FIRST ENERGY NUCLEAR OPERATING CO.)  
**Contractor:** B&W (BABCOCK & WILCOX CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 882.0 MW(e)  
**Design Net RUP:** 906.0 MW(e)  
**Design Discharge Burnup:** 31700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5778.4 GW(e).h  
**Energy Availability Factor:** 75.6%  
**Load Factor:** 74.6%  
**Operating Factor:** 75.5%  
**Energy Unavailability Factor:** 24.4%  
**Total Off-line Time:** 2156 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 0.0   | 0.0   | 49.0 | 618.9 | 656.7 | 635.5 | 656.6 | 554.9 | 636.2 | 662.2 | 644.3 | 664.0 | 5778.4 |
| <b>EAF (%)</b>  | 0.0   | 0.0   | 19.1 | 100.0 | 100.0 | 100.0 | 100.0 | 85.9  | 100.0 | 100.0 | 100.0 | 100.0 | 75.6   |
| <b>UCF (%)</b>  | 0.0   | 0.0   | 19.1 | 100.0 | 100.0 | 100.0 | 100.0 | 85.9  | 100.0 | 100.0 | 100.0 | 100.0 | 75.6   |
| <b>LF (%)</b>   | 0.0   | 0.0   | 7.5  | 97.6  | 100.1 | 100.1 | 100.1 | 84.6  | 100.2 | 100.8 | 101.5 | 101.2 | 74.6   |
| <b>OF (%)</b>   | 0.0   | 0.0   | 18.1 | 100.0 | 100.0 | 100.0 | 100.0 | 85.6  | 100.0 | 100.0 | 100.0 | 100.0 | 75.5   |
| <b>EUF (%)</b>  | 100.0 | 100.0 | 80.9 | 0.0   | 0.0   | 0.0   | 0.0   | 14.1  | 0.0   | 0.0   | 0.0   | 0.0   | 24.4   |
| <b>PUF (%)</b>  | 100.0 | 100.0 | 48.6 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 20.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 32.4 | 0.0   | 0.0   | 0.0   | 0.0   | 14.1  | 0.0   | 0.0   | 0.0   | 0.0   | 3.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1970  
**Date of First Criticality:** 12 Aug 1977  
**Date of Grid Connection:** 28 Aug 1977  
**Date of Commercial Operation:** 31 Jul 1978

**Lifetime Generation:** 126903.8 GW(e).h  
**Cumulative Energy Availability Factor:** 65.1%  
**Cumulative Load Factor:** 62.0%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 34.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4883.3         | 874.0          | 72.3   | 53.0   | 72.3                              | 53.0   | 63.8               | 45.5   | 6389               | 72.9   |
| 1984 | 4291.6         | 874.0          | 62.5   | 54.5   | 62.5                              | 54.5   | 55.9               | 47.2   | 5486               | 62.5   |
| 1985 | 1942.9         | 862.0          | 30.9   | 51.2   | 30.9                              | 51.2   | 25.7               | 44.2   | 2729               | 31.2   |
| 1986 | 3.5            | 860.0          | 1.3  | 45.1   | 1.3                               | 45.1   | 0.0                | 38.8   | 116                | 1.3    |
| 1987 | 5064.0         | 860.0          | 82.8   | 49.3   | 82.8                              | 49.2   | 67.2               | 41.9   | 7308               | 83.4   |
| 1988 | 1164.4         | 860.0          | 20.4   | 46.4   | 20.3                              | 46.4   | 15.4               | 39.3   | 1891               | 21.5   |
| 1989 | 7322.1         | 870.0          | 97.1   | 51.0   | 97.1                              | 51.0   | 96.1               | 44.4   | 8506               | 97.1   |
| 1990 | 4161.5         | 874.0          | 55.6   | 51.4   | 55.6                              | 51.4   | 54.4               | 45.3   | 4867               | 55.6   |
| 1991 | 5843.9         | 874.0          | 78.6   | 53.5   | 78.6                              | 53.5   | 76.3               | 47.6   | 6962               | 79.5   |
| 1992 | 7650.5         | 877.0          | 99.5   | 56.8   | 99.5                              | 56.8   | 99.3               | 51.4   | 8742               | 99.5   |
| 1993 | 6083.4         | 871.0          | 82.7   | 58.5   | 82.7                              | 58.5   | 79.7               | 53.2   | 7246               | 82.7   |
| 1994 | 6385.0         | 868.0          | 86.9   | 60.3   | 86.9                              | 60.2   | 84.0               | 55.1   | 7667               | 87.5   |
| 1995 | 7670.6         | 869.0          | 100.0  | 62.6   | 100.0                             | 62.6   | 100.8              | 57.8   | 8760               | 100.0  |
| 1996 | 6456.3         | 872.0          | 84.8   | 63.8   | 84.8                              | 63.8   | 84.3               | 59.3   | 7452               | 84.8   |
| 1997 | 7183.4         | 873.0          | 93.5   | 65.4   | 93.4                              | 65.4   | 93.9               | 61.1   | 8184               | 93.4   |
| 1998 | 6130.7         | 873.0          | 85.4   | 66.4   | 82.0                              | 66.2   | 80.2               | 62.1   | 7181               | 82.0   |
| 1999 | 7370.0         | 873.0          | 94.9   | 67.7   | 94.9                              | 67.6   | 96.4               | 63.7   | 8311               | 94.9   |
| 2000 | 6770.5         | 876.0          | 87.0   | 68.6   | 87.0                              | 68.4   | 88.0               | 64.8   | 7633               | 86.9   |
| 2001 | 7690.8         | 882.0          | 99.8   | 70.0   | 99.8                              | 69.8   | 99.5               | 66.3   | 8738               | 99.7   |
| 2002 | 929.0          | 882.0          | 12.4   | 67.5   | 12.4                              | 67.4   | 12.0               | 64.0   | 1081               | 12.3   |
| 2003 | 0.0            | 882.0          | 0.0  | 64.8   | 0.0                               | 64.7   | 0.0                | 61.5   | 0                  | 0.0    |
| 2004 | 5778.4         | 882.0          | 75.6   | 65.2   | 75.6                              | 65.1   | 74.6               | 62.0   | 6628               | 75.5   |

# US-346 DAVIS BESSE-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Jan | 1805.5 | 1576.2  | PF   | C21  | CONT'D REFUELLING OUTAGE. DISCOVERY OF BORIC ACID CORROSION ON REACTOR VESSEL HEAD. |
| 17 Mar | 243.4  | 212.5   | UF2  | A32  | SHUTDOWN REACTOR DUE TO SODIUM CONCENTRATION IN MAIN FEEDWATER.                     |
| 04 Aug | 106.1  | 92.6    | UF4  | A17  | REACTOR TRIP WHILE PERFORMING REACTOR TRIP B TESTING DUE TO A FUSE FAILURE.         |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 349       |          |  | 920       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1805            |           |          | 1610                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 228                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 13                                       | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 0         | 61       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 20        | 10       |
| Subtotal   | 1805            | 349       | 0        | 1851                                     | 956       | 71       |
| Total  |                 | 2154      |          |  | 2878      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 78                                       |
| 13. Reactor Auxiliary Systems                  |                 | 6  |
| 15. Reactor Cooling Systems                    |                 | 59                                       |
| 16. Steam generation systems                   |                 | 0  |
| 17. Safety I&C Systems (excluding reactor I&C) | 106             | 0  |
| 31. Turbine and auxiliaries                    |                 | 14                                       |
| 32. Feedwater and Main Steam System            | 243             | 537                                      |
| 35. All other I&C Systems                      |                 | 3  |
| 41. Main Generator Systems                     |                 | 1  |
| 42. Electrical Power Supply Systems            |                 | 95                                       |
| XX. Miscellaneous Systems                      |                 | 1  |
| Total  | 349             | 794                                      |

# US-275 DIABLO CANYON-1

**Operator:** PGE (PACIFIC GAS & ELECTRIC CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1087.0 MW(e)  
**Design Net RUP:** 1084.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7233.9 GW(e).h  
**Energy Availability Factor:** 78.2%  
**Load Factor:** 75.8%  
**Operating Factor:** 78.2%  
**Energy Unavailability Factor:** 21.8%  
**Total Off-line Time:** 1915 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 791.4 | 715.6 | 468.4 | 0.0   | 0.0   | 468.5 | 747.8 | 821.8 | 793.1 | 820.3 | 794.1 | 812.9 | 7233.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 67.7  | 0.0   | 0.0   | 78.0  | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 67.7  | 0.0   | 0.0   | 78.1  | 93.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.2   |
| <b>LF (%)</b>   | 97.9  | 94.6  | 57.9  | 0.0   | 0.0   | 59.9  | 92.5  | 101.6 | 101.3 | 101.3 | 101.5 | 100.5 | 75.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 68.1  | 0.0   | 0.0   | 77.2  | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 32.3  | 100.0 | 100.0 | 22.0  | 6.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 32.3  | 100.0 | 100.0 | 21.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6   | 6.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1968  
**Date of First Criticality:** 29 Apr 1984  
**Date of Grid Connection:** 11 Nov 1984  
**Date of Commercial Operation:** 07 May 1985

**Lifetime Generation:** 154301.0 GW(e).h  
**Cumulative Energy Availability Factor:** 84.4%  
**Cumulative Load Factor:** 83.1%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 15.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 204.0          | 1074.0         | 0.0  | 0.0    | 95.2                              | 100.0  | 2.2                | 0.0    | 814                | 9.5    |
| 1985 | 5234.2         | 1073.0         | 0.0  | 0.0    | 93.9                              | 100.0  | 56.6               | 0.0    | 5206               | 60.4   |
| 1986 | 5316.2         | 1073.0         | 65.7   | 65.7   | 65.7                              | 65.7   | 56.6               | 56.6   | 5757               | 65.7   |
| 1987 | 8284.2         | 1073.0         | 95.3   | 80.5   | 95.3                              | 80.5   | 88.1               | 72.3   | 8340               | 95.2   |
| 1988 | 5276.1         | 1073.0         | 34.6   | 65.2   | 34.6                              | 65.2   | 56.0               | 66.9   | 5555               | 63.2   |
| 1989 | 7199.9         | 1073.0         | 80.7   | 69.0   | 80.7                              | 69.0   | 76.6               | 69.3   | 7069               | 80.7   |
| 1990 | 8713.5         | 1073.0         | 96.2   | 74.5   | 96.2                              | 74.5   | 92.7               | 74.0   | 8425               | 96.2   |
| 1991 | 7366.3         | 1073.0         | 80.4   | 75.5   | 80.4                              | 75.5   | 78.4               | 74.7   | 7125               | 81.3   |
| 1992 | 7454.7         | 1073.0         | 82.3   | 76.4   | 82.3                              | 76.4   | 79.1               | 75.3   | 7224               | 82.2   |
| 1993 | 9028.0         | 1073.0         | 98.5   | 79.2   | 98.5                              | 79.2   | 96.0               | 77.9   | 8630               | 98.5   |
| 1994 | 7372.0         | 1073.0         | 79.8   | 79.3   | 79.9                              | 79.3   | 78.4               | 78.0   | 6991               | 79.8   |
| 1995 | 7451.8         | 1073.0         | 81.9   | 79.5   | 81.9                              | 79.5   | 79.3               | 78.1   | 7175               | 81.9   |
| 1996 | 8786.8         | 1073.0         | 94.7   | 80.9   | 94.7                              | 80.9   | 93.2               | 79.5   | 8316               | 94.7   |
| 1997 | 8195.0         | 1073.0         | 87.9   | 81.5   | 87.9                              | 81.5   | 87.2               | 80.1   | 7700               | 87.9   |
| 1998 | 8967.8         | 1073.0         | 97.8   | 82.8   | 97.8                              | 82.8   | 95.4               | 81.3   | 8564               | 97.8   |
| 1999 | 8224.8         | 1073.0         | 90.3   | 83.3   | 88.7                              | 83.2   | 87.5               | 81.7   | 7764               | 88.6   |
| 2000 | 7853.5         | 1073.0         | 85.2   | 83.4   | 85.2                              | 83.3   | 83.3               | 81.9   | 7485               | 85.2   |
| 2001 | 9504.6         | 1084.0         | 99.4   | 84.4   | 99.4                              | 84.3   | 100.1              | 83.0   | 8708               | 99.4   |
| 2002 | 7048.2         | 1087.0         | 76.0   | 83.9   | 76.0                              | 83.8   | 74.0               | 82.5   | 6652               | 75.9   |
| 2003 | 9585.4         | 1087.0         | 100.0  | 84.8   | 100.0                             | 84.7   | 100.7              | 83.5   | 8760               | 100.0  |
| 2004 | 7233.9         | 1087.0         | 78.2   | 84.5   | 78.2                              | 84.4   | 75.8               | 83.1   | 6869               | 78.2   |



# US-275 DIABLO CANYON-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 22 Mar | 1858.9 | 2020.6  | PF   | C21  | REFUELLING OUTAGE.  |
| 12 Jun | 4.1    | 4.4     | UF2  | A32  | U1 MANUAL SHUTDOWN FOR REPAIR OF MSR PILOT RELIEF VALVE RV-2A. UNIT 1 REMAINED IN MODE 1, THEREFORE, SHUTDOWN NUMBER WAS LEFT BLANK.                                  |
| 21 Jul | 51.0   | 55.4    | UF2  | H    | U1 TECH SPEC REQUIRED SHUTDOWN TO REPAIR A LEAK (CRACK) IN THE COMPONENT COOLING WATER SUPPLY TO THE REACTOR COOLANT PUMP 1-3 LUBE OIL COOLER. REF. NRC EVENT #40890. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 4         |          |  | 252       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1858            |           |          | 811                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 94                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| H. Nuclear regulatory requirements   |                 | 51        |          |  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 12        | 6        |
| Subtotal   | 1858            | 55        | 0        | 905                                      | 278       | 6        |
| Total  |                 | 1913      |          |  | 1189      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 3  |
| 14. Safety Systems                             |                 | 7  |
| 15. Reactor Cooling Systems                    |                 | 9  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 8  |
| 32. Feedwater and Main Steam System            | 4               | 129                                      |
| 33. Circulating Water System                   |                 | 12                                       |
| 35. All other I&C Systems                      |                 | 1  |
| 41. Main Generator Systems                     |                 | 3  |
| 42. Electrical Power Supply Systems            |                 | 53                                       |
| Total  | 4               | 227                                      |

# US-323 DIABLO CANYON-2

**Operator:** PGE (PACIFIC GAS & ELECTRIC CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1087.0 MW(e)  
**Design Net RUP:** 1106.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8017.9 GW(e).h  
**Energy Availability Factor:** 85.8%  
**Load Factor:** 84.0%  
**Operating Factor:** 85.8%  
**Energy Unavailability Factor:** 14.2%  
**Total Off-line Time:** 1249 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 812.0 | 724.7 | 810.9 | 785.1 | 810.5 | 744.0 | 802.0 | 802.4 | 759.7 | 616.1 | 0.0   | 350.5 | 8017.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.4  | 0.0   | 51.6  | 85.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.5  | 0.0   | 51.6  | 85.8   |
| <b>LF (%)</b>   | 100.4 | 95.8  | 100.3 | 100.4 | 100.2 | 95.1  | 99.2  | 99.2  | 97.1  | 76.1  | 0.0   | 43.3  | 84.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.6  | 0.0   | 51.3  | 85.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.6  | 100.0 | 48.4  | 14.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.6  | 100.0 | 48.4  | 14.2   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1970  
**Date of First Criticality:** 19 Aug 1985  
**Date of Grid Connection:** 20 Oct 1985  
**Date of Commercial Operation:** 13 Mar 1986

**Lifetime Generation:** 153239.2 GW(e).h  
**Cumulative Energy Availability Factor:** 87.4%  
**Cumulative Load Factor:** 85.1%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 12.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 540.6          | 1088.0         | 0.0  | 0.0    | 94.2                              | 100.0  | 6.0                | 0.0    | 1213               | 14.6   |
| 1986 | 6757.7         | 1080.0         | 0.0  | 0.0    | 96.2                              | 100.0  | 73.9               | 0.0    | 7078               | 83.6   |
| 1987 | 5728.8         | 1079.0         | 65.4   | 65.4   | 65.4                              | 65.4   | 60.6               | 60.6   | 5752               | 65.7   |
| 1988 | 6243.3         | 1087.0         | 69.3   | 67.4   | 69.3                              | 67.4   | 65.4               | 63.0   | 6086               | 69.3   |
| 1989 | 8616.0         | 1087.0         | 92.2   | 75.7   | 92.2                              | 75.7   | 90.5               | 72.2   | 8072               | 92.1   |
| 1990 | 7578.1         | 1087.0         | 83.2   | 77.5   | 83.2                              | 77.5   | 79.6               | 74.0   | 7284               | 83.2   |
| 1991 | 7718.5         | 1087.0         | 84.7   | 79.0   | 84.7                              | 79.0   | 81.1               | 75.4   | 7420               | 84.7   |
| 1992 | 9247.7         | 1087.0         | 98.5   | 82.2   | 98.5                              | 82.2   | 96.9               | 79.0   | 8651               | 98.5   |
| 1993 | 7796.2         | 1087.0         | 83.6   | 82.4   | 83.6                              | 82.4   | 81.9               | 79.4   | 7324               | 83.6   |
| 1994 | 7896.1         | 1087.0         | 85.0   | 82.8   | 85.0                              | 82.8   | 82.9               | 79.9   | 7439               | 84.9   |
| 1995 | 8821.0         | 1087.0         | 96.3   | 84.3   | 96.3                              | 84.3   | 92.6               | 81.3   | 8430               | 96.2   |
| 1996 | 7932.9         | 1087.0         | 85.0   | 84.3   | 85.0                              | 84.3   | 83.1               | 81.5   | 7459               | 84.9   |
| 1997 | 8883.5         | 1087.0         | 96.4   | 85.4   | 96.4                              | 85.4   | 93.3               | 82.5   | 8441               | 96.4   |
| 1998 | 8159.0         | 1087.0         | 87.1   | 85.6   | 87.1                              | 85.6   | 85.7               | 82.8   | 7624               | 87.0   |
| 1999 | 8443.7         | 1087.0         | 91.3   | 86.0   | 90.2                              | 85.9   | 88.7               | 83.3   | 7902               | 90.2   |
| 2000 | 9188.5         | 1087.0         | 96.9   | 86.8   | 96.9                              | 86.7   | 96.2               | 84.2   | 8512               | 96.9   |
| 2001 | 8658.4         | 1087.0         | 91.9   | 87.1   | 91.9                              | 87.1   | 90.9               | 84.6   | 8051               | 91.9   |
| 2002 | 9286.1         | 1087.0         | 99.6   | 87.9   | 98.9                              | 87.8   | 97.5               | 85.4   | 8663               | 98.9   |
| 2003 | 7725.2         | 1087.0         | 82.5   | 87.6   | 82.5                              | 87.5   | 81.1               | 85.2   | 7225               | 82.5   |
| 2004 | 8017.9         | 1087.0         | 85.8   | 87.5   | 85.8                              | 87.4   | 84.0               | 85.1   | 7535               | 85.8   |

## US-323 DIABLO CANYON-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description        |
|--------|--------|---------|------|------|--------------------|
| 25 Oct | 1248.2 | 1356.8  | PF   | C21  | REFUELLING OUTAGE. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 168       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 15        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1248            |           |          | 710   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 19  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 13        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 34        | 7        |
| Subtotal   | 1248            | 0         | 0        | 730   | 230       | 7        |
| Total  |                 | 1248      |          |   | 967       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 11  |
| 13. Reactor Auxiliary Systems       |                    | 9   |
| 15. Reactor Cooling Systems         |                    | 7   |
| 31. Turbine and auxiliaries         |                    | 27  |
| 32. Feedwater and Main Steam System |                    | 27  |
| 33. Circulating Water System        |                    | 2   |
| 35. All other I&C Systems           |                    | 10  |
| 41. Main Generator Systems          |                    | 13  |
| 42. Electrical Power Supply Systems |                    | 58  |
| Total                               | 0                  | 164   |

# US-315 DONALD COOK-1

**Operator:** IMPCO (INDIANA MICHIGAN POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1000.0 MW(e)  
**Design Net RUP:** 1030.0 MW(e)  
**Design Discharge Burnup:** 32500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8831.5 GW(e).h  
**Energy Availability Factor:** 97.7%  
**Load Factor:** 100.5%  
**Operating Factor:** 97.8%  
**Energy Unavailability Factor:** 2.3%  
**Total Off-line Time:** 196 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 773.3 | 723.1 | 722.2 | 577.6 | 767.7 | 736.4 | 754.4 | 754.2 | 736.1 | 767.6 | 745.4 | 773.5 | 8831.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 93.4  | 79.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.7   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 93.5  | 79.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.7   |
| <b>LF (%)</b>   | 103.9 | 103.9 | 97.1  | 80.3  | 103.2 | 102.3 | 101.4 | 101.4 | 102.2 | 103.0 | 103.5 | 104.0 | 100.5  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 94.1  | 78.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 6.6   | 20.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.3    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 6.6   | 20.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.3    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1969  
**Date of First Criticality:** 18 Jan 1975  
**Date of Grid Connection:** 10 Feb 1975  
**Date of Commercial Operation:** 27 Aug 1975

**Lifetime Generation:** 168657.9 GW(e).h  
**Cumulative Energy Availability Factor:** 67.4%  
**Cumulative Load Factor:** 63.6%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 32.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5286.7         | 1030.0         | 64.3   | 68.3   | 64.3                              | 67.8   | 58.6               | 65.4   | 5628               | 64.2   |
| 1984 | 7550.8         | 1020.0         | 91.3   | 70.9   | 91.3                              | 70.3   | 84.3               | 67.4   | 8016               | 91.3   |
| 1985 | 2116.1         | 1020.0         | 29.9   | 66.8   | 29.9                              | 66.3   | 23.7               | 63.1   | 2489               | 28.4   |
| 1986 | 6650.1         | 1020.0         | 85.5   | 68.5   | 85.5                              | 68.1   | 74.4               | 64.1   | 7464               | 85.2   |
| 1987 | 5033.8         | 1020.0         | 68.2   | 68.5   | 68.2                              | 68.1   | 56.3               | 63.5   | 5917               | 67.5   |
| 1988 | 7467.8         | 1020.0         | 95.5   | 70.5   | 95.5                              | 70.2   | 83.3               | 65.0   | 8379               | 95.4   |
| 1989 | 5433.0         | 1020.0         | 69.9   | 70.5   | 69.9                              | 70.2   | 60.8               | 64.7   | 6069               | 69.3   |
| 1990 | 6301.6         | 1020.0         | 79.2   | 71.1   | 79.2                              | 70.8   | 70.5               | 65.1   | 6939               | 79.2   |
| 1991 | 7338.2         | 1013.0         | 86.0   | 72.0   | 86.0                              | 71.7   | 82.7               | 66.2   | 7524               | 85.9   |
| 1992 | 4990.7         | 1008.0         | 65.1   | 71.6   | 65.1                              | 71.3   | 56.4               | 65.6   | 5690               | 64.8   |
| 1993 | 8759.4         | 1006.0         | 100.0  | 73.1   | 99.4                              | 72.9   | 99.4               | 67.5   | 8760               | 100.0  |
| 1994 | 5759.5         | 1000.0         | 71.0   | 73.0   | 71.0                              | 72.8   | 65.7               | 67.4   | 6214               | 70.9   |
| 1995 | 5396.8         | 1000.0         | 66.4   | 72.7   | 66.4                              | 72.5   | 61.6               | 67.1   | 5809               | 66.3   |
| 1996 | 8373.3         | 1000.0         | 97.6   | 73.9   | 97.6                              | 73.6   | 95.3               | 68.4   | 8574               | 97.6   |
| 1997 | 4545.9         | 1000.0         | 52.4   | 72.9   | 52.4                              | 72.7   | 51.9               | 67.7   | 4608               | 52.6   |
| 1998 | 0.0            | 1000.0         | 0.0  | 69.8   | 0.0                               | 69.6   | 0.0                | 64.8   | 0                  | 0.0    |
| 1999 | 0.0            | 1000.0         | 0.0  | 67.0   | 0.0                               | 66.8   | 0.0                | 62.1   | 0                  | 0.0    |
| 2000 | 129.8          | 1000.0         | 2.8  | 64.4   | 2.8                               | 64.2   | 1.5                | 59.7   | 242                | 2.8    |
| 2001 | 7797.9         | 1000.0         | 90.5   | 65.4   | 89.5                              | 65.2   | 89.0               | 60.9   | 7840               | 89.5   |
| 2002 | 7740.9         | 1000.0         | 88.9   | 66.3   | 88.9                              | 66.0   | 88.4               | 61.9   | 7782               | 88.8   |
| 2003 | 6570.1         | 1000.0         | 74.1   | 66.5   | 74.1                              | 66.3   | 75.0               | 62.3   | 6489               | 74.1   |
| 2004 | 8831.5         | 1000.0         | 97.7   | 67.6   | 97.7                              | 67.4   | 100.5              | 63.6   | 8588               | 97.8   |

**US-315 DONALD COOK-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 30 Mar | 195.1 | 198.2   | PF   | D14  | UNIT 1 REACTOR WAS MANUALLY SHUT DOWN TO REPAIR A SMALL STEAM LEAK AT THE PRESSURIZER UPPER MANWAY. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 260       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1233  |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 195             |           |          | 141   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 10  | 7         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 3   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 0         | 25       |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 969       | 3        |
| P. Fire  |                 |           |          |   | 16        |          |
| Subtotal   | 195             | 0         | 0        | 1387  | 1265      | 28       |
| Total  |                 | 195       |          |   | 2680      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1975 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 22  |
| 14. Safety Systems                             |                    | 10  |
| 15. Reactor Cooling Systems                    |                    | 40  |
| 16. Steam generation systems                   |                    | 8   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 1   |
| 31. Turbine and auxiliaries                    |                    | 68  |
| 32. Feedwater and Main Steam System            |                    | 21  |
| 33. Circulating Water System                   |                    | 43  |
| 35. All other I&C Systems                      |                    | 0   |
| 41. Main Generator Systems                     |                    | 23  |
| 42. Electrical Power Supply Systems            |                    | 19  |
| Total  | 0                  | 255   |

# US-316 DONALD COOK-2

**Operator:** IMPCO (INDIANA MICHIGAN POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1060.0 MW(e)  
**Design Net RUP:** 1100.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7938.5 GW(e).h  
**Energy Availability Factor:** 84.3%  
**Load Factor:** 85.3%  
**Operating Factor:** 84.3%  
**Energy Unavailability Factor:** 15.7%  
**Total Off-line Time:** 1377 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 730.2 | 777.7 | 765.1 | 559.2 | 818.5 | 778.5 | 781.3 | 790.5 | 774.7 | 10.3 | 316.5 | 836.0 | 7938.5 |
| <b>EAF (%)</b>  | 89.2  | 100.0 | 90.2  | 80.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 1.3  | 51.7  | 100.0 | 84.3   |
| <b>UCF (%)</b>  | 89.2  | 100.0 | 90.2  | 80.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 1.3  | 51.7  | 100.0 | 84.3   |
| <b>LF (%)</b>   | 92.6  | 105.4 | 97.0  | 73.4  | 103.8 | 102.0 | 99.1  | 100.2 | 101.5 | 1.3  | 41.5  | 106.0 | 85.3   |
| <b>OF (%)</b>   | 89.4  | 100.0 | 92.2  | 78.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 3.2  | 49.0  | 100.0 | 84.3   |
| <b>EUF (%)</b>  | 10.8  | 0.0   | 9.8   | 19.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 98.7 | 48.3  | 0.0   | 15.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 98.7 | 27.1  | 0.0   | 10.6   |
| <b>UCLF (%)</b> | 10.8  | 0.0   | 9.8   | 19.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 21.2  | 0.0   | 5.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1969  
**Date of First Criticality:** 10 Mar 1978  
**Date of Grid Connection:** 22 Mar 1978  
**Date of Commercial Operation:** 01 Jul 1978

**Lifetime Generation:** 149750.9 GW(e).h  
**Cumulative Energy Availability Factor:** 64.5%  
**Cumulative Load Factor:** 60.1%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 35.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 7013.6         | 1071.0         | 78.3   | 73.9   | 78.3                              | 72.9   | 74.8               | 69.8   | 6835               | 78.0   |
| 1984 | 5364.4         | 1060.0         | 59.2   | 71.5   | 59.2                              | 70.6   | 57.6               | 67.8   | 5196               | 59.2   |
| 1985 | 5683.6         | 1060.0         | 66.8   | 70.8   | 66.9                              | 70.1   | 61.2               | 66.9   | 5852               | 66.8   |
| 1986 | 4335.6         | 1060.0         | 61.5   | 69.7   | 61.5                              | 69.0   | 46.7               | 64.4   | 5389               | 61.5   |
| 1987 | 5026.6         | 1060.0         | 71.4   | 69.9   | 71.4                              | 69.3   | 54.1               | 63.3   | 6248               | 71.3   |
| 1988 | 2323.3         | 1060.0         | 30.9   | 66.0   | 30.9                              | 65.5   | 25.0               | 59.5   | 2715               | 30.9   |
| 1989 | 6661.0         | 1060.0         | 74.4   | 66.8   | 74.4                              | 66.3   | 71.7               | 60.6   | 6518               | 74.4   |
| 1990 | 4813.3         | 1060.0         | 55.4   | 65.8   | 55.4                              | 65.4   | 51.8               | 59.8   | 4854               | 55.4   |
| 1991 | 8185.9         | 1065.0         | 92.2   | 67.8   | 91.5                              | 67.4   | 87.7               | 62.0   | 8013               | 91.5   |
| 1992 | 1427.3         | 1072.0         | 20.5   | 64.5   | 20.4                              | 64.0   | 15.2               | 58.6   | 1714               | 19.5   |
| 1993 | 7553.8         | 1070.0         | 96.6   | 66.6   | 96.6                              | 66.2   | 80.6               | 60.1   | 8459               | 96.6   |
| 1994 | 3531.5         | 1060.0         | 54.4   | 65.8   | 54.4                              | 65.5   | 38.0               | 58.7   | 4757               | 54.3   |
| 1995 | 8602.5         | 1060.0         | 94.5   | 67.5   | 94.5                              | 67.1   | 92.6               | 60.7   | 8268               | 94.4   |
| 1996 | 8022.6         | 1060.0         | 87.0   | 68.6   | 87.0                              | 68.2   | 86.2               | 62.1   | 7641               | 87.0   |
| 1997 | 5875.2         | 1060.0         | 64.9   | 68.4   | 64.9                              | 68.1   | 63.3               | 62.2   | 5705               | 65.1   |
| 1998 | 0.0            | 1060.0         | 0.0  | 65.0   | 0.0                               | 64.7   | 0.0                | 59.1   | 0                  | 0.0    |
| 1999 | 0.0            | 1060.0         | 0.0  | 61.9   | 0.0                               | 61.6   | 0.0                | 56.3   | 0                  | 0.0    |
| 2000 | 4789.8         | 1060.0         | 51.9   | 61.5   | 51.9                              | 61.2   | 51.4               | 56.1   | 4557               | 51.9   |
| 2001 | 7963.4         | 1060.0         | 87.8   | 62.6   | 87.8                              | 62.3   | 85.8               | 57.3   | 7690               | 87.8   |
| 2002 | 7687.7         | 1060.0         | 83.8   | 63.5   | 83.8                              | 63.2   | 82.8               | 58.4   | 7335               | 83.7   |
| 2003 | 7112.2         | 1060.0         | 75.5   | 64.0   | 75.5                              | 63.7   | 76.6               | 59.1   | 6610               | 75.5   |
| 2004 | 7938.5         | 1060.0         | 84.3   | 64.7   | 84.3                              | 64.5   | 85.3               | 60.1   | 7407               | 84.3   |

## US-316 DONALD COOK-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 78.9  | 85.0    | UF4  | Z42  | UNIT 2 REACTOR AUTOMATICALLY TRIPPED FROM 100% POWER DUE TO A LOW STEM GENERATOR LEVEL COINCIDENT WITH FEED FLOW LESS THAN STEAM FLOW, WHICH OCCURRED DURING MAINTENANCE ACTIVITIES.                                     |
| 29 Mar | 110.3 | 118.8   | UF4  | A12  | UNIT 2 REACTOR AUTOMATICALLY TRIPPED FROM 100% POWER TO A VOLTAGE TRANSIENT IN THE ROD CONTROL SYSTEM.   |
| 08 Apr | 99.6  | 107.3   | UF4  | Z    | DURING PLANNED POWER REDUCTION, REACTOR AUTOMATICALLY TRIPPED FROM APPROX. 50% POWER DUE TO TURBINE TRIP AS A RESULT OF HIGH-HIGH WATER LEVEL IN #24 STEAM GENERATOR WHILE REMOVING THE EAST MAIN FEEDPUMP FROM SERVICE. |
| 01 Oct | 935.5 | 1007.5  | PF   | C    | SCHEDULED REFUELLING OUTAGE.   |
| 10 Nov | 1.1   | 1.2     | PF   | E31  | GENERATOR TAKEN OFF-LINE FOR MAIN TURBINE OVERSPEED TESTING.   |
| 12 Nov | 150.5 | 162.1   | UF2  | A15  | RCS LEAK DUE TO FAULTY PRESSURIZER MANWAY GASKET.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 260       |          |  | 600       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 18        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 935             |           |          | 1208                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 130                                      | 146       |          |
| E. Testing of plant systems or components  | 1               |           |          |  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 3         | 25       |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 829       |          |
| Z. Others  |                 | 178       |          |  | 10        |          |
| Subtotal   | 936             | 438       | 0        | 1338                                     | 1606      | 27       |
| Total  |                 | 1374      |          |  | 2971      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 0  |
| 12. Reactor I&C Systems                        | 110             | 11                                       |
| 13. Reactor Auxiliary Systems                  |                 | 57                                       |
| 15. Reactor Cooling Systems                    | 150             | 93                                       |
| 16. Steam generation systems                   |                 | 200                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 10                                       |
| 31. Turbine and auxiliaries                    |                 | 29                                       |
| 32. Feedwater and Main Steam System            |                 | 25                                       |
| 33. Circulating Water System                   |                 | 41                                       |
| 35. All other I&C Systems                      |                 | 16                                       |
| 41. Main Generator Systems                     |                 | 48                                       |
| 42. Electrical Power Supply Systems            |                 | 52                                       |
| Total  | 260             | 582                                      |

# US-237 DRESDEN-2

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 850.0 MW(e)  
**Design Net RUP:** 794.0 MW(e)  
**Design Discharge Burnup:** 20950 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5909.3 GW(e).h  
**Energy Availability Factor:** 80.2%  
**Load Factor:** 79.1%  
**Operating Factor:** 80.2%  
**Energy Unavailability Factor:** 19.8%  
**Total Off-line Time:** 1739 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 645.9 | 604.4 | 645.9 | 486.4 | 426.5 | 625.1 | 646.5 | 430.7 | 381.9 | 616.9 | 0.7   | 398.5 | 5909.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 77.5  | 70.4  | 100.0 | 100.0 | 75.4  | 76.4  | 98.4  | 0.0   | 63.4  | 80.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 77.5  | 70.4  | 100.0 | 100.0 | 75.4  | 76.4  | 98.4  | 0.0   | 63.4  | 80.2   |
| <b>LF (%)</b>   | 102.1 | 102.2 | 102.1 | 79.6  | 67.4  | 102.1 | 102.2 | 68.1  | 62.4  | 97.4  | 0.1   | 63.0  | 79.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 79.7  | 68.3  | 100.0 | 100.0 | 75.4  | 76.4  | 98.4  | 0.4   | 63.0  | 80.2   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 22.5  | 29.6  | 0.0   | 0.0   | 24.6  | 23.6  | 1.6   | 100.0 | 36.6  | 19.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 12.5  | 0.0   | 0.0   | 0.0   | 0.0   | 23.6  | 0.0   | 0.0   | 0.0   | 3.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 10.0  | 29.6  | 0.0   | 0.0   | 24.6  | 0.0   | 1.6   | 100.0 | 36.6  | 16.8   |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1966  
**Date of First Criticality:** 07 Jan 1970  
**Date of Grid Connection:** 13 Apr 1970  
**Date of Commercial Operation:** 09 Jun 1970

**Lifetime Generation:** 151532.7 GW(e).h  
**Cumulative Energy Availability Factor:** 71.6%  
**Cumulative Load Factor:** 64.2%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 28.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3402.2         | 772.0          | 59.2   | 75.0   | 58.9                              | 66.6   | 50.3               | 58.6   | 5076               | 57.9   |
| 1984 | 4468.4         | 772.0          | 72.9   | 74.8   | 72.9                              | 67.1   | 65.9               | 59.1   | 6402               | 72.9   |
| 1985 | 3106.0         | 772.0          | 54.5   | 73.5   | 54.5                              | 66.2   | 45.9               | 58.2   | 4678               | 53.4   |
| 1986 | 4655.7         | 772.0          | 77.2   | 73.7   | 77.2                              | 66.9   | 68.8               | 58.9   | 6761               | 77.2   |
| 1987 | 3362.6         | 772.0          | 61.0   | 73.0   | 61.0                              | 66.6   | 49.7               | 58.3   | 5342               | 61.0   |
| 1988 | 4325.2         | 772.0          | 78.9   | 73.3   | 78.9                              | 67.3   | 63.8               | 58.6   | 6931               | 78.9   |
| 1989 | 4751.7         | 772.0          | 80.2   | 73.7   | 80.2                              | 67.9   | 70.3               | 59.2   | 7023               | 80.2   |
| 1990 | 4116.9         | 772.0          | 67.6   | 73.4   | 67.6                              | 67.9   | 60.9               | 59.3   | 5920               | 67.6   |
| 1991 | 2984.2         | 772.0          | 58.0   | 72.6   | 58.0                              | 67.4   | 44.1               | 58.6   | 5031               | 57.4   |
| 1992 | 4185.8         | 772.0          | 84.5   | 73.2   | 84.5                              | 68.2   | 61.7               | 58.7   | 7419               | 84.5   |
| 1993 | 3058.6         | 772.0          | 54.7   | 72.4   | 54.7                              | 67.6   | 45.2               | 58.2   | 4790               | 54.7   |
| 1994 | 4086.1         | 772.0          | 66.3   | 72.1   | 66.3                              | 67.6   | 60.4               | 58.3   | 5808               | 66.3   |
| 1995 | 1890.5         | 772.0          | 33.5   | 70.6   | 33.5                              | 66.2   | 28.0               | 57.1   | 2938               | 33.5   |
| 1996 | 2161.4         | 772.0          | 42.5   | 69.5   | 42.5                              | 65.3   | 31.9               | 56.1   | 3731               | 42.5   |
| 1997 | 5578.4         | 772.0          | 89.4   | 70.3   | 89.4                              | 66.2   | 82.5               | 57.1   | 7738               | 88.3   |
| 1998 | 5632.9         | 772.0          | 85.6   | 70.8   | 85.6                              | 66.9   | 83.3               | 58.0   | 7496               | 85.6   |
| 1999 | 6229.5         | 772.0          | 92.7   | 71.5   | 92.7                              | 67.8   | 92.1               | 59.2   | 8122               | 92.7   |
| 2000 | 6867.4         | 772.0          | 99.6   | 72.5   | 99.6                              | 68.8   | 101.3              | 60.5   | 8747               | 99.6   |
| 2001 | 6072.7         | 772.0          | 91.2   | 73.1   | 91.2                              | 69.5   | 89.8               | 61.5   | 8005               | 91.4   |
| 2002 | 7527.5         | 850.0          | 100.0  | 74.0   | 100.0                             | 70.6   | 101.1              | 62.8   | 8760               | 100.0  |
| 2003 | 6703.1         | 850.0          | 92.0   | 74.6   | 92.0                              | 71.3   | 90.0               | 63.7   | 7999               | 91.3   |
| 2004 | 5909.3         | 850.0          | 80.2   | 74.8   | 80.2                              | 71.6   | 79.1               | 64.2   | 7045               | 80.2   |



## US-237 DRESDEN-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 24 Apr | 90.0  | 76.5    | PF   | D    | PLANNED MAINTENANCE OUTAGE. REACTOR WAS TO STAY CRITICAL AT 20% POWER, BUT AUTO SCRAMMED FOLLOWING MANUAL TURBINE TRIP                |
| 28 Apr | 292.0 | 248.2   | UF5  | A15  | DURING POWER ASCENSION FROM THE PREVIOUS OUTAGE, THE REACTOR WAS MANUALLY TRIPPED DUE TO A TRIP OF THE 2A REACTOR RECIRCULATION PUMP. |
| 14 Aug | 183.0 | 155.6   | UF2  | A41  | UNIT WAS MANUALLY SHUTDOWN TO REPAIR A CRACK IN A WELD OF THE MAIN GENERATOR SUPPORT RAIL.  |
| 18 Sep | 170.0 | 144.5   | PF   | D41  | UNIT WAS MANUALLY SHUTDOWN TO SHIM THE FOOTING AND BALANCE THE MAIN GENERATOR ROTOR IN ORDER TO CORRECT HIGH BEARING VIBRATION.       |
| 02 Oct | 12.0  | 10.2    | UF2  | A41  | UNIT TAKEN OFFLINE TO BALANCE THE MAIN GENERATOR ROTOR TO REDUCE HIGH BEARING VIBRATION. THE REACTOR REMAINED AT POWER.               |
| 01 Nov | 992.0 | 843.2   | UF2  | A41  | THE UNIT WAS TAKEN OFFLINE TO INSPECT THE MAIN GENERATOR ROTOR. A CRACK ON THE ROTOR WAS DETECTED AND REPAIRS WERE MADE.              |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 1479      |          |  | 596       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 21        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1387                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 260             |           |          | 66                                       | 2         |          |
| E. Testing of plant systems or components  |                 |           |          | 11                                       | 8         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 5         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 73        | 3        |
| Subtotal   | 260             | 1479      | 0        | 1464                                     | 705       | 3        |
| Total  |                 | 1739      |          |  | 2172      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 11                                       |
| 12. Reactor I&C Systems             |                 | 85                                       |
| 13. Reactor Auxiliary Systems       |                 | 12                                       |
| 14. Safety Systems                  |                 | 23                                       |
| 15. Reactor Cooling Systems         | 292             | 108                                      |
| 31. Turbine and auxiliaries         |                 | 147                                      |
| 32. Feedwater and Main Steam System |                 | 27                                       |
| 35. All other I&C Systems           |                 | 23                                       |
| 41. Main Generator Systems          | 1187            | 23                                       |
| 42. Electrical Power Supply Systems |                 | 19                                       |
| XX. Miscellaneous Systems           |                 | 13                                       |
| Total                               | 1479            | 491                                      |

# US-249 DRESDEN-3

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 850.0 MW(e)  
**Design Net RUP:** 794.0 MW(e)  
**Design Discharge Burnup:** 20950 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6436.9 GW(e).h  
**Energy Availability Factor:** 85.9%  
**Load Factor:** 86.2%  
**Operating Factor:** 85.9%  
**Energy Unavailability Factor:** 14.1%  
**Total Off-line Time:** 1240 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 570.2 | 552.4 | 640.7 | 626.6 | 528.9 | 625.5 | 648.1 | 644.4 | 624.6 | 513.5 | 0.0   | 462.2 | 6436.9 |
| <b>EAF (%)</b>  | 88.6  | 95.7  | 100.0 | 100.0 | 85.5  | 100.0 | 100.0 | 100.0 | 100.0 | 80.7  | 0.0   | 79.4  | 85.9   |
| <b>UCF (%)</b>  | 88.6  | 95.7  | 100.0 | 100.0 | 85.5  | 100.0 | 100.0 | 100.0 | 100.0 | 80.7  | 0.0   | 79.4  | 85.9   |
| <b>LF (%)</b>   | 90.2  | 93.4  | 101.3 | 102.5 | 83.6  | 102.2 | 102.5 | 101.9 | 102.1 | 81.1  | 0.0   | 73.1  | 86.2   |
| <b>OF (%)</b>   | 90.2  | 94.0  | 100.0 | 100.0 | 85.5  | 100.0 | 100.0 | 100.0 | 100.0 | 81.3  | 0.0   | 78.8  | 85.9   |
| <b>EUF (%)</b>  | 11.4  | 4.3   | 0.0   | 0.0   | 14.5  | 0.0   | 0.0   | 0.0   | 0.0   | 19.3  | 100.0 | 20.6  | 14.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 19.3  | 100.0 | 20.6  | 11.6   |
| <b>UCLF (%)</b> | 11.4  | 4.3   | 0.0   | 0.0   | 14.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1966  
**Date of First Criticality:** 31 Jan 1971  
**Date of Grid Connection:** 22 Jul 1971  
**Date of Commercial Operation:** 16 Nov 1971

**Lifetime Generation:** 144306.8 GW(e).h  
**Cumulative Energy Availability Factor:** 69.5%  
**Cumulative Load Factor:** 63.2%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 30.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4159.7         | 773.0          | 73.1   | 67.9   | 73.1                              | 64.9   | 61.4               | 59.2   | 6401               | 73.1   |
| 1984 | 2135.5         | 773.0          | 37.7   | 65.6   | 37.7                              | 62.8   | 31.5               | 57.1   | 3309               | 37.7   |
| 1985 | 4401.3         | 773.0          | 75.6   | 66.3   | 75.6                              | 63.7   | 65.0               | 57.6   | 6618               | 75.5   |
| 1986 | 1498.3         | 773.0          | 28.1   | 63.8   | 28.1                              | 61.4   | 22.1               | 55.3   | 2456               | 28.0   |
| 1987 | 4395.5         | 773.0          | 75.3   | 64.5   | 75.3                              | 62.2   | 64.9               | 55.9   | 6591               | 75.2   |
| 1988 | 4168.4         | 773.0          | 71.5   | 64.9   | 71.5                              | 62.8   | 61.4               | 56.2   | 6278               | 71.5   |
| 1989 | 5119.5         | 773.0          | 82.6   | 65.9   | 82.6                              | 63.9   | 75.6               | 57.3   | 7235               | 82.6   |
| 1990 | 5149.8         | 773.0          | 83.0   | 66.8   | 83.0                              | 64.9   | 76.1               | 58.3   | 7272               | 83.0   |
| 1991 | 2584.2         | 773.0          | 59.9   | 66.5   | 59.9                              | 64.6   | 38.2               | 57.3   | 5247               | 59.9   |
| 1992 | 3077.1         | 773.0          | 61.1   | 66.2   | 61.1                              | 64.5   | 45.3               | 56.7   | 5364               | 61.1   |
| 1993 | 4969.0         | 773.0          | 80.4   | 66.8   | 80.4                              | 65.2   | 73.4               | 57.5   | 7040               | 80.4   |
| 1994 | 1666.4         | 773.0          | 34.4   | 65.4   | 34.3                              | 63.8   | 24.6               | 56.0   | 3009               | 34.3   |
| 1995 | 3477.3         | 773.0          | 59.5   | 65.2   | 59.5                              | 63.7   | 51.4               | 55.8   | 5209               | 59.5   |
| 1996 | 2962.1         | 773.0          | 48.9   | 64.5   | 48.9                              | 63.1   | 43.6               | 55.4   | 4273               | 48.6   |
| 1997 | 4046.2         | 773.0          | 68.5   | 64.7   | 68.6                              | 63.3   | 59.8               | 55.5   | 5900               | 67.4   |
| 1998 | 6234.6         | 773.0          | 93.1   | 65.7   | 93.1                              | 64.4   | 92.1               | 56.9   | 8157               | 93.1   |
| 1999 | 6130.0         | 773.0          | 91.1   | 66.6   | 91.1                              | 65.3   | 90.5               | 58.1   | 7978               | 91.1   |
| 2000 | 6365.1         | 773.0          | 93.8   | 67.6   | 93.8                              | 66.3   | 93.7               | 59.3   | 8243               | 93.8   |
| 2001 | 6466.0         | 773.0          | 95.4   | 68.5   | 95.4                              | 67.3   | 95.5               | 60.5   | 8359               | 95.4   |
| 2002 | 6060.9         | 792.0          | 90.5   | 69.2   | 90.5                              | 68.0   | 87.4               | 61.4   | 7915               | 90.4   |
| 2003 | 6963.9         | 850.0          | 94.2   | 70.1   | 94.2                              | 68.9   | 93.5               | 62.5   | 8206               | 93.7   |
| 2004 | 6436.9         | 850.0          | 85.9   | 70.6   | 85.9                              | 69.5   | 86.2               | 63.2   | 7544               | 85.9   |

# US-249 DRESDEN-3

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 24 Jan | 37.0   | 31.5    | UF4  | A31  | REACTOR SCRAM DUE TO EQUIPMENT FAILURES OF THE MASTER TRIP SOLENOID VALVE DURING TURBINE WEEKLY SURVEILLANCES.    |
| 30 Jan | 78.0   | 66.3    | UF4  | Z    | REACTOR SCRAM DUE TO PROBLEMS WITH THE MAIN TURBINE LUBE OIL SYSTEM FROM INADEQUATE OPERATOR PROCEDURAL GUIDANCE. |
| 05 May | 108.0  | 91.8    | UF4  | A42  | REACTOR SCRAM DUE TO A LOSS OF OFFSITE POWER CAUSED BY EQUIPMENT PROBLEMS IN THE SWITCHYARD,                      |
| 26 Oct | 1015.0 | 862.8   | PF   | C21  | REFUELLING OUTAGE.  |
| 07 Dec | 2.0    | 1.7     | PF   | E31  | TURBINE TESTING.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 145       |          |  | 727       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 26        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1015            |           |          | 1435                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 85                                       |           |          |
| E. Testing of plant systems or components  | 2               |           |          | 1  | 6         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 10                                       | 1         | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 10                                       | 11        | 1        |
| Z. Others  |                 | 78        |          |  |           |          |
| Subtotal   | 1017            | 223       | 0        | 1541                                     | 771       | 2        |
| Total  |                 | 1240      |          |  | 2314      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 8  |
| 12. Reactor I&C Systems                        |                 | 19                                       |
| 13. Reactor Auxiliary Systems                  |                 | 2  |
| 14. Safety Systems                             |                 | 61                                       |
| 15. Reactor Cooling Systems                    |                 | 60                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 72                                       |
| 31. Turbine and auxiliaries                    | 37              | 207                                      |
| 32. Feedwater and Main Steam System            |                 | 68                                       |
| 33. Circulating Water System                   |                 | 7  |
| 35. All other I&C Systems                      |                 | 1  |
| 41. Main Generator Systems                     |                 | 17                                       |
| 42. Electrical Power Supply Systems            | 108             | 98                                       |
| XX. Miscellaneous Systems                      |                 | 77                                       |
| Total  | 145             | 697                                      |

# US-331 DUANE ARNOLD-1

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 565.0 MW(e)  
**Design Net RUP:** 538.0 MW(e)  
**Design Discharge Burnup:** 16600 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4929.9 GW(e).h  
**Energy Availability Factor:** 97.9%  
**Load Factor:** 99.3%  
**Operating Factor:** 97.9%  
**Energy Unavailability Factor:** 2.1%  
**Total Off-line Time:** 188 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 436.9 | 406.5 | 435.4 | 349.6 | 430.0 | 412.3 | 425.4 | 424.9 | 410.8 | 358.9 | 405.6 | 433.7 | 4929.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 87.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.6  | 100.0 | 100.0 | 97.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 87.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.6  | 100.0 | 100.0 | 97.9   |
| <b>LF (%)</b>   | 103.9 | 103.4 | 103.6 | 86.1  | 102.3 | 101.3 | 101.2 | 101.1 | 101.0 | 85.3  | 99.7  | 103.2 | 99.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 86.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.4  | 100.0 | 100.0 | 97.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 13.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.4  | 0.0   | 0.0   | 2.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 13.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.4  | 0.0   | 0.0   | 2.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1970  
**Date of First Criticality:** 23 Mar 1974  
**Date of Grid Connection:** 19 May 1974  
**Date of Commercial Operation:** 01 Feb 1975

**Lifetime Generation:** 99042.8 GW(e).h  
**Cumulative Energy Availability Factor:** 76.1%  
**Cumulative Load Factor:** 71.6%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 23.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2324.3         | 515.0          | 61.8   | 61.4   | 61.8                              | 61.2   | 51.5               | 53.0   | 5503               | 62.8   |
| 1984 | 2717.6         | 515.0          | 72.2   | 62.6   | 72.2                              | 62.4   | 60.1               | 53.8   | 6402               | 72.9   |
| 1985 | 1940.5         | 515.0          | 52.6   | 61.6   | 52.6                              | 61.4   | 43.0               | 52.7   | 4711               | 53.8   |
| 1986 | 3192.8         | 515.0          | 81.5   | 63.4   | 81.5                              | 63.2   | 70.8               | 54.3   | 7495               | 85.6   |
| 1987 | 2546.6         | 515.0          | 62.0   | 63.3   | 62.0                              | 63.1   | 56.4               | 54.5   | 5513               | 62.9   |
| 1988 | 3520.2         | 520.0          | 72.3   | 64.0   | 72.3                              | 63.9   | 77.1               | 56.3   | 7128               | 81.1   |
| 1989 | 3143.6         | 536.0          | 62.5   | 63.9   | 62.4                              | 63.7   | 67.0               | 57.1   | 6561               | 74.9   |
| 1990 | 3021.0         | 538.0          | 74.7   | 64.6   | 74.7                              | 64.5   | 64.1               | 57.5   | 6498               | 74.2   |
| 1991 | 4146.8         | 532.0          | 93.9   | 66.5   | 93.9                              | 66.4   | 89.0               | 59.6   | 8217               | 93.8   |
| 1992 | 3434.6         | 515.0          | 80.5   | 67.3   | 80.5                              | 67.2   | 75.9               | 60.5   | 7112               | 81.0   |
| 1993 | 3241.4         | 515.0          | 76.6   | 67.8   | 76.5                              | 67.7   | 71.8               | 61.1   | 6755               | 77.1   |
| 1994 | 4108.4         | 515.0          | 92.0   | 69.1   | 92.0                              | 69.0   | 91.1               | 62.7   | 8078               | 92.2   |
| 1995 | 3737.0         | 515.0          | 82.4   | 69.7   | 82.4                              | 69.7   | 82.8               | 63.7   | 7253               | 82.8   |
| 1996 | 3938.5         | 520.0          | 89.9   | 70.7   | 89.9                              | 70.6   | 86.2               | 64.8   | 7906               | 90.0   |
| 1997 | 4155.5         | 520.0          | 92.7   | 71.7   | 92.7                              | 71.6   | 91.2               | 66.0   | 8125               | 92.8   |
| 1998 | 3839.2         | 520.0          | 85.2   | 72.3   | 85.2                              | 72.2   | 84.3               | 66.8   | 7477               | 85.4   |
| 1999 | 3649.0         | 520.0          | 83.0   | 72.7   | 83.0                              | 72.7   | 80.1               | 67.3   | 7267               | 83.0   |
| 2000 | 4455.7         | 520.0          | 97.4   | 73.7   | 97.4                              | 73.7   | 97.5               | 68.6   | 8553               | 97.4   |
| 2001 | 3860.6         | 523.0          | 85.4   | 74.2   | 85.4                              | 74.1   | 84.3               | 69.2   | 7473               | 85.3   |
| 2002 | 4581.1         | 563.0          | 95.1   | 75.0   | 93.6                              | 74.9   | 92.9               | 70.1   | 8147               | 93.0   |
| 2003 | 3998.6         | 565.0          | 83.8   | 75.4   | 83.8                              | 75.2   | 80.8               | 70.5   | 7209               | 82.3   |
| 2004 | 4929.9         | 565.0          | 97.9   | 76.2   | 97.9                              | 76.1   | 99.3               | 71.6   | 8596               | 97.9   |

**US-331 DUANE ARNOLD-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 19 Apr | 93.8  | 52.7    | PF   | D32  | PLANNED SHUTDOWN TO REPLACE A LEAKING MAIN STEAM RELIEF VALVE. |
| 25 Oct | 93.2  | 52.4    | PF   | D31  | PLANNED SHUTDOWN TO REPAIR MAIN CONDENSER TUBE LEAK.           |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 471       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 50        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 913   |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 186             |           |          | 261   | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 23  | 3         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 53  | 21        | 11       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 10  | 46        | 5        |
| Subtotal   | 186             | 0         | 0        | 1260  | 591       | 16       |
| Total  |                 | 186       |          |   | 1867      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 5   |
| 13. Reactor Auxiliary Systems                  |                    | 13  |
| 14. Safety Systems                             |                    | 19  |
| 15. Reactor Cooling Systems                    |                    | 264   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 7   |
| 31. Turbine and auxiliaries                    |                    | 49  |
| 32. Feedwater and Main Steam System            |                    | 40  |
| 35. All other I&C Systems                      |                    | 2   |
| 41. Main Generator Systems                     |                    | 7   |
| 42. Electrical Power Supply Systems            |                    | 22  |
| XX. Miscellaneous Systems                      |                    | 2   |
| Total  | 0                  | 430   |

# US-341 ENRICO FERMI-2

**Operator:** DETED (DETROIT EDISON CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1089.0 MW(e)  
**Design Net RUP:** 1093.0 MW(e)  
**Design Discharge Burnup:** 23500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8453.1 GW(e).h  
**Energy Availability Factor:** 88.2%  
**Load Factor:** 88.4%  
**Operating Factor:** 88.4%  
**Energy Unavailability Factor:** 11.8%  
**Total Off-line Time:** 1020 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 806.6 | 781.0 | 820.3 | 800.5 | 820.0 | 788.2 | 798.8 | 559.3 | 690.9 | 823.2 | 125.2 | 639.1 | 8453.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 70.8  | 89.3  | 100.0 | 15.0  | 82.3  | 88.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 70.8  | 89.3  | 100.0 | 15.0  | 82.3  | 88.2   |
| <b>LF (%)</b>   | 99.6  | 103.0 | 101.2 | 102.2 | 101.2 | 100.5 | 98.6  | 69.0  | 88.1  | 101.5 | 16.0  | 78.9  | 88.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 71.4  | 89.4  | 100.0 | 17.2  | 81.9  | 88.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 29.2  | 10.7  | 0.0   | 85.0  | 17.7  | 11.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 85.0  | 7.3   | 7.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 29.2  | 10.7  | 0.0   | 0.0   | 10.5  | 4.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1969  
**Date of First Criticality:** 21 Jun 1985  
**Date of Grid Connection:** 21 Sep 1986  
**Date of Commercial Operation:** 23 Jan 1988

**Lifetime Generation:** 113050.6 GW(e).h  
**Cumulative Energy Availability Factor:** 75.1%  
**Cumulative Load Factor:** 71.8%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 24.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 4060.1         | 1093.0         | 57.0   | 57.0   | 57.0                              | 57.0   | 45.0               | 45.0   | 4719               | 57.2   |
| 1989 | 5230.7         | 1093.0         | 63.4   | 60.3   | 63.4                              | 60.3   | 54.6               | 50.0   | 5575               | 63.6   |
| 1990 | 7118.3         | 1059.0         | 82.3   | 67.6   | 82.3                              | 67.6   | 76.7               | 58.9   | 7266               | 82.9   |
| 1991 | 6180.9         | 1059.0         | 72.8   | 68.9   | 72.8                              | 68.9   | 66.6               | 60.8   | 6466               | 73.8   |
| 1992 | 7356.8         | 1060.0         | 79.2   | 71.0   | 79.1                              | 71.0   | 79.0               | 64.5   | 7019               | 79.9   |
| 1993 | 8284.7         | 1085.0         | 92.1   | 74.6   | 92.1                              | 74.6   | 87.2               | 68.3   | 8076               | 92.2   |
| 1994 | 0.0            | 1085.0         | 0.0  | 63.7   | 0.0                               | 63.7   | 0.0                | 58.4   | 0                  | 0.0    |
| 1995 | 5132.0         | 997.0          | 71.8   | 64.7   | 71.7                              | 64.7   | 58.8               | 58.4   | 6509               | 74.3   |
| 1996 | 4790.0         | 876.0          | 58.2   | 64.1   | 58.2                              | 64.1   | 62.3               | 58.8   | 5859               | 66.7   |
| 1997 | 5579.9         | 1000.0         | 70.5   | 64.7   | 70.4                              | 64.7   | 63.7               | 59.3   | 5461               | 62.3   |
| 1998 | 7146.8         | 1098.0         | 78.4   | 66.0   | 78.4                              | 66.0   | 74.3               | 60.7   | 6868               | 78.4   |
| 1999 | 9484.7         | 1081.0         | 99.3   | 68.9   | 99.3                              | 68.9   | 100.2              | 64.1   | 8698               | 99.3   |
| 2000 | 8237.8         | 1083.0         | 85.7   | 70.2   | 85.7                              | 70.2   | 86.6               | 65.9   | 7514               | 85.5   |
| 2001 | 8564.0         | 1089.0         | 89.3   | 71.6   | 89.3                              | 71.6   | 89.8               | 67.7   | 7837               | 89.5   |
| 2002 | 9302.9         | 1089.0         | 98.5   | 73.5   | 98.5                              | 73.5   | 97.5               | 69.7   | 8630               | 98.5   |
| 2003 | 8127.8         | 1089.0         | 85.3   | 74.3   | 85.3                              | 74.2   | 85.2               | 70.7   | 7479               | 85.4   |
| 2004 | 8453.1         | 1089.0         | 88.2   | 75.1   | 88.2                              | 75.1   | 88.4               | 71.8   | 7764               | 88.4   |

## US-341 ENRICO FERMI-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 09 Aug | 212.9 | 236.5   | UF2  | A42  | TECHNICAL SPECIFICATION REQUIRED SHUTDOWN DUE TO EMERGENCY DIESEL NO. 12 SCAVENGING AIR BLOWER FAILURE. BLOWER WAS REPLACED.  |
| 03 Sep | 75.2  | 83.5    | UF4  | A41  | TURBINE TRIP AND AUTOMATIC REACTOR SCRAM DUE TO FAILURE OF GENERATOR EXCITATION AUTOMATIC VOLTAGE REGULATOR SYSTEM. FAULTY AUTOMATIC VOLTAGE REGULATOR REPLACED.  |
| 06 Nov | 653.8 | 726.4   | PF   | C21  | REFUELLING OUTAGE.  |
| 04 Dec | 76.4  | 84.9    | UF4  | A41  | AUTOMATIC MAIN TURBINE TRIP AND REACTOR SCRAM DUE TO GENERATOR AUTOMATIC VOLTAGE REGULATOR (AVR) FAILURE. ELECTRONIC MODULE COMMUNICATION ERRORS CAUSED THE AVR FAILURE. MODULES HAVE BEEN REPLACED AND SOFTWARE CHANGES IMPLEMENTED. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 364       |          | 12                                       | 1161      |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 653             |           |          | 665                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 233                                      | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 3         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 7         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1         |          |
| Subtotal   | 653             | 364       | 0        | 910                                      | 1185      | 0        |
| Total  |                 | 1017      |          |  | 2095      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 29                                       |
| 13. Reactor Auxiliary Systems                  |                 | 69                                       |
| 14. Safety Systems                             |                 | 20                                       |
| 15. Reactor Cooling Systems                    |                 | 26                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 24                                       |
| 31. Turbine and auxiliaries                    |                 | 583                                      |
| 32. Feedwater and Main Steam System            |                 | 7  |
| 33. Circulating Water System                   |                 | 3  |
| 35. All other I&C Systems                      |                 | 20                                       |
| 41. Main Generator Systems                     | 151             | 194                                      |
| 42. Electrical Power Supply Systems            | 212             | 115                                      |
| XX. Miscellaneous Systems                      |                 | 66                                       |
| Total  | 363             | 1156                                     |

# US-348 FARLEY-1

**Operator:** SOUTH (Southern Nuclear Operating Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 830.0 MW(e)  
**Design Net RUP:** 829.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6423.9 GW(e).h  
**Energy Availability Factor:** 87.0%  
**Load Factor:** 86.9%  
**Operating Factor:** 86.8%  
**Energy Unavailability Factor:** 13.0%  
**Total Off-line Time:** 1157 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 637.6 | 596.9 | 590.5 | 611.6 | 625.8 | 613.1 | 631.7 | 633.0 | 605.8 | 10.4 | 224.8 | 642.5 | 6423.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 94.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 5.4  | 46.4  | 100.0 | 87.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 94.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 5.4  | 46.4  | 100.0 | 87.0   |
| <b>LF (%)</b>   | 103.3 | 103.3 | 95.6  | 102.5 | 101.3 | 100.1 | 99.8  | 100.0 | 98.9  | 1.6  | 36.7  | 101.5 | 86.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 94.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 3.2  | 45.3  | 100.0 | 86.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 5.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 94.6 | 53.6  | 0.0   | 13.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 94.6 | 53.6  | 0.0   | 12.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 5.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1970  
**Date of First Criticality:** 09 Aug 1977  
**Date of Grid Connection:** 18 Aug 1977  
**Date of Commercial Operation:** 01 Dec 1977

**Lifetime Generation:** 155449.7 GW(e).h  
**Cumulative Energy Availability Factor:** 81.5%  
**Cumulative Load Factor:** 79.5%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 18.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5268.6         | 804.0          | 77.7   | 63.0   | 77.7                              | 62.3   | 74.8               | 59.4   | 6832               | 78.0   |
| 1984 | 5432.7         | 804.0          | 78.5   | 65.2   | 78.5                              | 64.6   | 76.9               | 61.9   | 6920               | 78.8   |
| 1985 | 5868.7         | 816.0          | 84.3   | 67.6   | 84.3                              | 67.0   | 82.1               | 64.4   | 7378               | 84.2   |
| 1986 | 5738.6         | 827.0          | 82.4   | 69.2   | 82.4                              | 68.8   | 79.2               | 66.1   | 7247               | 82.7   |
| 1987 | 6444.9         | 825.0          | 93.7   | 71.7   | 93.7                              | 71.3   | 89.2               | 68.4   | 8201               | 93.6   |
| 1988 | 5908.2         | 813.0          | 83.8   | 72.8   | 83.8                              | 72.4   | 82.7               | 69.7   | 7363               | 83.8   |
| 1989 | 6022.6         | 824.0          | 86.0   | 73.9   | 86.0                              | 73.6   | 83.4               | 70.9   | 7520               | 85.8   |
| 1990 | 6908.6         | 824.0          | 99.1   | 75.9   | 99.1                              | 75.6   | 95.7               | 72.8   | 8681               | 99.1   |
| 1991 | 5416.1         | 814.0          | 78.9   | 76.1   | 78.4                              | 75.8   | 76.0               | 73.0   | 6870               | 78.4   |
| 1992 | 5667.9         | 812.0          | 81.0   | 76.4   | 81.0                              | 76.1   | 79.5               | 73.4   | 7119               | 81.0   |
| 1993 | 6873.9         | 812.0          | 97.3   | 77.7   | 97.3                              | 77.4   | 96.6               | 74.9   | 8522               | 97.3   |
| 1994 | 6059.8         | 812.0          | 86.1   | 78.2   | 86.1                              | 77.9   | 85.2               | 75.5   | 7546               | 86.1   |
| 1995 | 5752.0         | 812.0          | 82.4   | 78.4   | 82.4                              | 78.2   | 80.9               | 75.8   | 7220               | 82.4   |
| 1996 | 7142.3         | 812.0          | 99.5   | 79.5   | 99.5                              | 79.3   | 100.1              | 77.1   | 8740               | 99.5   |
| 1997 | 5434.0         | 821.0          | 77.7   | 79.5   | 77.7                              | 79.2   | 75.6               | 77.0   | 6803               | 77.7   |
| 1998 | 5237.9         | 822.0          | 74.8   | 79.2   | 74.8                              | 79.0   | 72.7               | 76.8   | 6539               | 74.6   |
| 1999 | 7226.5         | 847.0          | 99.3   | 80.2   | 99.3                              | 80.0   | 97.4               | 77.8   | 8695               | 99.3   |
| 2000 | 5204.1         | 828.0          | 76.8   | 80.0   | 76.8                              | 79.8   | 71.6               | 77.5   | 6775               | 77.1   |
| 2001 | 6392.5         | 833.0          | 88.3   | 80.4   | 88.3                              | 80.2   | 87.6               | 77.9   | 7736               | 88.3   |
| 2002 | 7221.8         | 833.0          | 98.7   | 81.1   | 98.7                              | 80.9   | 99.0               | 78.8   | 8641               | 98.6   |
| 2003 | 6609.9         | 830.0          | 90.3   | 81.5   | 90.3                              | 81.3   | 90.9               | 79.2   | 7909               | 90.3   |
| 2004 | 6423.9         | 842.0          | 87.0   | 81.7   | 87.0                              | 81.5   | 86.9               | 79.5   | 7627               | 86.8   |



# US-348 FARLEY-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 01 Mar | 41.3   | 34.4    | UF4  | A35  | REACTOR TRIP DUE TO STEAM GENERATOR FEEDWATER PUMP SPEED CONTROL FAILURE. |
| 02 Oct | 1114.7 | 928.5   | PF   | C21  | REFUELLING OUTAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 41        |          |  | 261       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1114            |           |          | 1109                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 72                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 8         | 13       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         | 6        |
| Subtotal   | 1114            | 41        | 0        | 1183                                     | 288       | 19       |
| Total  |                 | 1155      |          |  | 1490      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1977 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 2  |
| 12. Reactor I&C Systems                        |                 | 10                                       |
| 13. Reactor Auxiliary Systems                  |                 | 1  |
| 14. Safety Systems                             |                 | 4  |
| 15. Reactor Cooling Systems                    |                 | 8  |
| 16. Steam generation systems                   |                 | 18                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    |                 | 123                                      |
| 32. Feedwater and Main Steam System            |                 | 17                                       |
| 35. All other I&C Systems                      | 41              | 1  |
| 41. Main Generator Systems                     |                 | 6  |
| 42. Electrical Power Supply Systems            |                 | 62                                       |
| XX. Miscellaneous Systems                      |                 | 1  |
| Total  | 41              | 254                                      |

# US-364 FARLEY-2

**Operator:** SOUTH (Southern Nuclear Operating Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 839.0 MW(e)  
**Design Net RUP:** 829.0 MW(e)  
**Design Discharge Burnup:** 15200 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6724.1 GW(e).h  
**Energy Availability Factor:** 90.5%  
**Load Factor:** 90.7%  
**Operating Factor:** 90.5%  
**Energy Unavailability Factor:** 9.5%  
**Total Off-line Time:** 835 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 643.7 | 600.2 | 217.9 | 251.1 | 644.4 | 620.8 | 628.9 | 629.0 | 591.6 | 631.1 | 620.6 | 644.9 | 6724.1 |
| <b>EAFF (%)</b> | 100.0 | 100.0 | 38.5  | 47.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 38.5  | 47.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.5   |
| <b>LF (%)</b>   | 103.1 | 102.8 | 34.9  | 41.6  | 103.2 | 102.8 | 99.6  | 99.6  | 96.8  | 99.8  | 101.5 | 102.1 | 90.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 38.7  | 47.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 61.5  | 52.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 61.5  | 49.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 3.5   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1970  
**Date of First Criticality:** 05 May 1981  
**Date of Grid Connection:** 25 May 1981  
**Date of Commercial Operation:** 30 Jul 1981

**Lifetime Generation:** 142622.5 GW(e).h  
**Cumulative Energy Availability Factor:** 86.3%  
**Cumulative Load Factor:** 83.8%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 13.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5984.1         | 814.0          | 87.7   | 83.6   | 87.7                              | 83.6   | 83.9               | 79.2   | 7696               | 87.9   |
| 1984 | 6618.9         | 814.0          | 94.4   | 87.2   | 94.2                              | 87.1   | 92.6               | 83.7   | 8276               | 94.2   |
| 1985 | 5474.2         | 809.0          | 77.8   | 84.9   | 77.4                              | 84.7   | 77.2               | 82.1   | 6813               | 77.8   |
| 1986 | 5959.9         | 829.0          | 85.2   | 84.9   | 85.2                              | 84.8   | 82.1               | 82.1   | 7455               | 85.1   |
| 1987 | 4910.4         | 824.0          | 73.0   | 82.9   | 73.0                              | 82.8   | 68.0               | 79.7   | 6396               | 73.0   |
| 1988 | 6550.4         | 823.0          | 100.0  | 85.4   | 90.6                              | 85.3   | 90.6               | 81.3   | 8039               | 91.5   |
| 1989 | 5621.6         | 830.0          | 80.5   | 84.8   | 80.5                              | 84.7   | 77.3               | 80.8   | 7037               | 80.3   |
| 1990 | 5277.0         | 828.0          | 71.8   | 83.3   | 71.8                              | 83.2   | 72.8               | 79.9   | 6478               | 73.9   |
| 1991 | 6739.9         | 824.0          | 96.0   | 84.6   | 95.6                              | 84.5   | 93.4               | 81.2   | 8376               | 95.6   |
| 1992 | 5409.9         | 824.0          | 79.5   | 84.1   | 79.5                              | 84.0   | 74.7               | 80.6   | 6987               | 79.5   |
| 1993 | 5248.5         | 822.0          | 75.8   | 83.4   | 75.8                              | 83.3   | 72.9               | 80.0   | 6644               | 75.8   |
| 1994 | 7147.2         | 822.0          | 98.9   | 84.6   | 98.9                              | 84.5   | 99.3               | 81.5   | 8660               | 98.9   |
| 1995 | 5091.4         | 822.0          | 79.7   | 84.3   | 79.7                              | 84.2   | 70.7               | 80.7   | 6984               | 79.7   |
| 1996 | 5741.3         | 822.0          | 81.5   | 84.1   | 81.5                              | 84.0   | 79.5               | 80.6   | 7160               | 81.5   |
| 1997 | 7280.9         | 822.0          | 100.0  | 85.1   | 100.0                             | 85.0   | 101.1              | 81.9   | 8760               | 100.0  |
| 1998 | 6271.4         | 824.0          | 85.8   | 85.1   | 85.8                              | 85.1   | 86.9               | 82.2   | 7514               | 85.8   |
| 1999 | 5356.2         | 852.0          | 82.7   | 85.0   | 82.7                              | 84.9   | 71.8               | 81.6   | 7242               | 82.7   |
| 2000 | 7362.6         | 839.0          | 99.5   | 85.8   | 99.4                              | 85.7   | 99.9               | 82.6   | 8736               | 99.5   |
| 2001 | 5777.7         | 842.0          | 79.0   | 85.4   | 79.0                              | 85.4   | 78.3               | 82.4   | 6921               | 79.0   |
| 2002 | 6463.4         | 842.0          | 87.7   | 85.5   | 87.7                              | 85.5   | 87.6               | 82.6   | 7682               | 87.7   |
| 2003 | 7379.4         | 839.0          | 99.2   | 86.2   | 99.2                              | 86.1   | 100.4              | 83.4   | 8687               | 99.2   |
| 2004 | 6724.1         | 844.0          | 90.5   | 86.3   | 90.5                              | 86.3   | 90.7               | 83.8   | 7949               | 90.5   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                                   |
|--------|-------|---------|------|------|---|
| 13 Mar | 809.6 | 681.7   | PF   | C21  | REFUELLING OUTAGE.                            |
| 16 Apr | 24.8  | 20.9    | UF2  | A31  | TURBINE TRIP ONLY. REACTOR REMAINED CRITICAL. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 24        |          |   | 176       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 809             |           |          | 879   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 29  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 9   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 10  | 5         | 2        |
| Subtotal   | 809             | 24        | 0        | 927   | 195       | 2        |
| Total  |                 | 833       |          |   | 1124      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1981 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 21  |
| 13. Reactor Auxiliary Systems                  |                    | 11  |
| 14. Safety Systems                             |                    | 23  |
| 15. Reactor Cooling Systems                    |                    | 53  |
| 16. Steam generation systems                   |                    | 20  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 3   |
| 31. Turbine and auxiliaries                    | 24                 | 17  |
| 32. Feedwater and Main Steam System            |                    | 7   |
| 35. All other I&C Systems                      |                    | 1   |
| 41. Main Generator Systems                     |                    | 6   |
| 42. Electrical Power Supply Systems            |                    | 1   |
| Total  | 24                 | 163   |

# US-333 FITZPATRICK

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 813.0 MW(e)  
**Design Net RUP:** 821.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6455.9 GW(e).h  
**Energy Availability Factor:** 90.8%  
**Load Factor:** 90.4%  
**Operating Factor:** 90.9%  
**Energy Unavailability Factor:** 9.2%  
**Total Off-line Time:** 800 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 626.6 | 511.1 | 600.0 | 601.8 | 621.0 | 596.7 | 593.3 | 523.2 | 410.3 | 122.1 | 612.2 | 637.5 | 6455.9 |
| <b>EAF (%)</b>  | 100.0 | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.8  | 79.7  | 21.8  | 100.0 | 100.0 | 90.8   |
| <b>UCF (%)</b>  | 100.0 | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.8  | 79.7  | 21.8  | 100.0 | 100.0 | 90.8   |
| <b>LF (%)</b>   | 103.6 | 90.3  | 99.2  | 103.0 | 102.7 | 101.9 | 98.1  | 86.5  | 70.1  | 20.2  | 104.6 | 105.4 | 90.4   |
| <b>OF (%)</b>   | 100.0 | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.7  | 80.0  | 22.7  | 100.0 | 100.0 | 90.9   |
| <b>EUF (%)</b>  | 0.0   | 6.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.2   | 20.3  | 78.2  | 0.0   | 0.0   | 9.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 20.3  | 78.2  | 0.0   | 0.0   | 8.3    |
| <b>UCLF (%)</b> | 0.0   | 6.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.9    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1968  
**Date of First Criticality:** 17 Nov 1974  
**Date of Grid Connection:** 01 Feb 1975  
**Date of Commercial Operation:** 28 Jul 1975

**Lifetime Generation:** 144912.2 GW(e).h  
**Cumulative Energy Availability Factor:** 73.7%  
**Cumulative Load Factor:** 71.1%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 26.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4634.3         | 810.0          | 70.7   | 65.2   | 70.7                              | 65.2   | 65.3               | 61.7   | 6183               | 70.6   |
| 1984 | 4899.4         | 810.0          | 76.9   | 66.6   | 76.9                              | 66.5   | 68.9               | 62.5   | 6745               | 76.8   |
| 1985 | 4166.5         | 810.0          | 64.1   | 66.3   | 64.1                              | 66.3   | 58.7               | 62.1   | 5576               | 63.7   |
| 1986 | 6015.6         | 797.0          | 90.5   | 68.5   | 90.5                              | 68.5   | 86.2               | 64.3   | 7931               | 90.5   |
| 1987 | 4198.3         | 795.0          | 67.1   | 68.4   | 67.1                              | 68.4   | 60.3               | 64.0   | 5891               | 67.2   |
| 1988 | 4356.9         | 780.0          | 66.5   | 68.3   | 66.5                              | 68.2   | 63.6               | 64.0   | 5844               | 66.5   |
| 1989 | 6155.3         | 757.0          | 90.3   | 69.8   | 90.3                              | 69.7   | 92.8               | 65.9   | 7944               | 90.7   |
| 1990 | 4601.9         | 782.0          | 68.4   | 69.7   | 68.4                              | 69.6   | 67.2               | 66.0   | 6045               | 69.0   |
| 1991 | 3376.8         | 780.0          | 56.0   | 68.8   | 56.0                              | 68.8   | 49.4               | 65.0   | 4534               | 51.8   |
| 1992 | 0.0            | 780.0          | 0.0  | 64.8   | 0.0                               | 64.8   | 0.0                | 61.2   | 0                  | 0.0    |
| 1993 | 4746.5         | 780.0          | 71.6   | 65.2   | 71.6                              | 65.2   | 69.5               | 61.7   | 6301               | 71.9   |
| 1994 | 4972.6         | 774.0          | 81.9   | 66.0   | 81.9                              | 66.0   | 73.3               | 62.3   | 7224               | 82.5   |
| 1995 | 4804.0         | 777.0          | 71.6   | 66.3   | 71.6                              | 66.3   | 70.6               | 62.7   | 6336               | 72.3   |
| 1996 | 5290.4         | 765.0          | 79.3   | 66.9   | 79.2                              | 66.9   | 78.7               | 63.4   | 7036               | 80.1   |
| 1997 | 6624.6         | 799.0          | 96.3   | 68.3   | 94.9                              | 68.2   | 94.6               | 64.9   | 8310               | 94.9   |
| 1998 | 4930.5         | 785.0          | 75.2   | 68.6   | 75.2                              | 68.5   | 71.7               | 65.2   | 6613               | 75.5   |
| 1999 | 6567.4         | 799.0          | 93.5   | 69.7   | 93.5                              | 69.6   | 93.8               | 66.4   | 8205               | 93.7   |
| 2000 | 6024.8         | 813.0          | 86.6   | 70.3   | 86.6                              | 70.3   | 84.4               | 67.1   | 7617               | 86.7   |
| 2001 | 7090.5         | 813.0          | 98.6   | 71.5   | 98.6                              | 71.4   | 99.6               | 68.4   | 8639               | 98.6   |
| 2002 | 6595.0         | 813.0          | 92.4   | 72.3   | 92.4                              | 72.2   | 92.6               | 69.3   | 8112               | 92.6   |
| 2003 | 6966.0         | 813.0          | 96.2   | 73.2   | 96.2                              | 73.1   | 97.8               | 70.4   | 8435               | 96.3   |
| 2004 | 6455.9         | 813.0          | 90.8   | 73.8   | 90.8                              | 73.7   | 90.4               | 71.1   | 7984               | 90.9   |

# US-333 FITZPATRICK

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 16 Feb | 47.3  | 39.0    | UF2  | A32  | THE MAIN TURBINE WAS TAKEN OFFLINE TO REMOVE STEAM FROM THE SYSTEM AND ALLOW PUMP SEAL REPLACEMENT. |
| 04 Aug | 31.1  | 25.6    | UF2  | A14  | REACTOR SHUTDOWN DUE TO EHC LEAK.   |
| 25 Sep | 717.7 | 592.1   | PF   | C21  | REFUELLING OUTAGE.  |
| 25 Oct | 1.2   | 1.0     | PF   | E31  | GENERATOR WAS TAKEN OFF-LINE TO PERFORM OVERSPEED TESTING FOLLOWING A REFUELING OUTAGE.             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 78        |          |  | 456       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 62        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 717             |           |          | 1224                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 264                                      |           |          |
| E. Testing of plant systems or components  | 1               |           |          | 2  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 2         | 142      |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 5  | 25        | 4        |
| Subtotal   | 718             | 78        | 0        | 1495                                     | 546       | 148      |
| Total  |                 | 796       |          |  | 2189      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 3  |
| 12. Reactor I&C Systems             |                 | 18                                       |
| 13. Reactor Auxiliary Systems       |                 | 9  |
| 14. Safety Systems                  | 31              | 93                                       |
| 15. Reactor Cooling Systems         |                 | 57                                       |
| 31. Turbine and auxiliaries         |                 | 72                                       |
| 32. Feedwater and Main Steam System | 47              | 43                                       |
| 35. All other I&C Systems           |                 | 7  |
| 41. Main Generator Systems          |                 | 23                                       |
| 42. Electrical Power Supply Systems |                 | 54                                       |
| XX. Miscellaneous Systems           |                 | 21                                       |
| Total                               | 78              | 400                                      |

# US-285 FORT CALHOUN-1

**Operator:** OPPD (OMAHA PUBLIC POWER DISTRICT)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 478.0 MW(e)  
**Design Net RUP:** 478.0 MW(e)  
**Design Discharge Burnup:** 27900 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4071.3 GW(e).h  
**Energy Availability Factor:** 96.8%  
**Load Factor:** 97.0%  
**Operating Factor:** 96.8%  
**Energy Unavailability Factor:** 3.2%  
**Total Off-line Time:** 281 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 365.7 | 341.4 | 296.8 | 251.3 | 357.4 | 343.3 | 349.1 | 351.0 | 342.0 | 361.1 | 350.0 | 362.3 | 4071.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 80.7  | 81.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 80.7  | 81.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.8   |
| <b>LF (%)</b>   | 102.8 | 102.6 | 83.4  | 73.1  | 100.5 | 99.8  | 98.2  | 98.7  | 99.4  | 101.4 | 101.7 | 101.9 | 97.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 83.5  | 78.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 19.3  | 19.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 19.3  | 19.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1968  
**Date of First Criticality:** 06 Aug 1973  
**Date of Grid Connection:** 25 Aug 1973  
**Date of Commercial Operation:** 20 Jun 1974

**Lifetime Generation:** 96642.5 GW(e).h  
**Cumulative Energy Availability Factor:** 79.7%  
**Cumulative Load Factor:** 75.3%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 20.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2749.9         | 461.0          | 73.1   | 71.4   | 73.1                              | 71.4   | 68.1               | 66.4   | 6404               | 73.1   |
| 1984 | 2331.8         | 478.0          | 60.1   | 70.3   | 60.1                              | 70.3   | 55.5               | 65.3   | 5262               | 59.9   |
| 1985 | 3066.3         | 478.0          | 73.7   | 70.6   | 73.7                              | 70.6   | 73.2               | 66.0   | 6454               | 73.7   |
| 1986 | 3605.6         | 478.0          | 94.3   | 72.6   | 94.3                              | 72.6   | 86.1               | 67.8   | 8263               | 94.3   |
| 1987 | 3060.6         | 478.0          | 74.7   | 72.8   | 74.7                              | 72.8   | 73.1               | 68.2   | 6531               | 74.6   |
| 1988 | 2627.4         | 478.0          | 74.0   | 72.9   | 74.0                              | 72.9   | 62.6               | 67.8   | 6496               | 74.0   |
| 1989 | 3296.0         | 478.0          | 87.8   | 73.9   | 87.8                              | 73.9   | 78.7               | 68.5   | 7589               | 86.6   |
| 1990 | 2417.2         | 478.0          | 62.1   | 73.1   | 62.1                              | 73.1   | 57.7               | 67.8   | 5420               | 61.9   |
| 1991 | 3249.0         | 478.0          | 92.9   | 74.3   | 92.9                              | 74.3   | 77.6               | 68.4   | 7946               | 90.7   |
| 1992 | 2537.1         | 478.0          | 64.9   | 73.8   | 64.9                              | 73.8   | 60.4               | 68.0   | 5683               | 64.7   |
| 1993 | 3102.2         | 478.0          | 80.0   | 74.1   | 80.0                              | 74.1   | 74.1               | 68.3   | 6996               | 79.9   |
| 1994 | 4118.7         | 478.0          | 99.5   | 75.4   | 99.5                              | 75.4   | 98.4               | 69.8   | 8711               | 99.4   |
| 1995 | 3365.6         | 478.0          | 82.4   | 75.7   | 82.4                              | 75.7   | 80.4               | 70.3   | 7204               | 82.2   |
| 1996 | 3128.7         | 478.0          | 78.5   | 75.9   | 78.5                              | 75.9   | 74.5               | 70.5   | 6886               | 78.4   |
| 1997 | 3818.2         | 478.0          | 92.9   | 76.6   | 92.9                              | 76.6   | 91.2               | 71.4   | 8131               | 92.8   |
| 1998 | 3396.6         | 478.0          | 82.2   | 76.8   | 82.2                              | 76.9   | 81.1               | 71.8   | 7195               | 82.1   |
| 1999 | 3584.4         | 478.0          | 88.9   | 77.3   | 88.9                              | 77.3   | 85.6               | 72.4   | 7785               | 88.9   |
| 2000 | 3898.1         | 478.0          | 93.2   | 78.0   | 93.2                              | 78.0   | 92.8               | 73.2   | 8185               | 93.2   |
| 2001 | 3524.1         | 478.0          | 88.0   | 78.3   | 88.0                              | 78.3   | 84.2               | 73.6   | 7702               | 87.9   |
| 2002 | 3808.5         | 478.0          | 92.0   | 78.8   | 92.1                              | 78.8   | 91.0               | 74.2   | 8061               | 92.0   |
| 2003 | 3510.1         | 478.0          | 86.8   | 79.1   | 86.8                              | 79.1   | 83.8               | 74.6   | 7596               | 86.7   |
| 2004 | 4071.3         | 478.0          | 96.8   | 79.7   | 96.8                              | 79.7   | 97.0               | 75.3   | 8503               | 96.8   |

# US-285 FORT CALHOUN-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 26 Mar | 281.0 | 133.8   | PF   | D15  | MAINTENANCE OUTAGE TO REPAIR REACTOR COOLANT PUMP SEALS. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 184       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1280                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 281             |           |          | 71                                       | 15        |          |
| E. Testing of plant systems or components  |                 |           |          | 31                                       |           |          |
| G. Major back-fitting, refurbishment or upgrading activities without refuelling      |                 |           |          |  |           | 0        |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 5        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 5  | 17        | 0        |
| Subtotal   | 281             | 0         | 0        | 1387                                     | 217       | 5        |
| Total  |                 | 281       |          |  | 1609      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1973 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 12                                       |
| 13. Reactor Auxiliary Systems       |                 | 7  |
| 14. Safety Systems                  |                 | 16                                       |
| 15. Reactor Cooling Systems         |                 | 55                                       |
| 16. Steam generation systems        |                 | 5  |
| 31. Turbine and auxiliaries         |                 | 18                                       |
| 32. Feedwater and Main Steam System |                 | 17                                       |
| 42. Electrical Power Supply Systems |                 | 42                                       |
| XX. Miscellaneous Systems           |                 | 7  |
| Total                               | 0               | 179                                      |

# US-416 GRAND GULF-1

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1207.0 MW(e)  
**Design Net RUP:** 1250.0 MW(e)  
**Design Discharge Burnup:** 28000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10235.1 GW(e).h  
**Energy Availability Factor:** 91.2%  
**Load Factor:** 96.5%  
**Operating Factor:** 91.6%  
**Energy Unavailability Factor:** 8.8%  
**Total Off-line Time:** 737 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 954.3 | 632.7 | 204.9 | 926.5 | 947.4 | 918.0 | 945.5 | 944.3 | 920.2 | 951.9 | 927.4 | 962.0 | 10235.1 |
| <b>EAF (%)</b>  | 100.0 | 71.1  | 23.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.2    |
| <b>UCF (%)</b>  | 100.0 | 71.1  | 23.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.2    |
| <b>LF (%)</b>   | 106.3 | 75.3  | 22.8  | 106.8 | 105.5 | 105.6 | 105.3 | 105.2 | 105.9 | 105.9 | 106.7 | 107.1 | 96.5    |
| <b>OF (%)</b>   | 100.0 | 75.3  | 24.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.6    |
| <b>EUF (%)</b>  | 0.0   | 28.9  | 76.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.8     |
| <b>PUF (%)</b>  | 0.0   | 28.9  | 76.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.8     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1974  
**Date of First Criticality:** 18 Aug 1982  
**Date of Grid Connection:** 20 Oct 1984  
**Date of Commercial Operation:** 01 Jul 1985

**Lifetime Generation:** 173237.7 GW(e).h  
**Cumulative Energy Availability Factor:** 86.2%  
**Cumulative Load Factor:** 86.7%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 13.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 165.0          | 1192.0         | 0.0  | 0.0    | 87.8                              | 100.0  | 1.7                | 0.0    | 702                | 8.4    |
| 1985 | 4316.4         | 1108.0         | 0.0  | 0.0    | 79.2                              | 100.0  | 44.5               | 0.0    | 5042               | 57.6   |
| 1986 | 4098.1         | 1108.0         | 60.5   | 60.5   | 60.5                              | 60.5   | 42.2               | 42.2   | 5326               | 60.8   |
| 1987 | 7727.0         | 1130.0         | 80.9   | 70.8   | 80.9                              | 70.8   | 78.1               | 60.3   | 7098               | 81.0   |
| 1988 | 9591.0         | 1142.0         | 93.8   | 78.6   | 93.8                              | 78.6   | 95.6               | 72.3   | 8250               | 93.9   |
| 1989 | 7846.3         | 1142.0         | 76.9   | 78.2   | 76.9                              | 78.2   | 78.4               | 73.8   | 6815               | 77.8   |
| 1990 | 7404.0         | 1142.0         | 76.6   | 77.9   | 76.6                              | 77.9   | 74.0               | 73.9   | 6765               | 77.2   |
| 1991 | 9118.7         | 1142.0         | 89.6   | 79.8   | 88.3                              | 79.6   | 91.2               | 76.8   | 8035               | 91.7   |
| 1992 | 8171.1         | 1143.0         | 81.1   | 80.0   | 81.1                              | 79.8   | 81.4               | 77.4   | 7163               | 81.5   |
| 1993 | 7898.5         | 1143.0         | 77.6   | 79.7   | 77.6                              | 79.5   | 78.9               | 77.6   | 6845               | 78.1   |
| 1994 | 9614.8         | 1143.0         | 94.5   | 81.4   | 94.5                              | 81.2   | 96.0               | 79.7   | 8284               | 94.6   |
| 1995 | 7809.7         | 1153.0         | 77.7   | 81.0   | 77.7                              | 80.9   | 77.3               | 79.4   | 6829               | 78.0   |
| 1996 | 9224.7         | 1175.0         | 87.7   | 81.6   | 87.7                              | 81.5   | 89.4               | 80.4   | 7696               | 87.6   |
| 1997 | 10817.6        | 1200.0         | 100.0  | 83.2   | 99.9                              | 83.1   | 102.9              | 82.3   | 8760               | 100.0  |
| 1998 | 9190.8         | 1200.0         | 87.5   | 83.6   | 87.5                              | 83.5   | 87.4               | 82.7   | 7641               | 87.2   |
| 1999 | 8428.4         | 1204.0         | 79.3   | 83.3   | 79.3                              | 83.1   | 79.9               | 82.5   | 6944               | 79.3   |
| 2000 | 10694.6        | 1208.0         | 99.2   | 84.4   | 98.3                              | 84.2   | 100.8              | 83.8   | 8634               | 98.3   |
| 2001 | 9924.0         | 1210.0         | 92.3   | 84.9   | 91.8                              | 84.7   | 93.6               | 84.4   | 8040               | 91.8   |
| 2002 | 10059.5        | 1207.0         | 93.8   | 85.4   | 92.9                              | 85.2   | 95.1               | 85.1   | 8139               | 92.9   |
| 2003 | 10902.5        | 1207.0         | 97.9   | 86.1   | 97.9                              | 85.9   | 103.1              | 86.1   | 8574               | 97.9   |
| 2004 | 10235.1        | 1207.0         | 91.2   | 86.4   | 91.2                              | 86.2   | 96.5               | 86.7   | 8047               | 91.6   |



# US-416 GRAND GULF-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description        |
|--------|-------|---------|------|------|--------------------|
| 22 Feb | 737.0 | 930.8   | PF   | C21  | REFUELLING OUTAGE. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 251       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 35        |          |
| C. Inspection, maintenance or repair combined with refuelling  | 737             |           |          | 696   | 22        |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 113   | 3         |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |   | 41        | 14       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |   | 7         |          |
| Subtotal   | 737             | 0         | 0        | 809   | 360       | 14       |
| Total  |                 | 737       |          |   | 1183      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 6   |
| 13. Reactor Auxiliary Systems                  |                    | 28  |
| 14. Safety Systems                             |                    | 2   |
| 15. Reactor Cooling Systems                    |                    | 46  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 15  |
| 31. Turbine and auxiliaries                    |                    | 29  |
| 32. Feedwater and Main Steam System            |                    | 18  |
| 33. Circulating Water System                   |                    | 3   |
| 35. All other I&C Systems                      |                    | 6   |
| 41. Main Generator Systems                     |                    | 15  |
| 42. Electrical Power Supply Systems            |                    | 44  |
| XX. Miscellaneous Systems                      |                    | 31  |
| Total  | 0                  | 243   |

# US-261 H.B. ROBINSON-2

**Operator:** PROGRESS (Progress Energy Corporation)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 710.0 MW(e)  
**Design Net RUP:** 700.0 MW(e)  
**Design Discharge Burnup:** 25400 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5742.2 GW(e).h  
**Energy Availability Factor:** 88.9%  
**Load Factor:** 92.1%  
**Operating Factor:** 88.9%  
**Energy Unavailability Factor:** 11.1%  
**Total Off-line Time:** 973 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 558.6 | 523.1 | 556.8 | 335.3 | 33.3 | 520.9 | 535.9 | 539.0 | 528.2 | 510.8 | 538.9 | 561.4 | 5742.2 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 59.9  | 14.5 | 100.0 | 100.0 | 100.0 | 100.0 | 93.7  | 100.0 | 100.0 | 88.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 59.9  | 14.5 | 100.0 | 100.0 | 100.0 | 100.0 | 93.7  | 100.0 | 100.0 | 88.9   |
| <b>LF (%)</b>   | 105.7 | 105.9 | 105.4 | 65.7  | 6.3  | 101.9 | 101.5 | 102.0 | 103.3 | 96.6  | 105.4 | 106.3 | 92.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 63.3  | 11.2 | 100.0 | 100.0 | 100.0 | 100.0 | 93.6  | 100.0 | 100.0 | 88.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 40.1  | 85.5 | 0.0   | 0.0   | 0.0   | 0.0   | 6.3   | 0.0   | 0.0   | 11.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 40.1  | 85.5 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 6.4   | 0.0   | 0.0   | 0.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1967      **Lifetime Generation:** 148614.4 GW(e).h  
**Date of First Criticality:** 20 Sep 1970      **Cumulative Energy Availability Factor:** 75.8%  
**Date of Grid Connection:** 26 Sep 1970      **Cumulative Load Factor:** 74.4%  
**Date of Commercial Operation:** 07 Mar 1971      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 24.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3347.5         | 665.0          | 75.5   | 74.2   | 75.5                              | 72.1   | 57.5               | 66.1   | 6609               | 75.4   |
| 1984 | 224.3          | 665.0          | 7.0  | 69.1   | 7.0                               | 67.2   | 3.8                | 61.4   | 615                | 7.0    |
| 1985 | 5239.9         | 665.0          | 87.6   | 70.4   | 87.6                              | 68.6   | 89.9               | 63.4   | 7697               | 87.9   |
| 1986 | 4799.6         | 665.0          | 79.7   | 71.0   | 79.7                              | 69.3   | 82.4               | 64.6   | 7028               | 80.2   |
| 1987 | 4235.5         | 665.0          | 70.3   | 71.0   | 70.3                              | 69.4   | 72.7               | 65.1   | 6224               | 71.1   |
| 1988 | 3182.4         | 665.0          | 64.2   | 70.6   | 64.2                              | 69.1   | 54.5               | 64.5   | 5717               | 65.1   |
| 1989 | 2790.5         | 665.0          | 45.5   | 69.2   | 45.5                              | 67.8   | 47.9               | 63.6   | 4107               | 46.9   |
| 1990 | 3319.2         | 665.0          | 63.1   | 68.9   | 63.1                              | 67.6   | 57.0               | 63.2   | 5614               | 64.1   |
| 1991 | 4792.2         | 672.0          | 80.2   | 69.5   | 80.1                              | 68.2   | 81.4               | 64.2   | 7048               | 80.5   |
| 1992 | 4062.9         | 683.0          | 66.2   | 69.3   | 66.2                              | 68.1   | 67.7               | 64.3   | 5812               | 66.2   |
| 1993 | 4193.3         | 683.0          | 70.1   | 69.3   | 70.1                              | 68.2   | 70.1               | 64.6   | 6137               | 70.1   |
| 1994 | 4655.1         | 683.0          | 78.2   | 69.7   | 78.2                              | 68.6   | 77.8               | 65.2   | 6845               | 78.1   |
| 1995 | 5033.8         | 683.0          | 84.0   | 70.3   | 84.0                              | 69.3   | 84.1               | 66.0   | 7356               | 84.0   |
| 1996 | 5460.1         | 683.0          | 88.2   | 71.0   | 88.2                              | 70.0   | 91.0               | 67.0   | 7745               | 88.2   |
| 1997 | 6197.6         | 683.0          | 98.9   | 72.1   | 98.9                              | 71.2   | 103.6              | 68.4   | 8662               | 98.9   |
| 1998 | 5505.6         | 683.0          | 88.5   | 72.7   | 88.5                              | 71.8   | 92.0               | 69.3   | 7751               | 88.5   |
| 1999 | 5684.5         | 683.0          | 91.5   | 73.4   | 91.4                              | 72.5   | 95.0               | 70.2   | 8009               | 91.4   |
| 2000 | 6237.1         | 683.0          | 99.6   | 74.3   | 99.6                              | 73.5   | 104.0              | 71.4   | 8750               | 99.6   |
| 2001 | 5515.0         | 683.0          | 90.4   | 74.9   | 90.4                              | 74.0   | 92.2               | 72.1   | 7919               | 90.4   |
| 2002 | 5606.1         | 683.0          | 90.9   | 75.4   | 90.9                              | 74.6   | 93.7               | 72.8   | 7960               | 90.9   |
| 2003 | 6439.9         | 710.0          | 100.0  | 76.2   | 100.0                             | 75.4   | 103.5              | 73.8   | 8760               | 100.0  |
| 2004 | 5742.2         | 710.0          | 88.9   | 76.6   | 88.9                              | 75.8   | 92.1               | 74.4   | 7811               | 88.9   |

## US-261 H.B. ROBINSON-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 19 Apr | 924.6 | 656.5   | PF   | C21  | SHUTDOWN FOR REFUELLING OUTAGE.  |
| 13 Oct | 47.3  | 33.6    | UF2  | A14  | THE UNIT WAS SHUTDOWN TO REPAIR A VALVE PACKING LEAK ON THE PRESSURIZER SPRAY BYPASS LINE. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 47        |          |  | 561       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 66        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 924             |           |          | 1210                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 45                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 0         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 2  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 120       | 18       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 41        | 1        |
| Subtotal   | 924             | 47        | 0        | 1257                                     | 788       | 19       |
| Total  |                 | 971       |          |  | 2064      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 41                                       |
| 13. Reactor Auxiliary Systems       |                 | 3  |
| 14. Safety Systems                  | 47              | 39                                       |
| 15. Reactor Cooling Systems         |                 | 70                                       |
| 16. Steam generation systems        |                 | 131                                      |
| 31. Turbine and auxiliaries         |                 | 99                                       |
| 32. Feedwater and Main Steam System |                 | 42                                       |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 91                                       |
| XX. Miscellaneous Systems           |                 | 15                                       |
| Total                               | 47              | 531                                      |

# US-321 HATCH-1

**Operator:** SOUTH (Southern Nuclear Operating Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 856.0 MW(e)  
**Design Net RUP:** 777.0 MW(e)  
**Design Discharge Burnup:** 19800 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6896.1 GW(e).h  
**Energy Availability Factor:** 91.7%  
**Load Factor:** 90.9%  
**Operating Factor:** 91.6%  
**Energy Unavailability Factor:** 8.3%  
**Total Off-line Time:** 738 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 620.8 | 229.8 | 260.2 | 607.4 | 651.4 | 629.4 | 650.4 | 645.1 | 637.1 | 661.0 | 634.5 | 668.9 | 6896.1 |
| <b>EAF (%)</b>  | 100.0 | 44.8  | 52.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.7   |
| <b>UCF (%)</b>  | 100.0 | 44.8  | 52.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.7   |
| <b>LF (%)</b>   | 97.5  | 38.6  | 40.9  | 98.7  | 100.8 | 100.6 | 100.6 | 99.8  | 101.8 | 102.1 | 101.4 | 103.5 | 90.9   |
| <b>OF (%)</b>   | 100.0 | 44.8  | 52.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.6   |
| <b>EUF (%)</b>  | 0.0   | 55.2  | 47.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.3    |
| <b>PUF (%)</b>  | 0.0   | 55.2  | 44.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 3.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1968  
**Date of First Criticality:** 12 Sep 1974  
**Date of Grid Connection:** 11 Nov 1974  
**Date of Commercial Operation:** 31 Dec 1975

**Lifetime Generation:** 151883.9 GW(e).h  
**Cumulative Energy Availability Factor:** 78.3%  
**Cumulative Load Factor:** 75.5%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 21.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3968.9         | 764.0          | 71.5   | 61.8   | 71.5                              | 61.7   | 59.3               | 57.0   | 6240               | 71.2   |
| 1984 | 3609.2         | 752.0          | 62.5   | 61.8   | 62.3                              | 61.8   | 54.6               | 56.7   | 5473               | 62.3   |
| 1985 | 4761.4         | 752.0          | 76.5   | 63.3   | 76.5                              | 63.3   | 72.3               | 58.3   | 6694               | 76.4   |
| 1986 | 3645.4         | 768.0          | 59.0   | 62.9   | 59.0                              | 62.9   | 54.2               | 57.9   | 5162               | 58.9   |
| 1987 | 5080.7         | 750.0          | 80.4   | 64.4   | 80.4                              | 64.3   | 77.3               | 59.5   | 7043               | 80.4   |
| 1988 | 4115.8         | 756.0          | 66.0   | 64.5   | 66.0                              | 64.5   | 62.0               | 59.7   | 5802               | 66.1   |
| 1989 | 6479.7         | 757.0          | 100.0  | 67.0   | 97.7                              | 67.0   | 97.7               | 62.4   | 8760               | 100.0  |
| 1990 | 4103.4         | 753.0          | 65.1   | 66.9   | 65.1                              | 66.9   | 62.2               | 62.4   | 5722               | 65.3   |
| 1991 | 4707.5         | 741.0          | 74.6   | 67.4   | 74.0                              | 67.3   | 72.5               | 63.1   | 6530               | 74.5   |
| 1992 | 6157.2         | 741.0          | 96.1   | 69.1   | 96.1                              | 69.0   | 94.6               | 64.9   | 8444               | 96.1   |
| 1993 | 4956.7         | 737.0          | 78.4   | 69.6   | 78.4                              | 69.5   | 76.8               | 65.5   | 6913               | 78.9   |
| 1994 | 5512.2         | 741.0          | 85.8   | 70.4   | 85.8                              | 70.4   | 84.9               | 66.5   | 7542               | 86.1   |
| 1995 | 6465.8         | 741.0          | 100.0  | 71.9   | 99.6                              | 71.8   | 99.6               | 68.2   | 8760               | 100.0  |
| 1996 | 5726.7         | 788.0          | 87.8   | 72.7   | 87.8                              | 72.6   | 82.7               | 68.9   | 7666               | 87.3   |
| 1997 | 6009.0         | 800.0          | 87.9   | 73.4   | 87.9                              | 73.4   | 85.7               | 69.7   | 7637               | 87.2   |
| 1998 | 6951.8         | 800.0          | 99.9   | 74.6   | 99.9                              | 74.6   | 99.2               | 71.1   | 8751               | 99.9   |
| 1999 | 5968.8         | 808.0          | 82.2   | 75.0   | 82.1                              | 74.9   | 84.3               | 71.7   | 7153               | 81.7   |
| 2000 | 6413.4         | 860.0          | 86.2   | 75.5   | 86.2                              | 75.4   | 84.9               | 72.3   | 7530               | 85.7   |
| 2001 | 7496.2         | 863.0          | 99.1   | 76.5   | 99.1                              | 76.5   | 99.2               | 73.4   | 8689               | 99.2   |
| 2002 | 6627.1         | 856.0          | 88.8   | 77.0   | 88.8                              | 77.0   | 88.4               | 74.0   | 7778               | 88.8   |
| 2003 | 7146.9         | 856.0          | 96.3   | 77.8   | 96.3                              | 77.7   | 95.3               | 74.9   | 8438               | 96.3   |
| 2004 | 6896.1         | 864.0          | 91.7   | 78.3   | 91.7                              | 78.3   | 90.9               | 75.5   | 8046               | 91.6   |

# US-321 HATCH-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 14 Feb | 713.8 | 611.0   | PF   | C21  | REFUELLING OUTAGE.  |
| 14 Mar | 7.5   | 6.4     | UF5  | A31  | SHIFT MANUALLY TRIPPED THE MAIN TURBINE DUE TO VIBRATION. |
| 15 Mar | 7.7   | 6.6     | UF5  | A31  | SHIFT MANUALLY TRIPPED THE MAIN TURBINE DUE TO VIBRATION. |
| 17 Mar | 8.6   | 7.4     | UF5  | A31  | SHIFT MANUALLY TRIPPED THE MAIN TURBINE DUE TO VIBRATION. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 23        |          |  | 408       | 0        |
| B. Refuelling without a maintenance  |                 |           |          |  | 23        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 713             |           |          | 1200                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 101                                      | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 3         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 0        |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 3  | 56        |          |
| Subtotal   | 713             | 23        | 0        | 1304                                     | 490       | 2        |
| Total  |                 | 736       |          |  | 1796      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1976 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 2  |
| 12. Reactor I&C Systems                        |                 | 22                                       |
| 13. Reactor Auxiliary Systems                  |                 | 51                                       |
| 14. Safety Systems                             |                 | 39                                       |
| 15. Reactor Cooling Systems                    |                 | 55                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    | 23              | 74                                       |
| 32. Feedwater and Main Steam System            |                 | 74                                       |
| 33. Circulating Water System                   |                 | 1  |
| 35. All other I&C Systems                      |                 | 9  |
| 41. Main Generator Systems                     |                 | 33                                       |
| 42. Electrical Power Supply Systems            |                 | 17                                       |
| XX. Miscellaneous Systems                      |                 | 10                                       |
| Total  | 23              | 388                                      |

# US-366 HATCH-2

**Operator:** SOUTH (Southern Nuclear Operating Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 883.0 MW(e)  
**Design Net RUP:** 784.0 MW(e)  
**Design Discharge Burnup:** 16780 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7520.6 GW(e).h  
**Energy Availability Factor:** 97.8%  
**Load Factor:** 97.0%  
**Operating Factor:** 97.8%  
**Energy Unavailability Factor:** 2.2%  
**Total Off-line Time:** 195 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 665.3 | 613.8 | 662.7 | 632.7 | 655.3 | 625.8 | 641.4 | 647.8 | 497.1 | 584.5 | 634.9 | 659.5 | 7520.6 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.0  | 93.3  | 100.0 | 100.0 | 97.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.0  | 93.3  | 100.0 | 100.0 | 97.8   |
| <b>LF (%)</b>   | 101.3 | 99.9  | 100.9 | 99.7  | 99.7  | 98.4  | 97.6  | 98.6  | 78.2  | 88.9  | 99.9  | 100.4 | 97.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 80.1  | 93.0  | 100.0 | 100.0 | 97.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 20.0  | 6.7   | 0.0   | 0.0   | 2.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 20.0  | 6.7   | 0.0   | 0.0   | 2.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1972  
**Date of First Criticality:** 04 Jul 1978  
**Date of Grid Connection:** 22 Sep 1978  
**Date of Commercial Operation:** 05 Sep 1979

**Lifetime Generation:** 136694.0 GW(e).h  
**Cumulative Energy Availability Factor:** 80.5%  
**Cumulative Load Factor:** 76.5%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 19.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3817.2         | 771.0          | 66.1   | 67.4   | 66.1                              | 67.0   | 56.5               | 58.1   | 5774               | 65.9   |
| 1984 | 1893.5         | 748.0          | 26.7   | 59.5   | 26.7                              | 59.1   | 28.8               | 52.4   | 2833               | 32.3   |
| 1985 | 5376.1         | 748.0          | 82.7   | 63.3   | 82.6                              | 62.9   | 82.0               | 57.2   | 7239               | 82.6   |
| 1986 | 3618.7         | 777.0          | 70.4   | 64.3   | 70.4                              | 64.0   | 53.2               | 56.6   | 6169               | 70.4   |
| 1987 | 5755.6         | 761.0          | 95.7   | 68.2   | 95.7                              | 68.0   | 86.3               | 60.3   | 8388               | 95.8   |
| 1988 | 4254.5         | 768.0          | 65.7   | 67.9   | 65.7                              | 67.7   | 63.1               | 60.6   | 5917               | 67.4   |
| 1989 | 4147.2         | 768.0          | 68.6   | 68.0   | 68.6                              | 67.8   | 61.6               | 60.7   | 6155               | 70.3   |
| 1990 | 6527.8         | 766.0          | 98.7   | 70.8   | 98.7                              | 70.6   | 97.3               | 64.0   | 8649               | 98.7   |
| 1991 | 4932.2         | 761.0          | 74.4   | 71.1   | 74.4                              | 70.9   | 74.0               | 64.9   | 6656               | 76.0   |
| 1992 | 4692.4         | 764.0          | 74.5   | 71.3   | 74.5                              | 71.2   | 69.9               | 65.3   | 6668               | 75.9   |
| 1993 | 4999.7         | 757.0          | 87.5   | 72.5   | 87.4                              | 72.3   | 75.4               | 66.0   | 7734               | 88.3   |
| 1994 | 5275.6         | 765.0          | 85.2   | 73.3   | 85.2                              | 73.2   | 78.7               | 66.8   | 7534               | 86.0   |
| 1995 | 5055.5         | 768.0          | 77.5   | 73.6   | 77.4                              | 73.5   | 75.1               | 67.3   | 6888               | 78.6   |
| 1996 | 7021.7         | 809.0          | 98.4   | 75.1   | 98.4                              | 75.0   | 98.8               | 69.3   | 8639               | 98.3   |
| 1997 | 6033.6         | 818.0          | 86.4   | 75.8   | 86.4                              | 75.7   | 84.2               | 70.2   | 7560               | 86.3   |
| 1998 | 5829.9         | 821.0          | 82.8   | 76.2   | 82.8                              | 76.1   | 81.1               | 70.8   | 7247               | 82.7   |
| 1999 | 7073.6         | 855.0          | 93.3   | 77.1   | 93.3                              | 77.0   | 94.4               | 72.1   | 8173               | 93.3   |
| 2000 | 6900.3         | 873.0          | 89.7   | 77.8   | 89.6                              | 77.7   | 90.0               | 73.0   | 7884               | 89.8   |
| 2001 | 6584.5         | 878.0          | 86.3   | 78.2   | 86.3                              | 78.1   | 85.6               | 73.7   | 7618               | 87.0   |
| 2002 | 7423.3         | 870.0          | 97.3   | 79.1   | 97.3                              | 79.1   | 97.4               | 74.8   | 8544               | 97.5   |
| 2003 | 6962.5         | 872.0          | 91.9   | 79.7   | 91.9                              | 79.6   | 91.1               | 75.6   | 8052               | 91.9   |
| 2004 | 7520.6         | 883.0          | 97.8   | 80.5   | 97.8                              | 80.5   | 97.0               | 76.5   | 8589               | 97.8   |

## US-366 HATCH-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 25 Sep | 194.9 | 172.1   | PF   | D15  | UNIT 2 WAS SHUTDOWN AT MANAGEMENT DISCRETION TO REPAIR A LEAKING SRV, 2B21-F013L. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 245       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 48        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1130                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 194             |           |          | 136                                      | 2         |          |
| E. Testing of plant systems or components  |                 |           |          | 12                                       | 99        |          |
| H. Nuclear regulatory requirements   |                 |           |          | 3  |           | 6        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  | 45        |          |
| Subtotal   | 194             | 0         | 0        | 1281                                     | 439       | 6        |
| Total  | 194             |           |          | 1726                                     |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1978 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 6  |
| 12. Reactor I&C Systems                  |                 | 17                                       |
| 14. Safety Systems                       |                 | 6  |
| 15. Reactor Cooling Systems              |                 | 59                                       |
| 21. Fuel Handling and Storage Facilities |                 | 29                                       |
| 31. Turbine and auxiliaries              |                 | 28                                       |
| 32. Feedwater and Main Steam System      |                 | 43                                       |
| 33. Circulating Water System             |                 | 2  |
| 41. Main Generator Systems               |                 | 29                                       |
| 42. Electrical Power Supply Systems      |                 | 15                                       |
| Total                                    | 0               | 234                                      |

# US-354 HOPE CREEK-1

**Operator:** PSEG (PUBLIC SERVICE ELECTRIC & GAS CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1049.0 MW(e)  
**Design Net RUP:** 1067.0 MW(e)  
**Design Discharge Burnup:** 28500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6048.9 GW(e).h  
**Energy Availability Factor:** 69.7%  
**Load Factor:** 65.6%  
**Operating Factor:** 69.7%  
**Energy Unavailability Factor:** 30.3%  
**Total Off-line Time:** 2661 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 617.5 | 715.3 | 495.5 | 228.8 | 785.5 | 724.0 | 770.2 | 740.9 | 723.0 | 248.1 | 0.0   | 0.0   | 6048.9 |
| <b>EAF (%)</b>  | 84.4  | 100.0 | 61.3  | 60.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.4  | 0.0   | 0.0   | 69.7   |
| <b>UCF (%)</b>  | 84.4  | 100.0 | 61.3  | 60.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.4  | 0.0   | 0.0   | 69.7   |
| <b>LF (%)</b>   | 79.1  | 98.0  | 63.5  | 30.3  | 100.6 | 95.9  | 98.7  | 94.9  | 95.7  | 31.8  | 0.0   | 0.0   | 65.6   |
| <b>OF (%)</b>   | 84.4  | 100.0 | 62.5  | 59.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 31.4  | 0.0   | 0.0   | 69.7   |
| <b>EUF (%)</b>  | 15.6  | 0.0   | 38.7  | 39.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 68.6  | 100.0 | 100.0 | 30.3   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 38.7  | 39.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 100.0 | 100.0 | 23.2   |
| <b>UCLF (%)</b> | 15.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 68.6  | 0.0   | 0.0   | 7.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1976  
**Date of First Criticality:** 28 Jun 1986  
**Date of Grid Connection:** 01 Aug 1986  
**Date of Commercial Operation:** 20 Dec 1986

**Lifetime Generation:** 133058.6 GW(e).h  
**Cumulative Energy Availability Factor:** 84.0%  
**Cumulative Load Factor:** 81.2%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 16.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 7308.7         | 1067.0         | 92.7   | 92.7   | 92.7                              | 92.7   | 78.2               | 78.2   | 7457               | 85.1   |
| 1988 | 6470.9         | 1061.0         | 79.0   | 85.9   | 79.0                              | 85.9   | 69.4               | 73.8   | 6369               | 72.5   |
| 1989 | 6614.3         | 1031.0         | 76.7   | 82.9   | 76.7                              | 82.9   | 73.2               | 73.6   | 6717               | 76.7   |
| 1990 | 8100.1         | 1031.0         | 90.7   | 84.8   | 90.7                              | 84.8   | 89.7               | 77.6   | 7940               | 90.6   |
| 1991 | 7402.7         | 1031.0         | 83.1   | 84.5   | 83.1                              | 84.5   | 82.0               | 78.4   | 7280               | 83.1   |
| 1992 | 7059.1         | 1031.0         | 78.9   | 83.5   | 78.9                              | 83.5   | 77.9               | 78.4   | 6930               | 78.9   |
| 1993 | 8825.3         | 1031.0         | 97.3   | 85.5   | 97.4                              | 85.5   | 97.7               | 81.1   | 8526               | 97.3   |
| 1994 | 7125.6         | 1031.0         | 79.6   | 84.8   | 79.6                              | 84.8   | 78.9               | 80.8   | 6969               | 79.6   |
| 1995 | 7072.3         | 1031.0         | 79.2   | 84.2   | 79.2                              | 84.2   | 78.3               | 80.5   | 6937               | 79.2   |
| 1996 | 6770.7         | 1031.0         | 75.4   | 83.3   | 75.4                              | 83.3   | 74.8               | 80.0   | 6618               | 75.3   |
| 1997 | 6417.8         | 1031.0         | 74.3   | 82.5   | 74.3                              | 82.5   | 71.1               | 79.2   | 6511               | 74.3   |
| 1998 | 8700.4         | 1031.0         | 97.5   | 83.7   | 97.5                              | 83.7   | 96.3               | 80.6   | 8539               | 97.5   |
| 1999 | 7701.1         | 1031.0         | 86.0   | 83.9   | 86.1                              | 83.9   | 85.3               | 80.9   | 7538               | 86.1   |
| 2000 | 7271.7         | 1031.0         | 82.6   | 83.8   | 82.6                              | 83.8   | 80.3               | 80.9   | 7259               | 82.6   |
| 2001 | 8065.3         | 1038.0         | 89.8   | 84.2   | 89.8                              | 84.2   | 88.7               | 81.4   | 7859               | 89.7   |
| 2002 | 8843.1         | 1049.0         | 97.7   | 85.0   | 97.7                              | 85.0   | 96.2               | 82.4   | 8555               | 97.7   |
| 2003 | 7260.6         | 1049.0         | 81.5   | 84.8   | 81.5                              | 84.8   | 79.0               | 82.2   | 7137               | 81.5   |
| 2004 | 6048.9         | 1049.0         | 69.7   | 84.0   | 69.7                              | 84.0   | 65.6               | 81.2   | 6123               | 69.7   |



# US-354 HOPE CREEK-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 12 Jan | 116.0  | 121.7   | UF2  | E    | PCIG INITIATION DUE TO RMS FAILURE DURING TESTING.                  |
| 20 Mar | 570.0  | 597.9   | PF   | D12  | REPAIR F020 VALVE STEAM LEAK AND CONTROL ROD DRIVE MECHANISMS.      |
| 10 Oct | 511.0  | 536.0   | UF2  | A31  | MOISTURE SEPARATOR DUMP LINE BREAK TRANSITIONED INTO REFUEL OUTAGE. |
| 01 Nov | 1464.0 | 1535.7  | PF   | C21  | REFUELLING OUTAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 511       |          |  | 267       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 21        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1464            |           |          | 870                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 570             |           |          | 93                                       |           |          |
| E. Testing of plant systems or components  |                 | 116       |          | 0  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 7         |          |
| Subtotal   | 2034            | 627       | 0        | 963                                      | 295       | 0        |
| Total  |                 | 2661      |          |  | 1258      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 3  |
| 12. Reactor I&C Systems                        |                 | 2  |
| 13. Reactor Auxiliary Systems                  |                 | 40                                       |
| 15. Reactor Cooling Systems                    |                 | 46                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 31. Turbine and auxiliaries                    | 511             | 38                                       |
| 32. Feedwater and Main Steam System            |                 | 44                                       |
| 33. Circulating Water System                   |                 | 3  |
| 41. Main Generator Systems                     |                 | 28                                       |
| 42. Electrical Power Supply Systems            |                 | 42                                       |
| Total  | 511             | 249                                      |

# US-247 INDIAN POINT-2

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 956.0 MW(e)  
**Design Net RUP:** 873.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7513.1 GW(e).h  
**Energy Availability Factor:** 89.3%  
**Load Factor:** 89.5%  
**Operating Factor:** 89.4%  
**Energy Unavailability Factor:** 10.7%  
**Total Off-line Time:** 933 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 738.8 | 690.9 | 736.8 | 710.0 | 727.7 | 702.8 | 718.8 | 717.3 | 416.3 | 491.3 | 117.3 | 745.2 | 7513.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.6  | 70.7  | 23.8  | 98.6  | 89.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.6  | 70.7  | 23.8  | 98.6  | 89.3   |
| <b>LF (%)</b>   | 103.9 | 103.8 | 103.6 | 103.3 | 102.3 | 102.1 | 101.1 | 100.8 | 60.5  | 69.0  | 17.0  | 104.8 | 89.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.6  | 70.9  | 24.4  | 98.5  | 89.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.4  | 29.3  | 76.2  | 1.4   | 10.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 29.3  | 73.2  | 0.0   | 8.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.5  | 0.0   | 3.1   | 1.4   | 2.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1966  
**Date of First Criticality:** 22 May 1973  
**Date of Grid Connection:** 26 Jun 1973  
**Date of Commercial Operation:** 15 Aug 1974

**Lifetime Generation:** 160345.8 GW(e).h  
**Cumulative Energy Availability Factor:** 68.2%  
**Cumulative Load Factor:** 66.3%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 31.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5895.3         | 859.0          | 83.5   | 60.3   | 83.5                              | 60.0   | 78.3               | 57.5   | 7354               | 83.9   |
| 1984 | 2891.6         | 864.0          | 48.4   | 59.1   | 48.4                              | 58.8   | 38.1               | 55.6   | 4552               | 51.8   |
| 1985 | 6665.0         | 855.0          | 95.5   | 62.4   | 95.5                              | 62.1   | 89.0               | 58.6   | 8382               | 95.7   |
| 1986 | 3827.4         | 855.0          | 52.6   | 61.6   | 52.6                              | 61.3   | 51.1               | 58.0   | 4924               | 56.2   |
| 1987 | 5149.6         | 852.0          | 69.8   | 62.2   | 69.7                              | 62.0   | 69.0               | 58.8   | 6331               | 72.3   |
| 1988 | 6064.0         | 856.0          | 81.0   | 63.5   | 81.0                              | 63.3   | 80.6               | 60.4   | 7247               | 82.5   |
| 1989 | 4476.9         | 856.0          | 60.4   | 63.3   | 60.3                              | 63.1   | 59.7               | 60.3   | 5556               | 63.4   |
| 1990 | 5222.1         | 886.0          | 64.3   | 63.4   | 64.3                              | 63.2   | 67.3               | 60.8   | 5779               | 66.0   |
| 1991 | 3873.4         | 929.0          | 51.2   | 62.6   | 51.2                              | 62.5   | 47.6               | 59.9   | 4495               | 51.3   |
| 1992 | 7880.6         | 939.0          | 96.7   | 64.7   | 96.7                              | 64.5   | 95.5               | 62.1   | 8494               | 96.7   |
| 1993 | 5931.7         | 941.0          | 75.3   | 65.3   | 75.3                              | 65.1   | 72.0               | 62.6   | 6570               | 75.0   |
| 1994 | 7634.6         | 941.0          | 100.0  | 67.1   | 92.6                              | 67.0   | 92.6               | 64.2   | 8760               | 100.0  |
| 1995 | 4896.9         | 941.0          | 63.6   | 67.0   | 63.6                              | 66.8   | 59.4               | 64.0   | 5533               | 63.2   |
| 1996 | 7831.8         | 941.0          | 94.2   | 68.3   | 94.2                              | 68.2   | 94.7               | 65.5   | 8261               | 94.0   |
| 1997 | 3179.7         | 936.0          | 41.7   | 67.1   | 41.7                              | 66.9   | 38.8               | 64.3   | 3639               | 41.5   |
| 1998 | 2512.5         | 932.0          | 30.9   | 65.5   | 30.9                              | 65.4   | 30.8               | 62.8   | 2698               | 30.8   |
| 1999 | 7300.4         | 937.0          | 87.6   | 66.4   | 87.6                              | 66.3   | 88.9               | 63.9   | 7665               | 87.5   |
| 2000 | 1062.3         | 941.0          | 12.5   | 64.2   | 12.5                              | 64.1   | 12.9               | 61.8   | 1099               | 12.5   |
| 2001 | 7792.7         | 941.0          | 96.2   | 65.5   | 96.2                              | 65.4   | 94.5               | 63.1   | 8429               | 96.2   |
| 2002 | 7556.6         | 941.0          | 90.3   | 66.4   | 90.2                              | 66.3   | 91.7               | 64.2   | 7931               | 90.5   |
| 2003 | 8370.8         | 952.0          | 98.1   | 67.6   | 98.1                              | 67.5   | 100.4              | 65.5   | 8597               | 98.1   |
| 2004 | 7513.1         | 956.0          | 89.3   | 68.3   | 89.3                              | 68.2   | 89.5               | 66.3   | 7851               | 89.4   |

## US-247 INDIAN POINT-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Sep | 54.0  | 52.1    | UF5  | A32  | MANUAL REACTOR TRIP DUE TO 22 FEEDWATER (FW) FLOW OSCILLATIONS ATTRIBUTED TO FW CONTROL VALVE FCV-427 (LER-2004-001). |
| 04 Sep | 14.1  | 13.6    | UF2  | A32  | TURBINE TAKEN OFFLINE DUE TO CONTINUED 22 FW FLOW OSCILLATIONS TO REPAIR A LEAKING ACTUATOR FOR FCV-427.              |
| 05 Sep | 26.5  | 25.6    | UF2  | A32  | TURBINE TAKEN OFFLINE DUE TO CONTINUED 22 FW FLOW OSCILLATIONS TO REPAIR A LEAKING ACTUATOR FOR FCV-427.              |
| 15 Sep | 45.6  | 44.0    | UF2  | A32  | TURBINE TAKEN OFFLINE TO REPAIR 21 MAIN BOILER FEED PUMP DISCHARGE CHECK VALVE, BFD-1, THAT FAILED TO CLOSE           |
| 24 Sep | 20.0  | 19.3    | UF5  | A32  | MANUAL REACTOR TRIP DUE TO DECREASING 23 STEAM GENERATOR LEVEL, ATTRIBUTED TO THE FAILURE OF FCV-437-SOV-E.           |
| 23 Oct | 738.6 | 712.7   | PF   | C21  | REFUELLING AND MAINTENANCE OUTAGE.  |
| 26 Nov | 21.8  | 21.0    | UF2  | A41  | UNIT SHUTDOWN DUE TO A MAIN GENERATOR LOW STATOR WATER COOLING PRESSURE.  |
| 03 Dec | 10.6  | 10.2    | UF2  | A32  | TURBINE SHUTDOWN TO REPAIR A LEAKING WELD AT MS-1607. (CR-IP2-2004-06527).  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 192       |          |  | 1084      |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 738             |           |          | 1141                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 217                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 27                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 5  | 2         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 6        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 95                                       | 15        | 0        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |  | 1         |          |
| Subtotal   | 738             | 192       | 0        | 1485                                     | 1111      | 6        |
| Total  |                 | 930       |          |  | 2602      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1973 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 2  |
| 12. Reactor I&C Systems                        |                 | 57                                       |
| 13. Reactor Auxiliary Systems                  |                 | 9  |
| 14. Safety Systems                             |                 | 11                                       |
| 15. Reactor Cooling Systems                    |                 | 70                                       |
| 16. Steam generation systems                   |                 | 90                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 3  |
| 31. Turbine and auxiliaries                    |                 | 68                                       |
| 32. Feedwater and Main Steam System            | 170             | 370                                      |
| 35. All other I&C Systems                      |                 | 3  |
| 41. Main Generator Systems                     | 21              | 50                                       |
| 42. Electrical Power Supply Systems            |                 | 256                                      |
| XX. Miscellaneous Systems                      |                 | 0  |
| Total  | 191             | 989                                      |

# US-286 INDIAN POINT-3

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 979.0 MW(e)  
**Design Net RUP:** 965.0 MW(e)  
**Design Discharge Burnup:** 33250 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8747.3 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 101.7%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 742.7 | 695.3 | 744.7 | 719.2 | 742.3 | 715.2 | 735.0 | 735.1 | 714.7 | 741.5 | 718.3 | 743.2 | 8747.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 102.0 | 102.0 | 102.2 | 102.2 | 101.9 | 101.5 | 100.9 | 100.9 | 101.4 | 101.7 | 101.9 | 102.0 | 101.7  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1968  
**Date of First Criticality:** 06 Apr 1976  
**Date of Grid Connection:** 27 Apr 1976  
**Date of Commercial Operation:** 30 Aug 1976

**Lifetime Generation:** 145326.0 GW(e).h  
**Cumulative Energy Availability Factor:** 63.8%  
**Cumulative Load Factor:** 60.6%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 36.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 60.7           | 934.0          | 2.4  | 47.9   | 2.4                               | 47.9   | 0.7                | 41.0   | 229                | 2.6    |
| 1984 | 6041.7         | 965.0          | 76.2   | 51.5   | 76.2                              | 51.5   | 71.3               | 44.9   | 6703               | 76.3   |
| 1985 | 4728.5         | 965.0          | 65.5   | 53.1   | 65.5                              | 53.1   | 55.9               | 46.2   | 5782               | 66.0   |
| 1986 | 5525.6         | 959.0          | 72.9   | 55.1   | 72.9                              | 55.2   | 65.8               | 48.2   | 6431               | 73.4   |
| 1987 | 4850.6         | 950.0          | 60.5   | 55.6   | 60.5                              | 55.6   | 58.3               | 49.1   | 5396               | 61.6   |
| 1988 | 6711.9         | 965.0          | 81.9   | 57.9   | 81.9                              | 57.9   | 79.2               | 51.7   | 7217               | 82.2   |
| 1989 | 4968.7         | 965.0          | 59.7   | 58.0   | 59.7                              | 58.0   | 58.8               | 52.2   | 5279               | 60.3   |
| 1990 | 5031.8         | 965.0          | 60.8   | 58.2   | 60.8                              | 58.2   | 59.5               | 52.8   | 5374               | 61.3   |
| 1991 | 7300.8         | 965.0          | 88.8   | 60.3   | 88.8                              | 60.3   | 86.4               | 55.1   | 7577               | 86.5   |
| 1992 | 4760.6         | 965.0          | 59.1   | 60.2   | 59.2                              | 60.2   | 56.2               | 55.1   | 5248               | 59.7   |
| 1993 | 1192.6         | 965.0          | 13.4   | 57.4   | 13.4                              | 57.4   | 14.1               | 52.7   | 1292               | 14.7   |
| 1994 | 0.0            | 965.0          | 0.0  | 54.2   | 0.0                               | 54.2   | 0.0                | 49.7   | 0                  | 0.0    |
| 1995 | 1471.5         | 965.0          | 18.1   | 52.3   | 18.2                              | 52.3   | 17.4               | 48.0   | 1696               | 19.4   |
| 1996 | 5872.5         | 965.0          | 72.4   | 53.3   | 72.4                              | 53.3   | 69.3               | 49.1   | 6390               | 72.7   |
| 1997 | 4337.3         | 965.0          | 57.4   | 53.5   | 57.4                              | 53.5   | 51.3               | 49.2   | 4650               | 53.1   |
| 1998 | 7656.5         | 965.0          | 93.6   | 55.3   | 93.6                              | 55.3   | 90.6               | 51.1   | 8197               | 93.6   |
| 1999 | 7269.2         | 965.0          | 87.4   | 56.8   | 87.4                              | 56.7   | 86.0               | 52.6   | 7659               | 87.4   |
| 2000 | 8432.2         | 965.0          | 97.9   | 58.5   | 97.9                              | 58.5   | 99.5               | 54.6   | 8600               | 97.9   |
| 2001 | 7940.2         | 965.0          | 92.8   | 59.9   | 92.8                              | 59.9   | 93.9               | 56.2   | 8130               | 92.8   |
| 2002 | 8432.6         | 966.0          | 98.3   | 61.4   | 98.3                              | 61.4   | 99.7               | 57.9   | 8611               | 98.3   |
| 2003 | 7608.4         | 979.0          | 88.4   | 62.4   | 88.4                              | 62.4   | 88.7               | 59.0   | 7748               | 88.4   |
| 2004 | 8747.3         | 979.0          | 100.0  | 63.8   | 100.0                             | 63.8   | 101.7              | 60.6   | 8784               | 100.0  |

## US-286 INDIAN POINT-3

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 1457      |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1222                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 298                                      | 1         |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 12        |          |
| J. Grid failure or grid unavailability   |                 |           |          |  | 6         | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 14        |          |
| P. Fire  |                 |           |          |  | 0         |          |
| Subtotal   | 0               | 0         | 0        | 1522                                     | 1495      | 0        |
| Total  |                 | 0         |          |  | 3017      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1976 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 19                                       |
| 13. Reactor Auxiliary Systems       |                 | 11                                       |
| 14. Safety Systems                  |                 | 706                                      |
| 15. Reactor Cooling Systems         |                 | 42                                       |
| 16. Steam generation systems        |                 | 85                                       |
| 31. Turbine and auxiliaries         |                 | 122                                      |
| 32. Feedwater and Main Steam System |                 | 61                                       |
| 33. Circulating Water System        |                 | 1  |
| 41. Main Generator Systems          |                 | 362                                      |
| 42. Electrical Power Supply Systems |                 | 36                                       |
| XX. Miscellaneous Systems           |                 | 3  |
| Total                               | 0               | 1448                                     |

# US-305 KEWAUNEE

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 526.0 MW(e)  
**Design Net RUP:** 535.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3873.9 GW(e).h  
**Energy Availability Factor:** 80.3%  
**Load Factor:** 80.5%  
**Operating Factor:** 80.2%  
**Energy Unavailability Factor:** 19.7%  
**Total Off-line Time:** 1735 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 195.0 | 364.0 | 387.0 | 411.4 | 425.1 | 410.1 | 420.6 | 420.6 | 410.4 | 102.7 | 0.0   | 327.0 | 3873.9 |
| <b>EAF (%)</b>  | 47.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 28.2  | 0.0   | 89.6  | 80.3   |
| <b>UCF (%)</b>  | 47.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 28.2  | 0.0   | 89.6  | 80.3   |
| <b>LF (%)</b>   | 49.8  | 99.4  | 98.9  | 102.9 | 102.8 | 102.4 | 101.7 | 101.7 | 102.5 | 24.8  | 0.0   | 79.0  | 80.5   |
| <b>OF (%)</b>   | 49.1  | 99.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 25.8  | 0.0   | 89.2  | 80.2   |
| <b>EUF (%)</b>  | 52.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 71.8  | 100.0 | 10.4  | 19.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 71.8  | 100.0 | 10.4  | 15.4   |
| <b>UCLF (%)</b> | 52.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1968  
**Date of First Criticality:** 07 Mar 1974  
**Date of Grid Connection:** 08 Apr 1974  
**Date of Commercial Operation:** 16 Jun 1974

**Lifetime Generation:** 114003.9 GW(e).h  
**Cumulative Energy Availability Factor:** 83.4%  
**Cumulative Load Factor:** 83.0%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 16.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3706.9         | 510.0          | 83.7   | 80.3   | 83.7                              | 80.3   | 83.0               | 79.3   | 7334               | 83.7   |
| 1984 | 3810.0         | 503.0          | 85.3   | 80.8   | 85.3                              | 80.8   | 86.2               | 80.0   | 7527               | 85.7   |
| 1985 | 3699.2         | 503.0          | 81.8   | 80.9   | 81.8                              | 80.9   | 84.0               | 80.3   | 7213               | 82.3   |
| 1986 | 3854.7         | 503.0          | 85.3   | 81.3   | 85.3                              | 81.3   | 87.5               | 80.9   | 7514               | 85.8   |
| 1987 | 4008.6         | 503.0          | 88.8   | 81.8   | 88.8                              | 81.8   | 91.0               | 81.7   | 7809               | 89.1   |
| 1988 | 3914.8         | 503.0          | 87.1   | 82.2   | 87.1                              | 82.2   | 88.6               | 82.2   | 7679               | 87.4   |
| 1989 | 3741.8         | 503.0          | 83.9   | 82.3   | 83.9                              | 82.3   | 84.9               | 82.3   | 7390               | 84.4   |
| 1990 | 3900.8         | 503.0          | 87.2   | 82.6   | 87.2                              | 82.6   | 88.5               | 82.7   | 7668               | 87.5   |
| 1991 | 3674.8         | 507.0          | 80.3   | 82.5   | 80.3                              | 82.5   | 82.7               | 82.7   | 7247               | 82.7   |
| 1992 | 3938.1         | 511.0          | 87.3   | 82.7   | 87.3                              | 82.7   | 87.7               | 83.0   | 7682               | 87.5   |
| 1993 | 3816.9         | 511.0          | 86.0   | 82.9   | 86.0                              | 82.9   | 85.3               | 83.1   | 7548               | 86.2   |
| 1994 | 3961.5         | 511.0          | 88.2   | 83.2   | 88.2                              | 83.2   | 88.5               | 83.4   | 7738               | 88.3   |
| 1995 | 3793.4         | 511.0          | 87.1   | 83.4   | 87.1                              | 83.4   | 84.7               | 83.4   | 7645               | 87.3   |
| 1996 | 3171.1         | 511.0          | 71.3   | 82.8   | 71.3                              | 82.8   | 70.6               | 82.9   | 6299               | 71.7   |
| 1997 | 2363.8         | 511.0          | 55.5   | 81.6   | 55.5                              | 81.6   | 52.8               | 81.6   | 4866               | 55.5   |
| 1998 | 3705.4         | 511.0          | 86.6   | 81.8   | 86.6                              | 81.8   | 82.8               | 81.6   | 7584               | 86.6   |
| 1999 | 4424.7         | 511.0          | 100.0  | 82.6   | 100.0                             | 82.6   | 98.8               | 82.3   | 8760               | 100.0  |
| 2000 | 3799.9         | 511.0          | 88.5   | 82.8   | 88.5                              | 82.8   | 84.7               | 82.4   | 7760               | 88.3   |
| 2001 | 3461.7         | 511.0          | 80.1   | 82.7   | 80.1                              | 82.7   | 77.3               | 82.2   | 7009               | 80.0   |
| 2002 | 4468.7         | 511.0          | 97.3   | 83.2   | 97.3                              | 83.2   | 99.8               | 82.8   | 8514               | 97.2   |
| 2003 | 4159.1         | 518.0          | 90.5   | 83.5   | 90.5                              | 83.5   | 91.7               | 83.1   | 7893               | 90.1   |
| 2004 | 3873.9         | 548.0          | 80.4   | 83.3   | 80.3                              | 83.4   | 80.5               | 83.0   | 7049               | 80.2   |

# US-305 KEWAUNEE

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 16 Jan | 381.0  | 205.4   | UF2  | A14  | A PLANT BACKDOWN WAS INITIATED PER THE STANDARD SHUTDOWN SEQUENCE DUE TO LAKE WEED ACCUMULATION IN THE SI PUMP LUBE OIL COOLERS. |
| 09 Oct | 1352.8 | 729.2   | PF   | C21  | REFUELLING OUTAGE.   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 381       |          |  | 129       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1352            |           |          | 1083                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 77                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2  |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 2  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1         | 1        |
| Subtotal   | 1352            | 381       | 0        | 1164                                     | 134       | 1        |
| Total  |                 | 1733      |          |  | 1299      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 13                                       |
| 12. Reactor I&C Systems             |                 | 3  |
| 14. Safety Systems                  | 381             | 0  |
| 15. Reactor Cooling Systems         |                 | 15                                       |
| 16. Steam generation systems        |                 | 4  |
| 31. Turbine and auxiliaries         |                 | 30                                       |
| 32. Feedwater and Main Steam System |                 | 28                                       |
| 33. Circulating Water System        |                 | 7  |
| 35. All other I&C Systems           |                 | 1  |
| 42. Electrical Power Supply Systems |                 | 19                                       |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 381             | 121                                      |

# US-373 LASALLE-1

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1111.0 MW(e)  
**Design Net RUP:** 1078.0 MW(e)  
**Design Discharge Burnup:** 26500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9051.5 GW(e).h  
**Energy Availability Factor:** 91.5%  
**Load Factor:** 92.8%  
**Operating Factor:** 91.7%  
**Energy Unavailability Factor:** 8.5%  
**Total Off-line Time:** 725 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 315.5 | 444.5 | 850.7 | 824.0 | 846.8 | 787.0 | 833.2 | 836.1 | 801.4 | 849.7 | 823.8 | 838.9 | 9051.5 |
| <b>EAF (%)</b>  | 36.8  | 60.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.5   |
| <b>UCF (%)</b>  | 36.8  | 60.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.5   |
| <b>LF (%)</b>   | 38.2  | 57.5  | 102.9 | 103.2 | 102.4 | 98.4  | 100.8 | 101.2 | 100.2 | 102.7 | 103.0 | 101.5 | 92.8   |
| <b>OF (%)</b>   | 38.7  | 61.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.7   |
| <b>EUF (%)</b>  | 63.2  | 39.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5    |
| <b>PUF (%)</b>  | 63.2  | 39.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.5    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1973  
**Date of First Criticality:** 21 Jun 1982  
**Date of Grid Connection:** 04 Sep 1982  
**Date of Commercial Operation:** 01 Jan 1984

**Lifetime Generation:** 134282.6 GW(e).h  
**Cumulative Energy Availability Factor:** 70.8%  
**Cumulative Load Factor:** 68.1%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 29.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1639.8         | 1078.0         | 0.0  | 0.0    | 52.9                              | 100.0  | 17.4               | 0.0    | 3087               | 35.2   |
| 1984 | 5206.2         | 1078.0         | 69.4   | 69.4   | 69.4                              | 69.4   | 55.0               | 55.0   | 6052               | 68.9   |
| 1985 | 4827.5         | 1036.0         | 64.3   | 66.9   | 63.7                              | 66.6   | 53.2               | 54.1   | 5581               | 63.7   |
| 1986 | 2100.8         | 1036.0         | 25.8   | 53.4   | 25.8                              | 53.2   | 23.1               | 43.9   | 2331               | 26.6   |
| 1987 | 4108.1         | 1036.0         | 61.9   | 55.5   | 61.9                              | 55.3   | 45.3               | 44.3   | 5455               | 62.3   |
| 1988 | 5453.7         | 1036.0         | 65.9   | 57.5   | 65.9                              | 57.4   | 59.9               | 47.4   | 5818               | 66.2   |
| 1989 | 6180.6         | 1036.0         | 69.7   | 59.6   | 69.7                              | 59.5   | 68.1               | 50.8   | 6103               | 69.7   |
| 1990 | 8637.4         | 1036.0         | 95.0   | 64.6   | 95.0                              | 64.5   | 95.2               | 57.1   | 8329               | 95.1   |
| 1991 | 6841.4         | 1036.0         | 75.4   | 65.9   | 75.4                              | 65.9   | 75.4               | 59.4   | 6627               | 75.7   |
| 1992 | 6469.3         | 1036.0         | 74.0   | 66.8   | 74.0                              | 66.8   | 71.1               | 60.7   | 6528               | 74.3   |
| 1993 | 7207.5         | 1036.0         | 81.0   | 68.2   | 81.0                              | 68.2   | 79.4               | 62.5   | 7102               | 81.1   |
| 1994 | 4945.3         | 1036.0         | 57.8   | 67.3   | 57.8                              | 67.2   | 54.5               | 61.8   | 5095               | 58.2   |
| 1995 | 8239.6         | 1036.0         | 93.9   | 69.5   | 93.9                              | 69.5   | 90.8               | 64.2   | 8226               | 93.9   |
| 1996 | 3300.4         | 1036.0         | 37.5   | 67.0   | 37.5                              | 67.0   | 36.3               | 62.1   | 3349               | 38.1   |
| 1997 | 0.0            | 1036.0         | 0.0  | 62.3   | 0.0                               | 62.2   | 0.0                | 57.7   | 0                  | 0.0    |
| 1998 | 3336.7         | 1036.0         | 36.3   | 60.5   | 36.3                              | 60.5   | 36.8               | 56.3   | 3174               | 36.2   |
| 1999 | 8013.7         | 1036.0         | 90.8   | 62.4   | 90.8                              | 62.4   | 88.3               | 58.3   | 7963               | 90.9   |
| 2000 | 9745.4         | 1078.0         | 100.0  | 64.7   | 100.0                             | 64.7   | 102.9              | 61.0   | 8784               | 100.0  |
| 2001 | 9850.4         | 1113.0         | 99.4   | 66.8   | 99.4                              | 66.7   | 101.0              | 63.4   | 8708               | 99.4   |
| 2002 | 8927.6         | 1111.0         | 90.6   | 68.1   | 90.6                              | 68.1   | 91.7               | 64.9   | 7945               | 90.7   |
| 2003 | 9739.0         | 1111.0         | 99.5   | 69.8   | 99.5                              | 69.7   | 100.1              | 66.8   | 8716               | 99.5   |
| 2004 | 9051.5         | 1111.0         | 91.5   | 70.8   | 91.5                              | 70.8   | 92.8               | 68.1   | 8059               | 91.7   |



# US-373 LASALLE-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description                          |
|--------|-------|---------|------|------|--------------------------------------|
| 13 Jan | 723.7 | 829.4   | PF   | C21  | REFUELLING OUTAGE.                   |
| 22 Feb | 0.8   | 0.9     | PF   | E31  | OVERSPEED TRIP TESTING IAW LOP-TG-02 |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 536       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 44        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 723             |           |          | 1184                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 509                                      |           |          |
| E. Testing of plant systems or components  | 0               |           |          | 73                                       | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 244       |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 19        |          |
| Subtotal   | 723             | 0         | 0        | 1766                                     | 844       | 2        |
| Total  |                 | 723       |          |  | 2612      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 41                                       |
| 12. Reactor I&C Systems                        |                 | 29                                       |
| 13. Reactor Auxiliary Systems                  |                 | 5  |
| 14. Safety Systems                             |                 | 54                                       |
| 15. Reactor Cooling Systems                    |                 | 154                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 131                                      |
| 32. Feedwater and Main Steam System            |                 | 22                                       |
| 33. Circulating Water System                   |                 | 11                                       |
| 35. All other I&C Systems                      |                 | 5  |
| 41. Main Generator Systems                     |                 | 16                                       |
| 42. Electrical Power Supply Systems            |                 | 41                                       |
| Total  | 0               | 511                                      |

# US-374 LASALLE-2

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1111.0 MW(e)  
**Design Net RUP:** 1078.0 MW(e)  
**Design Discharge Burnup:** 26800 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9940.4 GW(e).h  
**Energy Availability Factor:** 99.8%  
**Load Factor:** 101.9%  
**Operating Factor:** 99.8%  
**Energy Unavailability Factor:** 0.2%  
**Total Off-line Time:** 20 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 858.3 | 799.8 | 857.5 | 826.0 | 837.9 | 756.2 | 836.8 | 840.3 | 806.3 | 852.5 | 813.6 | 855.0 | 9940.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.8   |
| <b>LF (%)</b>   | 103.8 | 103.4 | 103.7 | 103.4 | 101.4 | 94.5  | 101.2 | 101.7 | 100.8 | 103.0 | 101.7 | 103.4 | 101.9  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 97.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1973  
**Date of First Criticality:** 10 Mar 1984  
**Date of Grid Connection:** 20 Apr 1984  
**Date of Commercial Operation:** 19 Oct 1984

**Lifetime Generation:** 128247.8 GW(e).h  
**Cumulative Energy Availability Factor:** 69.5%  
**Cumulative Load Factor:** 68.0%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 30.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 2735.7         | 1039.0         | 0.0  | 0.0    | 96.9                              | 100.0  | 33.4               | 0.0    | 4058               | 51.5   |
| 1985 | 3477.0         | 1036.0         | 41.8   | 41.8   | 41.8                              | 41.8   | 38.3               | 38.3   | 3698               | 42.2   |
| 1986 | 5727.8         | 1036.0         | 75.0   | 58.4   | 74.6                              | 58.2   | 63.1               | 50.7   | 6533               | 74.6   |
| 1987 | 4573.3         | 1036.0         | 53.1   | 56.6   | 53.1                              | 56.5   | 50.4               | 50.6   | 4699               | 53.6   |
| 1988 | 5662.8         | 1036.0         | 75.1   | 61.3   | 75.1                              | 61.2   | 62.2               | 53.5   | 6593               | 75.1   |
| 1989 | 6506.8         | 1036.0         | 75.1   | 64.0   | 75.1                              | 63.9   | 71.7               | 57.2   | 6591               | 75.2   |
| 1990 | 6216.8         | 1036.0         | 70.0   | 65.0   | 70.0                              | 65.0   | 68.5               | 59.0   | 6162               | 70.3   |
| 1991 | 8712.4         | 1036.0         | 95.3   | 69.4   | 95.3                              | 69.3   | 96.0               | 64.3   | 8357               | 95.4   |
| 1992 | 5797.9         | 1036.0         | 66.3   | 69.0   | 66.3                              | 68.9   | 63.7               | 64.2   | 5850               | 66.6   |
| 1993 | 5859.2         | 1036.0         | 66.1   | 68.7   | 66.1                              | 68.6   | 64.6               | 64.3   | 5825               | 66.5   |
| 1994 | 8428.9         | 1036.0         | 92.4   | 71.0   | 92.4                              | 71.0   | 92.9               | 67.1   | 8101               | 92.5   |
| 1995 | 5905.7         | 1036.0         | 66.5   | 70.6   | 66.5                              | 70.6   | 65.1               | 66.9   | 5855               | 66.8   |
| 1996 | 5642.3         | 1036.0         | 64.5   | 70.1   | 64.5                              | 70.1   | 62.0               | 66.5   | 5649               | 64.3   |
| 1997 | 0.0            | 1036.0         | 0.0  | 64.7   | 0.0                               | 64.7   | 0.0                | 61.4   | 0                  | 0.0    |
| 1998 | 0.0            | 1036.0         | 0.0  | 60.1   | 0.0                               | 60.1   | 0.0                | 57.0   | 0                  | 0.0    |
| 1999 | 6632.3         | 1036.0         | 71.1   | 60.8   | 71.1                              | 60.8   | 73.1               | 58.1   | 6231               | 71.1   |
| 2000 | 9040.4         | 1072.0         | 93.1   | 62.9   | 93.1                              | 62.9   | 96.0               | 60.6   | 8229               | 93.7   |
| 2001 | 9683.4         | 1113.0         | 97.2   | 65.1   | 97.2                              | 65.0   | 99.3               | 63.0   | 8515               | 97.2   |
| 2002 | 8995.6         | 1111.0         | 92.1   | 66.7   | 92.1                              | 66.6   | 92.4               | 64.7   | 8078               | 92.2   |
| 2003 | 8709.1         | 1111.0         | 88.4   | 67.9   | 88.4                              | 67.8   | 89.5               | 66.1   | 7762               | 88.6   |
| 2004 | 9940.4         | 1111.0         | 99.8   | 69.6   | 99.8                              | 69.5   | 101.9              | 68.0   | 8764               | 99.8   |

# US-374 LASALLE-2

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 05 Jun | 19.5  | 22.4    | UF2  | A41  | GENERATOR TAKEN OFF LINE TO REPAIR OCB 2-3 BUS 3 DISCONNECT. REACTOR REMAINED CRITICAL. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 19        |          |  | 328       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1391            |           |          |  |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 222             |           |          |  |           |          |
| E. Testing of plant systems or components  | 2               |           |          |  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 531       |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) | 57              |           |          |  | 26        |          |
| Subtotal   | 0               | 19        | 0        | 1672                                     | 895       | 1        |
| Total  |                 | 19        |          |  | 2568      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 79                                       |
| 12. Reactor I&C Systems             |                 | 79                                       |
| 15. Reactor Cooling Systems         |                 | 21                                       |
| 31. Turbine and auxiliaries         |                 | 35                                       |
| 32. Feedwater and Main Steam System |                 | 6  |
| 35. All other I&C Systems           |                 | 15                                       |
| 41. Main Generator Systems          | 19              |  |
| 42. Electrical Power Supply Systems |                 | 30                                       |
| XX. Miscellaneous Systems           |                 | 19                                       |
| Total                               | 19              | 284                                      |

# US-352 LIMERICK-1

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1134.0 MW(e)  
**Design Net RUP:** 1055.0 MW(e)  
**Design Discharge Burnup:** 28500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9539.1 GW(e).h  
**Energy Availability Factor:** 95.0%  
**Load Factor:** 95.8%  
**Operating Factor:** 95.0%  
**Energy Unavailability Factor:** 5.0%  
**Total Off-line Time:** 439 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 862.2 | 728.7 | 306.1 | 843.2 | 855.3 | 829.3 | 852.0 | 852.5 | 823.0 | 869.5 | 842.2 | 875.1 | 9539.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 41.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 41.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.0   |
| <b>LF (%)</b>   | 102.2 | 92.3  | 36.3  | 103.4 | 101.4 | 101.6 | 101.0 | 101.0 | 100.8 | 102.9 | 103.2 | 103.7 | 95.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 41.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 59.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 59.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1970  
**Date of First Criticality:** 22 Dec 1984  
**Date of Grid Connection:** 13 Apr 1985  
**Date of Commercial Operation:** 01 Feb 1986

**Lifetime Generation:** 152956.2 GW(e).h  
**Cumulative Energy Availability Factor:** 88.2%  
**Cumulative Load Factor:** 84.0%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 11.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 1160.9         | 1055.0         | 0.0  | 0.0    | 55.8                              | 100.0  | 13.0               | 0.0    | 2552               | 30.2   |
| 1986 | 7210.6         | 1055.0         | 0.0  | 0.0    | 80.2                              | 100.0  | 78.0               | 0.0    | 7022               | 80.2   |
| 1987 | 5341.3         | 1055.0         | 67.7   | 67.7   | 67.7                              | 67.7   | 57.8               | 57.8   | 5924               | 67.6   |
| 1988 | 6674.8         | 1055.0         | 96.4   | 82.1   | 96.4                              | 82.1   | 72.0               | 64.9   | 8470               | 96.4   |
| 1989 | 5244.3         | 1055.0         | 69.4   | 77.8   | 69.4                              | 77.8   | 56.7               | 62.2   | 5638               | 64.4   |
| 1990 | 5633.1         | 1055.0         | 65.3   | 74.7   | 65.3                              | 74.7   | 61.0               | 61.9   | 5724               | 65.3   |
| 1991 | 8133.8         | 1055.0         | 91.8   | 78.1   | 91.8                              | 78.1   | 88.0               | 67.1   | 8043               | 91.8   |
| 1992 | 6239.6         | 1055.0         | 69.6   | 76.7   | 69.6                              | 76.7   | 67.3               | 67.1   | 6115               | 69.6   |
| 1993 | 8745.5         | 1055.0         | 98.5   | 79.8   | 98.5                              | 79.8   | 94.6               | 71.1   | 8626               | 98.5   |
| 1994 | 7858.0         | 1055.0         | 89.5   | 81.0   | 89.5                              | 81.0   | 85.0               | 72.8   | 7840               | 89.5   |
| 1995 | 8147.5         | 1055.0         | 91.1   | 82.1   | 91.1                              | 82.1   | 88.2               | 74.5   | 7973               | 91.0   |
| 1996 | 8141.6         | 1096.0         | 88.8   | 82.8   | 88.8                              | 82.8   | 84.6               | 75.6   | 7758               | 88.3   |
| 1997 | 9227.5         | 1105.0         | 97.5   | 84.2   | 97.5                              | 84.2   | 95.3               | 77.4   | 8534               | 97.4   |
| 1998 | 7449.1         | 1112.0         | 81.6   | 84.0   | 81.6                              | 84.0   | 76.5               | 77.3   | 7061               | 80.6   |
| 1999 | 9744.0         | 1134.0         | 98.0   | 85.1   | 98.0                              | 85.1   | 98.1               | 79.0   | 8588               | 98.0   |
| 2000 | 8988.1         | 1139.0         | 90.9   | 85.6   | 90.9                              | 85.6   | 89.8               | 79.8   | 7982               | 90.9   |
| 2001 | 10133.1        | 1143.0         | 99.7   | 86.6   | 99.7                              | 86.6   | 101.2              | 81.4   | 8735               | 99.7   |
| 2002 | 9286.8         | 1134.0         | 94.1   | 87.1   | 94.1                              | 87.1   | 93.5               | 82.1   | 8244               | 94.1   |
| 2003 | 10057.5        | 1134.0         | 99.0   | 87.8   | 99.0                              | 87.8   | 101.2              | 83.3   | 8672               | 99.0   |
| 2004 | 9539.1         | 1134.0         | 95.0   | 88.2   | 95.0                              | 88.2   | 95.8               | 84.0   | 8345               | 95.0   |

**US-352 LIMERICK-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description        |
|--------|-------|---------|------|------|--------------------|
| 01 Mar | 438.6 | 497.4   | PF   | C21  | REFUELLING OUTAGE. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 188       |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 438             |           |          | 784   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 157   | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 27  | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 124   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 131   | 45        |          |
| Subtotal   | 438             | 0         | 0        | 1223  | 235       | 0        |
| Total  |                 | 438       |          |   | 1458      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                                   | 2004<br>Hours Lost | 1985 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories              |                    | 5   |
| 13. Reactor Auxiliary Systems            |                    | 10  |
| 14. Safety Systems                       |                    | 16  |
| 15. Reactor Cooling Systems              |                    | 41  |
| 21. Fuel Handling and Storage Facilities |                    | 9   |
| 31. Turbine and auxiliaries              |                    | 56  |
| 32. Feedwater and Main Steam System      |                    | 10  |
| 41. Main Generator Systems               |                    | 3   |
| 42. Electrical Power Supply Systems      |                    | 20  |
| XX. Miscellaneous Systems                |                    | 14  |
| Total                                    | 0                  | 184   |

# US-353 LIMERICK-2

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1134.0 MW(e)  
**Design Net RUP:** 1055.0 MW(e)  
**Design Discharge Burnup:** 28500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9952.0 GW(e).h  
**Energy Availability Factor:** 99.4%  
**Load Factor:** 99.9%  
**Operating Factor:** 99.4%  
**Energy Unavailability Factor:** 0.6%  
**Total Off-line Time:** 50 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 868.6 | 820.5 | 872.0 | 837.8 | 829.0 | 738.8 | 843.5 | 846.1 | 755.8 | 853.1 | 831.0 | 855.8 | 9952.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.4   |
| <b>LF (%)</b>   | 103.0 | 104.0 | 103.4 | 102.8 | 98.3  | 90.5  | 100.0 | 100.3 | 92.6  | 101.0 | 101.8 | 101.4 | 99.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1970  
**Date of First Criticality:** 12 Aug 1989  
**Date of Grid Connection:** 01 Sep 1989  
**Date of Commercial Operation:** 08 Jan 1990

**Lifetime Generation:** 130970.5 GW(e).h  
**Cumulative Energy Availability Factor:** 92.3%  
**Cumulative Load Factor:** 90.4%  
**Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 7.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 7232.6         | 1055.0         | 81.8   | 81.8   | 81.8                              | 81.8   | 79.8               | 79.8   | 7174               | 83.5   |
| 1991 | 7146.9         | 1055.0         | 77.8   | 79.8   | 77.8                              | 79.8   | 77.3               | 78.5   | 6919               | 79.0   |
| 1992 | 8489.2         | 1055.0         | 97.4   | 85.7   | 97.4                              | 85.7   | 91.6               | 82.9   | 8557               | 97.4   |
| 1993 | 7468.7         | 1055.0         | 82.3   | 84.8   | 82.3                              | 84.9   | 80.8               | 82.4   | 7289               | 83.2   |
| 1994 | 8571.5         | 1055.0         | 98.8   | 87.7   | 98.8                              | 87.6   | 92.7               | 84.5   | 8657               | 98.8   |
| 1995 | 8401.4         | 1110.0         | 91.2   | 88.3   | 91.2                              | 88.3   | 86.4               | 84.8   | 7984               | 91.1   |
| 1996 | 9001.1         | 1115.0         | 95.7   | 89.4   | 95.1                              | 89.3   | 91.9               | 85.9   | 8346               | 95.0   |
| 1997 | 8307.5         | 1115.0         | 89.3   | 89.4   | 89.3                              | 89.3   | 85.1               | 85.8   | 7840               | 89.5   |
| 1998 | 9257.9         | 1115.0         | 95.3   | 90.0   | 95.3                              | 90.0   | 94.8               | 86.8   | 8346               | 95.3   |
| 1999 | 8561.0         | 1135.0         | 88.4   | 89.9   | 88.4                              | 89.8   | 86.1               | 86.7   | 7726               | 88.2   |
| 2000 | 9940.7         | 1145.0         | 98.6   | 90.7   | 98.6                              | 90.7   | 98.8               | 87.9   | 8661               | 98.6   |
| 2001 | 9243.4         | 1143.0         | 93.9   | 91.0   | 93.9                              | 90.9   | 92.3               | 88.3   | 8230               | 93.9   |
| 2002 | 10009.5        | 1134.0         | 99.0   | 91.6   | 99.0                              | 91.6   | 100.8              | 89.3   | 8672               | 99.0   |
| 2003 | 9387.1         | 1134.0         | 94.2   | 91.8   | 94.2                              | 91.8   | 94.5               | 89.6   | 8252               | 94.2   |
| 2004 | 9952.0         | 1134.0         | 99.4   | 92.3   | 99.4                              | 92.3   | 99.9               | 90.4   | 8734               | 99.4   |

## US-353 LIMERICK-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 22 Jun | 50.0  | 56.7    | UF4  | A41  | REACTOR SCRAM DUE TO GENERATOR LOCKOUT. WHILE OPENING THE 135 BREAKER, THE B PHASE EXPERIENCED AN INTERNAL FAULT. THE 345 BREAKER CT FAILED RESULTING IN ADDITIONAL BREAKER TRIPS THAT LED TO THE TURBINE TRIP. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 49        |          |  | 145       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 19        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 408                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 74                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 3        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 10        |          |
| Subtotal   | 0               | 49        | 0        | 482                                      | 174       | 3        |
| Total  |                 | 49        |          |  | 659       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1990 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 15. Reactor Cooling Systems                    |                 | 8  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 5  |
| 31. Turbine and auxiliaries                    |                 | 76                                       |
| 32. Feedwater and Main Steam System            |                 | 11                                       |
| 35. All other I&C Systems                      |                 | 11                                       |
| 41. Main Generator Systems                     | 49              | 11                                       |
| 42. Electrical Power Supply Systems            |                 | 9  |
| Total  | 49              | 131                                      |

# US-369 MCGUIRE-1

**Operator:** DUKE (DUKE POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1100.0 MW(e)  
**Design Net RUP:** 1180.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8238.5 GW(e).h  
**Energy Availability Factor:** 83.4%  
**Load Factor:** 85.3%  
**Operating Factor:** 83.3%  
**Energy Unavailability Factor:** 16.6%  
**Total Off-line Time:** 1463 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 860.5 | 804.8 | 136.9 | 483.2 | 850.1 | 809.4 | 828.6 | 829.3 | 807.2 | 456.0 | 512.4 | 860.2 | 8238.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 16.1  | 63.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 55.6  | 66.3  | 100.0 | 83.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 16.1  | 63.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 55.6  | 66.3  | 100.0 | 83.4   |
| <b>LF (%)</b>   | 105.1 | 105.1 | 16.7  | 61.1  | 103.9 | 102.2 | 101.2 | 101.3 | 101.9 | 55.6  | 64.7  | 105.1 | 85.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 16.8  | 62.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 55.4  | 66.3  | 100.0 | 83.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 83.9  | 36.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 44.4  | 33.8  | 0.0   | 16.6   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 83.9  | 18.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.2  | 0.0   | 0.0   | 9.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 18.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 32.2  | 33.8  | 0.0   | 7.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1971      **Lifetime Generation:** 169216.8 GW(e).h  
**Date of First Criticality:** 08 Aug 1981      **Cumulative Energy Availability Factor:** 78.5%  
**Date of Grid Connection:** 12 Sep 1981      **Cumulative Load Factor:** 74.2%  
**Date of Commercial Operation:** 01 Dec 1981      **Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 21.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4650.0         | 1180.0         | 57.3   | 69.4   | 57.3                              | 69.4   | 45.0               | 43.3   | 4852               | 55.4   |
| 1984 | 6434.3         | 1180.0         | 78.1   | 72.3   | 69.3                              | 69.4   | 62.1               | 49.6   | 6011               | 68.4   |
| 1985 | 6780.1         | 1180.0         | 77.1   | 73.5   | 77.1                              | 71.3   | 65.6               | 53.6   | 6747               | 77.0   |
| 1986 | 5181.1         | 1150.0         | 56.2   | 70.1   | 56.2                              | 68.4   | 51.4               | 53.2   | 4912               | 56.1   |
| 1987 | 7352.9         | 1150.0         | 76.7   | 71.2   | 76.7                              | 69.7   | 73.0               | 56.4   | 6713               | 76.6   |
| 1988 | 7406.4         | 1129.0         | 77.0   | 72.0   | 77.0                              | 70.7   | 74.7               | 58.9   | 6763               | 77.0   |
| 1989 | 7807.2         | 1129.0         | 84.5   | 73.5   | 84.5                              | 72.4   | 78.9               | 61.4   | 7187               | 82.0   |
| 1990 | 4755.3         | 1129.0         | 56.9   | 71.7   | 56.9                              | 70.7   | 48.1               | 59.9   | 4718               | 53.9   |
| 1991 | 6851.1         | 1129.0         | 71.5   | 71.7   | 71.4                              | 70.8   | 69.3               | 60.8   | 6259               | 71.4   |
| 1992 | 7485.3         | 1129.0         | 77.9   | 72.3   | 77.9                              | 71.4   | 75.5               | 62.2   | 6839               | 77.9   |
| 1993 | 5537.1         | 1129.0         | 58.2   | 71.1   | 58.2                              | 70.3   | 56.0               | 61.6   | 5095               | 58.2   |
| 1994 | 6877.3         | 1129.0         | 71.9   | 71.2   | 71.9                              | 70.5   | 69.5               | 62.2   | 6291               | 71.8   |
| 1995 | 8860.2         | 1129.0         | 91.6   | 72.6   | 91.6                              | 71.9   | 89.6               | 64.2   | 8017               | 91.5   |
| 1996 | 8558.3         | 1129.0         | 89.5   | 73.7   | 89.5                              | 73.1   | 86.3               | 65.6   | 7858               | 89.5   |
| 1997 | 7011.3         | 1129.0         | 72.7   | 73.7   | 72.7                              | 73.1   | 70.9               | 65.9   | 6361               | 72.6   |
| 1998 | 8822.6         | 1119.0         | 90.0   | 74.6   | 90.0                              | 74.1   | 90.0               | 67.3   | 7889               | 90.1   |
| 1999 | 8593.3         | 1100.0         | 86.6   | 75.2   | 86.6                              | 74.7   | 89.2               | 68.5   | 7584               | 86.6   |
| 2000 | 9995.0         | 1100.0         | 99.5   | 76.5   | 99.5                              | 76.0   | 103.4              | 70.3   | 8741               | 99.5   |
| 2001 | 8684.9         | 1100.0         | 88.0   | 77.0   | 88.0                              | 76.6   | 90.1               | 71.2   | 7708               | 88.0   |
| 2002 | 9100.8         | 1100.0         | 91.8   | 77.7   | 91.8                              | 77.3   | 94.4               | 72.3   | 8042               | 91.8   |
| 2003 | 9912.5         | 1100.0         | 100.0  | 78.7   | 100.0                             | 78.3   | 102.9              | 73.7   | 8760               | 100.0  |
| 2004 | 8238.5         | 1100.0         | 83.4   | 78.9   | 83.4                              | 78.5   | 85.3               | 74.2   | 7321               | 83.3   |



# US-369 MCGUIRE-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 Mar | 681.7 | 749.9   | PF   | C21  | REFUELLING OUTAGE.   |
| 03 Apr | 73.0  | 80.3    | PF   | E16  | OUTAGE EXTENDED 3.04 DAYS DUE TO STEAM GENERATOR EDDY CURRENT TESTING DELAYS.      |
| 06 Apr | 42.0  | 46.2    | UF3  | A13  | OUTAGE DELAYED 1.75 DAYS DUE TO CONTAINMENT BUILDING CLEAN-UP.                     |
| 08 Apr | 89.3  | 98.2    | UF3  | A15  | OUTAGE DELAYED 3.72 DAYS TO TROUBLE SHOOT/REPAIR 1SM7 MAIN STEAM ISOLATION VALVE.  |
| 12 Apr | 1.4   | 1.5     | PF   | E31  | TURBINW OVERSPEED TRIP TEST.   |
| 18 Oct | 90.7  | 99.8    | PF   | D17  | REPAIR 1B STEAM GENERATOR INSTRUMENT LINE LEAK.                                    |
| 22 Oct | 483.3 | 531.6   | UF3  | A15  | OUTAGE DELAYED TO REPAIR AND EVALUATE MAIN STEAM ISOLATION VALVES ISM-1 AND ISM-7. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 614       |          |  | 557       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 681             |           |          | 911                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 90              |           |          | 166                                      | 44        |          |
| E. Testing of plant systems or components  | 74              |           |          | 20                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 10        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 17                                       | 5         | 32       |
| Subtotal   | 845             | 614       | 0        | 1114                                     | 619       | 32       |
| Total  |                 | 1459      |          |  | 1765      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 8  |
| 12. Reactor I&C Systems                  |                 | 18                                       |
| 13. Reactor Auxiliary Systems            | 42              | 25                                       |
| 14. Safety Systems                       |                 | 33                                       |
| 15. Reactor Cooling Systems              | 572             | 65                                       |
| 16. Steam generation systems             |                 | 97                                       |
| 21. Fuel Handling and Storage Facilities |                 | 39                                       |
| 31. Turbine and auxiliaries              |                 | 64                                       |
| 32. Feedwater and Main Steam System      |                 | 147                                      |
| 41. Main Generator Systems               |                 | 6  |
| 42. Electrical Power Supply Systems      |                 | 16                                       |
| XX. Miscellaneous Systems                |                 | 31                                       |
| Total                                    | 614             | 549                                      |

# US-370 MCGUIRE-2

**Operator:** DUKE (DUKE POWER CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1100.0 MW(e)  
**Design Net RUP:** 1180.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9994.0 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 103.4%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 859.7 | 803.4 | 857.4 | 824.5 | 848.3 | 810.4 | 829.4 | 826.9 | 807.5 | 846.4 | 823.9 | 856.3 | 9994.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 105.0 | 104.9 | 104.8 | 104.3 | 103.7 | 102.3 | 101.3 | 101.0 | 102.0 | 103.3 | 104.0 | 104.6 | 103.4  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1971  
**Date of First Criticality:** 08 May 1983  
**Date of Grid Connection:** 23 May 1983  
**Date of Commercial Operation:** 01 Mar 1984

**Lifetime Generation:** 167509.9 GW(e).h  
**Cumulative Energy Availability Factor:** 83.0%  
**Cumulative Load Factor:** 81.6%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 17.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 6557.8         | 1171.0         | 0.0  | 0.0    | 85.7                              | 100.0  | 63.8               | 0.0    | 6086               | 69.3   |
| 1985 | 5609.3         | 1180.0         | 61.0   | 61.0   | 61.0                              | 61.0   | 54.3               | 54.3   | 5171               | 59.0   |
| 1986 | 6216.6         | 1150.0         | 64.5   | 62.8   | 64.5                              | 62.8   | 61.7               | 57.9   | 5601               | 63.9   |
| 1987 | 7577.4         | 1150.0         | 80.2   | 68.5   | 80.2                              | 68.5   | 75.2               | 63.6   | 6954               | 79.4   |
| 1988 | 8058.0         | 1129.0         | 82.3   | 71.9   | 82.3                              | 71.9   | 81.3               | 68.0   | 7229               | 82.3   |
| 1989 | 7418.3         | 1129.0         | 78.4   | 73.2   | 78.4                              | 73.2   | 75.0               | 69.4   | 6867               | 78.4   |
| 1990 | 6496.2         | 1129.0         | 69.5   | 72.6   | 69.5                              | 72.6   | 65.7               | 68.8   | 5873               | 67.0   |
| 1991 | 9516.0         | 1129.0         | 97.6   | 76.1   | 97.6                              | 76.1   | 96.2               | 72.6   | 8548               | 97.6   |
| 1992 | 6785.0         | 1129.0         | 70.0   | 75.3   | 70.0                              | 75.4   | 68.4               | 72.1   | 6141               | 69.9   |
| 1993 | 6821.1         | 1129.0         | 72.8   | 75.1   | 72.8                              | 75.1   | 69.0               | 71.8   | 6378               | 72.8   |
| 1994 | 8660.0         | 1129.0         | 88.0   | 76.4   | 88.0                              | 76.4   | 87.6               | 73.3   | 7708               | 88.0   |
| 1995 | 9090.0         | 1129.0         | 93.0   | 77.9   | 93.0                              | 77.9   | 91.9               | 75.0   | 8144               | 93.0   |
| 1996 | 7265.1         | 1129.0         | 74.6   | 77.6   | 74.6                              | 77.6   | 73.3               | 74.9   | 6543               | 74.5   |
| 1997 | 6648.4         | 1129.0         | 71.0   | 77.1   | 71.0                              | 77.1   | 67.2               | 74.3   | 6214               | 70.9   |
| 1998 | 9928.3         | 1119.0         | 99.5   | 78.7   | 99.5                              | 78.7   | 101.3              | 76.2   | 8715               | 99.5   |
| 1999 | 8596.7         | 1100.0         | 90.5   | 79.4   | 90.5                              | 79.4   | 89.2               | 77.0   | 7927               | 90.5   |
| 2000 | 8452.4         | 1100.0         | 88.3   | 80.0   | 88.3                              | 80.0   | 87.5               | 77.7   | 7757               | 88.3   |
| 2001 | 9878.0         | 1100.0         | 99.3   | 81.1   | 99.3                              | 81.1   | 102.5              | 79.1   | 8698               | 99.3   |
| 2002 | 8913.5         | 1100.0         | 90.7   | 81.6   | 90.7                              | 81.6   | 92.5               | 79.8   | 7940               | 90.6   |
| 2003 | 9027.8         | 1100.0         | 91.6   | 82.1   | 91.6                              | 82.1   | 93.7               | 80.5   | 8024               | 91.6   |
| 2004 | 9994.0         | 1100.0         | 100.0  | 83.0   | 100.0                             | 83.0   | 103.4              | 81.6   | 8784               | 100.0  |

## US-370 MCGUIRE-2

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          | 1   | 310       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1023  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 116   | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 13        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0   | 5         |          |
| Subtotal   | 0               | 0         | 0        | 1140  | 331       | 0        |
| Total  |                 | 0         |          |   | 1471      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1984 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 3   |
| 12. Reactor I&C Systems                        |                    | 24  |
| 13. Reactor Auxiliary Systems                  |                    | 25  |
| 14. Safety Systems                             |                    | 19  |
| 15. Reactor Cooling Systems                    |                    | 91  |
| 16. Steam generation systems                   |                    | 18  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 3   |
| 21. Fuel Handling and Storage Facilities       |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 5   |
| 32. Feedwater and Main Steam System            |                    | 48  |
| 41. Main Generator Systems                     |                    | 34  |
| 42. Electrical Power Supply Systems            |                    | 10  |
| XX. Miscellaneous Systems                      |                    | 1   |
| Total  | 0                  | 283   |

# US-336 MILLSTONE-2

**Operator:** DOMIN (DOMINION VIRGINIA POWER)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 866.0 MW(e)  
**Design Net RUP:** 870.0 MW(e)  
**Design Discharge Burnup:** 22000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7596.0 GW(e).h  
**Energy Availability Factor:** 98.8%  
**Load Factor:** 98.7%  
**Operating Factor:** 98.8%  
**Energy Unavailability Factor:** 1.2%  
**Total Off-line Time:** 107 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 659.3 | 616.6 | 541.5 | 636.6 | 649.6 | 636.7 | 647.1 | 654.2 | 632.9 | 657.6 | 605.2 | 658.7 | 7596.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 85.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 85.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.8   |
| <b>LF (%)</b>   | 102.3 | 101.0 | 83.0  | 101.0 | 99.6  | 100.8 | 99.2  | 100.3 | 100.2 | 100.6 | 95.8  | 100.9 | 98.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 85.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 14.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 14.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1969  
**Date of First Criticality:** 17 Oct 1975  
**Date of Grid Connection:** 09 Nov 1975  
**Date of Commercial Operation:** 26 Dec 1975

**Lifetime Generation:** 132691.5 GW(e).h  
**Cumulative Energy Availability Factor:** 62.5%  
**Cumulative Load Factor:** 60.8%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 37.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2474.4         | 861.0          | 34.1   | 65.2   | 34.1                              | 63.5   | 32.8               | 62.0   | 2993               | 34.2   |
| 1984 | 6608.3         | 860.0          | 93.4   | 68.4   | 93.4                              | 67.0   | 87.5               | 65.0   | 8209               | 93.5   |
| 1985 | 3515.6         | 841.0          | 59.4   | 67.5   | 47.7                              | 65.0   | 47.7               | 63.2   | 4322               | 49.3   |
| 1986 | 5164.9         | 857.0          | 72.5   | 68.0   | 72.5                              | 65.7   | 68.8               | 63.7   | 6352               | 72.5   |
| 1987 | 6892.5         | 857.0          | 93.3   | 70.1   | 93.3                              | 68.1   | 91.8               | 66.1   | 8177               | 93.3   |
| 1988 | 5735.9         | 860.0          | 77.2   | 70.7   | 77.2                              | 68.8   | 75.9               | 66.9   | 6810               | 77.5   |
| 1989 | 4763.6         | 863.0          | 66.8   | 70.4   | 66.8                              | 68.6   | 63.0               | 66.6   | 5705               | 65.1   |
| 1990 | 5309.9         | 863.0          | 72.8   | 70.6   | 72.8                              | 68.9   | 70.2               | 66.9   | 6389               | 72.9   |
| 1991 | 3948.1         | 863.0          | 55.3   | 69.6   | 55.3                              | 68.1   | 52.2               | 65.9   | 4820               | 55.0   |
| 1992 | 2725.0         | 870.0          | 36.1   | 67.6   | 36.1                              | 66.1   | 35.7               | 64.1   | 3187               | 36.3   |
| 1993 | 6295.9         | 873.0          | 84.8   | 68.5   | 84.8                              | 67.2   | 82.3               | 65.1   | 7431               | 84.8   |
| 1994 | 3676.5         | 873.0          | 49.0   | 67.5   | 49.0                              | 66.2   | 48.1               | 64.2   | 4289               | 49.0   |
| 1995 | 2740.5         | 873.0          | 37.4   | 66.0   | 37.4                              | 64.7   | 35.8               | 62.8   | 3273               | 37.4   |
| 1996 | 1046.5         | 871.0          | 13.7   | 63.4   | 13.7                              | 62.2   | 13.7               | 60.4   | 1222               | 13.9   |
| 1997 | 0.0            | 871.0          | 0.0  | 60.5   | 0.0                               | 59.4   | 0.0                | 57.6   | 0                  | 0.0    |
| 1998 | 0.0            | 871.0          | 0.0  | 57.8   | 0.0                               | 56.7   | 0.0                | 55.0   | 0                  | 0.0    |
| 1999 | 4433.2         | 870.0          | 60.6   | 57.9   | 60.6                              | 56.9   | 58.2               | 55.1   | 5310               | 60.6   |
| 2000 | 6268.5         | 872.0          | 83.7   | 59.0   | 83.7                              | 58.0   | 81.8               | 56.2   | 7353               | 83.7   |
| 2001 | 7284.0         | 871.0          | 98.0   | 60.5   | 98.0                              | 59.5   | 95.5               | 57.8   | 8587               | 98.0   |
| 2002 | 6209.3         | 870.0          | 83.2   | 61.3   | 83.2                              | 60.4   | 81.5               | 58.7   | 7285               | 83.2   |
| 2003 | 6109.8         | 869.0          | 80.9   | 62.0   | 80.9                              | 61.2   | 80.3               | 59.4   | 7083               | 80.9   |
| 2004 | 7596.0         | 876.0          | 98.8   | 63.4   | 98.8                              | 62.5   | 98.7               | 60.8   | 8677               | 98.8   |

## US-336 MILLSTONE-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 06 Mar | 61.5  | 53.3    | UF2  | A35  | SPURIOUS ACTUATION OF AN ELECTRICAL RELAY TRIPPING THE B MAIN FEEDWATER PUMP.  |
| 15 Mar | 44.6  | 38.6    | UF2  | E    | DURING TESTING OF THE B MAIN FEEDWATER PUMP EMERGENCY GOVERNOR AND TRIP LOCKOUT EXERCISER. THE B MAIN FEEDWATER PUMP TRIPPED WHEN THE TRIP LOCKOUT HANDSWITCH WAS INADVERTENTLY MOVED OUT OF THE LOCKOUT POSITION. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 61        |          |  | 603       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 31        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1364                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 54                                       |           |          |
| E. Testing of plant systems or components  |                 | 44        |          | 10                                       | 242       |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 688       | 37       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 28                                       | 7         | 35       |
| Subtotal   | 0               | 105       | 0        | 1456                                     | 1571      | 72       |
| Total  |                 | 105       |          |  | 3099      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             |                 | 52                                       |
| 13. Reactor Auxiliary Systems       |                 | 14                                       |
| 14. Safety Systems                  |                 | 13                                       |
| 15. Reactor Cooling Systems         |                 | 140                                      |
| 16. Steam generation systems        |                 | 106                                      |
| 31. Turbine and auxiliaries         |                 | 79                                       |
| 32. Feedwater and Main Steam System |                 | 108                                      |
| 33. Circulating Water System        |                 | 5  |
| 35. All other I&C Systems           | 61              |  |
| 41. Main Generator Systems          |                 | 2  |
| 42. Electrical Power Supply Systems |                 | 65                                       |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 61              | 585                                      |

# US-423 MILLSTONE-3

**Operator:** DOMIN (DOMINION VIRGINIA POWER)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1130.0 MW(e)  
**Design Net RUP:** 1159.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8983.7 GW(e).h  
**Energy Availability Factor:** 90.1%  
**Load Factor:** 90.0%  
**Operating Factor:** 90.0%  
**Energy Unavailability Factor:** 9.9%  
**Total Off-line Time:** 879 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 859.1 | 803.8 | 819.1 | 35.0 | 551.8 | 833.0 | 857.1 | 843.9 | 826.4 | 860.5 | 834.2 | 859.8 | 8983.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 6.5  | 72.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 6.5  | 72.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.1   |
| <b>LF (%)</b>   | 102.2 | 102.2 | 97.4  | 4.3  | 65.6  | 102.4 | 102.0 | 98.8  | 100.0 | 100.6 | 100.9 | 100.7 | 90.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 6.7  | 72.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 93.5 | 27.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.9    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 93.5 | 27.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.9    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1974      **Lifetime Generation:** 129179.0 GW(e).h  
**Date of First Criticality:** 23 Jan 1986      **Cumulative Energy Availability Factor:** 71.2%  
**Date of Grid Connection:** 12 Feb 1986      **Cumulative Load Factor:** 68.6%  
**Date of Commercial Operation:** 23 Apr 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 28.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 6748.2         | 1142.0         | 71.4   | 71.4   | 71.4                              | 71.4   | 67.5               | 67.5   | 6235               | 71.2   |
| 1988 | 7683.6         | 1142.0         | 79.5   | 75.4   | 79.5                              | 75.4   | 76.6               | 72.0   | 6954               | 79.2   |
| 1989 | 7082.6         | 1142.0         | 75.9   | 75.6   | 75.9                              | 75.6   | 70.8               | 71.6   | 6636               | 75.8   |
| 1990 | 8218.2         | 1137.0         | 89.2   | 79.0   | 89.2                              | 79.0   | 82.5               | 74.3   | 7798               | 89.0   |
| 1991 | 2876.7         | 1137.0         | 33.6   | 69.9   | 33.6                              | 69.9   | 28.9               | 65.3   | 2850               | 32.5   |
| 1992 | 6593.8         | 1137.0         | 72.1   | 70.3   | 72.1                              | 70.3   | 66.0               | 65.4   | 6311               | 71.8   |
| 1993 | 6502.8         | 1137.0         | 70.2   | 70.3   | 70.1                              | 70.3   | 65.3               | 65.4   | 6106               | 69.7   |
| 1994 | 9416.2         | 1137.0         | 96.3   | 73.5   | 96.3                              | 73.5   | 94.5               | 69.0   | 8426               | 96.2   |
| 1995 | 7993.6         | 1137.0         | 81.2   | 74.4   | 81.2                              | 74.4   | 80.3               | 70.3   | 7083               | 80.9   |
| 1996 | 2476.7         | 1137.0         | 25.7   | 69.5   | 25.7                              | 69.5   | 24.8               | 65.7   | 2156               | 24.5   |
| 1997 | 0.0            | 1137.0         | 0.0  | 63.2   | 0.0                               | 63.2   | 0.0                | 59.8   | 0                  | 0.0    |
| 1998 | 3392.1         | 1137.0         | 38.9   | 61.2   | 38.9                              | 61.2   | 34.1               | 57.6   | 3402               | 38.8   |
| 1999 | 8307.5         | 1139.0         | 83.7   | 62.9   | 83.7                              | 62.9   | 83.3               | 59.6   | 7329               | 83.7   |
| 2000 | 10125.7        | 1151.0         | 100.0  | 65.6   | 100.0                             | 65.6   | 100.2              | 62.5   | 8784               | 100.0  |
| 2001 | 8169.7         | 1146.0         | 84.3   | 66.8   | 84.3                              | 66.8   | 81.4               | 63.8   | 7392               | 84.4   |
| 2002 | 8746.2         | 1133.0         | 89.0   | 68.2   | 89.0                              | 68.2   | 88.1               | 65.3   | 7803               | 89.1   |
| 2003 | 10005.7        | 1130.0         | 99.7   | 70.0   | 99.6                              | 70.0   | 101.1              | 67.4   | 8729               | 99.6   |
| 2004 | 8983.7         | 1137.0         | 90.1   | 71.2   | 90.1                              | 71.2   | 90.0               | 68.6   | 7905               | 90.0   |

## US-423 MILLSTONE-3

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 03 Apr | 845.6 | 956.4   | PF   | C21  | SCHEDULED REFUELLING OUTAGE.   |
| 08 May | 31.7  | 35.9    | PF   | E31  | SCHEDULED TURBINE OVERSPEED TRIP TESTING- COULD NOT COMPLETE TESTING DUE TO EQUIPMENT PROBLEMS. REACTOR REMAINED CRITICAL. |
| 09 May | 1.1   | 1.2     | PF   | E31  | SCHEDULED TURBINE OVERSPEED TRIP TESTING - COMPLETED SATISFACTORY. REACTOR REMAINED CRITICAL.                              |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 690       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 845             |           |          | 713   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 85  |           |          |
| E. Testing of plant systems or components  | 32              |           |          | 1   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 486       |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 511       |          |
| Subtotal   | 877             | 0         | 0        | 799   | 1696      | 0        |
| Total  |                 | 877       |          |   | 2495      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1987 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 5   |
| 13. Reactor Auxiliary Systems                  |                    | 27  |
| 14. Safety Systems                             |                    | 250   |
| 15. Reactor Cooling Systems                    |                    | 50  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 13  |
| 31. Turbine and auxiliaries                    |                    | 14  |
| 32. Feedwater and Main Steam System            |                    | 25  |
| 33. Circulating Water System                   |                    | 7   |
| 41. Main Generator Systems                     |                    | 13  |
| 42. Electrical Power Supply Systems            |                    | 7   |
| XX. Miscellaneous Systems                      |                    | 212   |
| Total  | 0                  | 623   |

# US-263 MONTICELLO

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 578.0 MW(e)  
**Design Net RUP:** 545.0 MW(e)  
**Design Discharge Burnup:** 22700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5034.9 GW(e).h  
**Energy Availability Factor:** 98.9%  
**Load Factor:** 99.2%  
**Operating Factor:** 98.9%  
**Energy Unavailability Factor:** 1.1%  
**Total Off-line Time:** 95 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 433.2 | 408.8 | 440.4 | 424.2 | 423.6 | 350.1 | 420.3 | 425.0 | 412.5 | 436.4 | 423.7 | 436.6 | 5034.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9   |
| <b>LF (%)</b>   | 100.7 | 101.6 | 102.4 | 102.1 | 98.5  | 84.1  | 97.7  | 98.8  | 99.1  | 101.4 | 101.8 | 101.5 | 99.2   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1967      **Lifetime Generation:** 126281.7 GW(e).h  
**Date of First Criticality:** 10 Dec 1970      **Cumulative Energy Availability Factor:** 81.4%  
**Date of Grid Connection:** 05 Mar 1971      **Cumulative Load Factor:** 79.0%  
**Date of Commercial Operation:** 30 Jun 1971      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 18.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4147.7         | 525.0          | 96.3   | 82.0   | 96.3                              | 76.4   | 90.2               | 73.5   | 8438               | 96.3   |
| 1984 | 279.1          | 525.0          | 9.2  | 76.6   | 9.2                               | 71.3   | 6.1                | 68.5   | 808                | 9.2    |
| 1985 | 4287.0         | 536.0          | 91.6   | 77.6   | 91.6                              | 72.8   | 91.3               | 70.1   | 8028               | 91.6   |
| 1986 | 3379.9         | 536.0          | 78.8   | 77.7   | 78.8                              | 73.2   | 72.0               | 70.2   | 6926               | 79.1   |
| 1987 | 3535.6         | 536.0          | 80.2   | 77.9   | 80.2                              | 73.6   | 75.3               | 70.5   | 7051               | 80.5   |
| 1988 | 4573.6         | 536.0          | 99.7   | 79.2   | 99.7                              | 75.1   | 97.1               | 72.1   | 8759               | 99.7   |
| 1989 | 2650.4         | 536.0          | 74.7   | 78.9   | 74.7                              | 75.1   | 56.4               | 71.2   | 6578               | 75.1   |
| 1990 | 4505.9         | 536.0          | 96.0   | 79.8   | 96.0                              | 76.2   | 96.0               | 72.5   | 8414               | 96.1   |
| 1991 | 3596.5         | 536.0          | 79.6   | 79.8   | 79.6                              | 76.4   | 76.6               | 72.7   | 6996               | 79.9   |
| 1992 | 4453.7         | 536.0          | 97.0   | 80.6   | 97.0                              | 77.4   | 94.6               | 73.7   | 8527               | 97.1   |
| 1993 | 3864.4         | 536.0          | 83.4   | 80.7   | 83.4                              | 77.6   | 82.3               | 74.1   | 7322               | 83.6   |
| 1994 | 3956.2         | 536.0          | 85.5   | 80.9   | 85.6                              | 78.0   | 84.3               | 74.6   | 7508               | 85.7   |
| 1995 | 4756.3         | 536.0          | 100.0  | 81.7   | 100.0                             | 78.9   | 101.3              | 75.7   | 8760               | 100.0  |
| 1996 | 3872.9         | 541.0          | 84.8   | 81.8   | 84.7                              | 79.1   | 81.5               | 75.9   | 7443               | 84.7   |
| 1997 | 3661.6         | 544.0          | 75.2   | 81.6   | 75.2                              | 79.0   | 76.8               | 75.9   | 6609               | 75.4   |
| 1998 | 4118.9         | 553.0          | 87.7   | 81.8   | 87.7                              | 79.3   | 85.0               | 76.3   | 7659               | 87.4   |
| 1999 | 4649.3         | 578.0          | 92.4   | 82.2   | 92.4                              | 79.8   | 91.8               | 76.9   | 8092               | 92.4   |
| 2000 | 4251.4         | 578.0          | 83.5   | 82.3   | 83.5                              | 79.9   | 83.7               | 77.1   | 7332               | 83.5   |
| 2001 | 3880.6         | 578.0          | 76.9   | 82.1   | 76.9                              | 79.8   | 76.6               | 77.1   | 6774               | 77.3   |
| 2002 | 5015.6         | 578.0          | 98.3   | 82.6   | 98.4                              | 80.5   | 99.1               | 77.9   | 8620               | 98.4   |
| 2003 | 4592.5         | 578.0          | 90.7   | 82.9   | 90.7                              | 80.8   | 90.7               | 78.3   | 7969               | 91.0   |
| 2004 | 5034.9         | 578.0          | 98.9   | 83.4   | 98.9                              | 81.4   | 99.2               | 79.0   | 8689               | 98.9   |



**US-263 MONTICELLO****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                       |
|--------|-------|---------|------|------|-----------------------------------|
| 18 Jun | 94.2  | 53.6    | PF   | D15  | SHUTDOWN TO FIX RECIRC PUMP SEAL. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 243       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1013  |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 94              |           |          | 124   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 1         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 0   | 2         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   |           | 9        |
| J. Grid failure or grid unavailability   |                 |           |          |   | 0         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 1   | 97        |          |
| Subtotal   | 94              | 0         | 0        | 1138  | 349       | 9        |
| Total  |                 | 94        |          |   | 1496      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 11  |
| 12. Reactor I&C Systems                        |                    | 16  |
| 13. Reactor Auxiliary Systems                  |                    | 11  |
| 14. Safety Systems                             |                    | 19  |
| 15. Reactor Cooling Systems                    |                    | 26  |
| 16. Steam generation systems                   |                    | 3   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 4   |
| 31. Turbine and auxiliaries                    |                    | 26  |
| 32. Feedwater and Main Steam System            |                    | 57  |
| 33. Circulating Water System                   |                    | 0   |
| 35. All other I&C Systems                      |                    | 6   |
| 41. Main Generator Systems                     |                    | 15  |
| 42. Electrical Power Supply Systems            |                    | 21  |
| XX. Miscellaneous Systems                      |                    | 23  |
| Total  | 0                  | 238   |

# US-220 NINE MILE POINT-1

**Operator:** CONST (CONSTELLATION NUCLEAR GROUP)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 565.0 MW(e)  
**Design Net RUP:** 620.0 MW(e)  
**Design Discharge Burnup:** 15000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4988.2 GW(e).h  
**Energy Availability Factor:** 93.5%  
**Load Factor:** 100.5%  
**Operating Factor:** 94.0%  
**Energy Unavailability Factor:** 6.5%  
**Total Off-line Time:** 526 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 283.3 | 429.1 | 459.3 | 382.6 | 403.3 | 424.4 | 441.6 | 413.0 | 394.5 | 453.4 | 444.1 | 459.6 | 4988.2 |
| <b>EAF (%)</b>  | 61.5  | 100.0 | 100.0 | 85.3  | 89.1  | 100.0 | 100.0 | 92.9  | 93.3  | 100.0 | 100.0 | 100.0 | 93.5   |
| <b>UCF (%)</b>  | 61.5  | 100.0 | 100.0 | 85.3  | 89.1  | 100.0 | 100.0 | 92.9  | 93.3  | 100.0 | 100.0 | 100.0 | 93.5   |
| <b>LF (%)</b>   | 67.4  | 109.1 | 109.3 | 94.2  | 95.9  | 104.3 | 105.0 | 98.2  | 97.0  | 107.7 | 109.2 | 109.3 | 100.5  |
| <b>OF (%)</b>   | 64.9  | 100.0 | 100.0 | 86.8  | 89.8  | 100.0 | 100.0 | 94.6  | 92.5  | 100.0 | 100.0 | 100.0 | 94.0   |
| <b>EUF (%)</b>  | 38.5  | 0.0   | 0.0   | 14.7  | 10.9  | 0.0   | 0.0   | 7.1   | 6.7   | 0.0   | 0.0   | 0.0   | 6.5    |
| <b>PUF (%)</b>  | 38.5  | 0.0   | 0.0   | 14.7  | 10.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.4    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.1   | 6.7   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1965      **Lifetime Generation:** 121082.8 GW(e).h  
**Date of First Criticality:** 05 Sep 1969      **Cumulative Energy Availability Factor:** 67.5%  
**Date of Grid Connection:** 09 Nov 1969      **Cumulative Load Factor:** 66.4%  
**Date of Commercial Operation:** 01 Dec 1969      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 32.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2802.0         | 610.0          | 56.2   | 72.0   | 56.2                              | 62.1   | 52.4               | 59.4   | 4925               | 56.2   |
| 1984 | 3635.2         | 610.0          | 71.6   | 72.0   | 71.6                              | 62.8   | 67.8               | 60.0   | 6316               | 71.9   |
| 1985 | 4932.3         | 610.0          | 96.4   | 73.5   | 96.4                              | 64.9   | 92.3               | 62.0   | 8441               | 96.4   |
| 1986 | 3146.9         | 610.0          | 65.0   | 73.0   | 64.9                              | 64.9   | 58.9               | 61.9   | 5722               | 65.3   |
| 1987 | 4615.2         | 610.0          | 92.8   | 74.1   | 92.8                              | 66.5   | 86.4               | 63.2   | 8130               | 92.8   |
| 1988 | 0.0            | 610.0          | 0.0  | 70.2   | 0.0                               | 62.9   | 0.0                | 59.9   | 0                  | 0.0    |
| 1989 | 0.0            | 610.0          | 0.0  | 66.6   | 0.0                               | 59.8   | 0.0                | 56.9   | 0                  | 0.0    |
| 1990 | 1316.7         | 612.0          | 34.2   | 65.1   | 34.2                              | 58.5   | 24.6               | 55.3   | 3043               | 34.7   |
| 1991 | 3873.5         | 615.0          | 78.2   | 65.7   | 78.2                              | 59.4   | 71.9               | 56.1   | 6853               | 78.2   |
| 1992 | 2930.1         | 615.0          | 57.4   | 65.3   | 57.4                              | 59.4   | 54.2               | 56.0   | 5052               | 57.5   |
| 1993 | 4353.4         | 615.0          | 84.1   | 66.1   | 84.1                              | 60.4   | 80.8               | 57.0   | 7370               | 84.1   |
| 1994 | 4918.0         | 565.0          | 95.4   | 67.2   | 95.4                              | 61.7   | 99.4               | 58.6   | 8390               | 95.8   |
| 1995 | 4127.6         | 565.0          | 82.9   | 67.8   | 82.9                              | 62.5   | 83.4               | 59.5   | 7381               | 84.3   |
| 1996 | 4676.2         | 565.0          | 92.0   | 68.6   | 92.0                              | 63.5   | 94.2               | 60.7   | 8133               | 92.6   |
| 1997 | 2698.6         | 565.0          | 51.8   | 68.0   | 51.8                              | 63.1   | 54.5               | 60.5   | 4620               | 52.7   |
| 1998 | 4846.0         | 565.0          | 92.3   | 68.8   | 92.3                              | 64.0   | 97.9               | 61.7   | 8085               | 92.3   |
| 1999 | 3564.9         | 565.0          | 68.4   | 68.8   | 68.4                              | 64.2   | 72.0               | 62.0   | 6162               | 70.3   |
| 2000 | 4681.8         | 565.0          | 91.0   | 69.5   | 91.0                              | 65.0   | 94.3               | 63.0   | 8060               | 91.8   |
| 2001 | 4378.0         | 565.0          | 83.5   | 69.9   | 83.5                              | 65.6   | 88.5               | 63.8   | 7376               | 84.2   |
| 2002 | 4904.6         | 565.0          | 92.9   | 70.6   | 92.9                              | 66.3   | 99.1               | 64.8   | 8194               | 93.5   |
| 2003 | 4361.4         | 565.0          | 83.6   | 70.9   | 83.6                              | 66.8   | 88.1               | 65.4   | 7373               | 84.2   |
| 2004 | 4988.2         | 565.0          | 93.5   | 71.5   | 93.5                              | 67.5   | 100.5              | 66.4   | 8258               | 94.0   |

# US-220 NINE MILE POINT-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 10 Jan | 260.8 | 161.9   | PF   | D15  | REPLACED 15 REACTOR RECIRCULATION PUMP MOTOR AND MISC. MAINTENANCE TO IMPROVE RELIABILITY.  |
| 27 Apr | 170.4 | 105.8   | PF   | D32  | REPAIRED #123 ERV, VACCUM BREAKER 68-03 POSITION INDICATION HEAD SAFETY VALVE THERMAL COUPLES REBUILT #13 FWP CLUTCH AND CLEANED #11 & 12 CIRCULATING WATER BOXES.  |
| 30 Aug | 92.5  | 57.5    | UF5  | A35  | DUE TO OSCILLATIONS ON 13 FEEDWATER FLOW CONTROL VALVE A MANUAL SCRAM WAS INSERTED TO SHUT THE UNIT DOWN. REPAIRS TO 13 FEEDWATER FLOW CONTROL VALVE ARE IN PROCESS |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 92        |          | 0  | 798       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 33        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1351                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 431             |           |          | 145                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  | 0         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 2  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 1  | 4         | 6        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 5  | 158       |          |
| Subtotal   | 431             | 92        | 0        | 1507                                     | 993       | 6        |
| Total  |                 | 523       |          |  | 2506      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 13                                       |
| 12. Reactor I&C Systems                        |                 | 37                                       |
| 13. Reactor Auxiliary Systems                  |                 | 30                                       |
| 14. Safety Systems                             |                 | 65                                       |
| 15. Reactor Cooling Systems                    |                 | 366                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 46                                       |
| 32. Feedwater and Main Steam System            |                 | 61                                       |
| 35. All other I&C Systems                      | 92              | 0  |
| 41. Main Generator Systems                     |                 | 19                                       |
| 42. Electrical Power Supply Systems            |                 | 33                                       |
| Total  | 92              | 672                                      |

# US-410 NINE MILE POINT-2

**Operator:** CONST (CONSTELLATION NUCLEAR GROUP)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1119.0 MW(e)  
**Design Net RUP:** 1100.0 MW(e)  
**Design Discharge Burnup:** 24000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8643.5 GW(e).h  
**Energy Availability Factor:** 88.5%  
**Load Factor:** 87.9%  
**Operating Factor:** 88.7%  
**Energy Unavailability Factor:** 11.5%  
**Total Off-line Time:** 996 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 850.4 | 747.1 | 332.5 | 113.2 | 851.5 | 815.6 | 844.9 | 839.7 | 772.1 | 817.9 | 829.4 | 829.1 | 8643.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 44.4  | 17.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 44.4  | 17.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.5   |
| <b>LF (%)</b>   | 102.1 | 95.9  | 39.9  | 14.1  | 102.3 | 101.2 | 101.5 | 100.9 | 95.8  | 98.1  | 102.9 | 99.6  | 87.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 45.6  | 17.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 55.6  | 82.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 55.6  | 82.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 11.5   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1975      **Lifetime Generation:** 122632.1 GW(e).h  
**Date of First Criticality:** 23 May 1987      **Cumulative Energy Availability Factor:** 81.3%  
**Date of Grid Connection:** 08 Aug 1987      **Cumulative Load Factor:** 78.4%  
**Date of Commercial Operation:** 11 Mar 1988      **Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 18.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 2540.6         | 1040.0         | 0.0  | 0.0    | 57.4                              | 100.0  | 28.1               | 0.0    | 2800               | 32.2   |
| 1989 | 4288.3         | 1068.0         | 56.5   | 56.5   | 56.4                              | 56.4   | 45.8               | 45.8   | 4824               | 55.1   |
| 1990 | 4140.4         | 1082.0         | 54.4   | 55.4   | 54.4                              | 55.4   | 43.7               | 44.8   | 4697               | 53.6   |
| 1991 | 6562.9         | 1092.0         | 75.1   | 62.0   | 75.1                              | 62.0   | 68.6               | 52.8   | 6484               | 74.0   |
| 1992 | 5145.0         | 1075.0         | 61.9   | 62.0   | 61.8                              | 62.0   | 54.5               | 53.2   | 5169               | 58.8   |
| 1993 | 7191.1         | 1048.0         | 82.2   | 66.0   | 82.2                              | 65.9   | 78.3               | 58.1   | 7195               | 82.1   |
| 1994 | 8355.9         | 994.0          | 93.9   | 70.3   | 93.9                              | 70.3   | 96.0               | 64.0   | 8243               | 94.1   |
| 1995 | 7253.7         | 1061.0         | 78.9   | 71.5   | 78.9                              | 71.5   | 78.0               | 66.0   | 6848               | 78.2   |
| 1996 | 8698.5         | 1106.0         | 89.8   | 73.9   | 89.7                              | 73.9   | 89.5               | 69.1   | 7811               | 88.9   |
| 1997 | 8878.0         | 1105.0         | 94.9   | 76.3   | 94.9                              | 76.3   | 91.7               | 71.7   | 8279               | 94.5   |
| 1998 | 7307.2         | 1105.0         | 80.8   | 76.8   | 80.8                              | 76.8   | 75.5               | 72.1   | 7028               | 80.2   |
| 1999 | 8782.3         | 1128.0         | 89.1   | 78.0   | 89.1                              | 77.9   | 88.9               | 73.7   | 7810               | 89.2   |
| 2000 | 8001.5         | 1123.0         | 81.7   | 78.3   | 81.7                              | 78.3   | 81.1               | 74.3   | 7204               | 82.0   |
| 2001 | 8858.8         | 1119.0         | 90.7   | 79.3   | 90.7                              | 79.3   | 90.4               | 75.6   | 7964               | 90.9   |
| 2002 | 8417.5         | 1119.0         | 85.1   | 79.7   | 85.1                              | 79.7   | 85.9               | 76.3   | 7473               | 85.3   |
| 2003 | 9566.9         | 1119.0         | 96.4   | 80.8   | 96.4                              | 80.8   | 97.6               | 77.8   | 8448               | 96.4   |
| 2004 | 8643.5         | 1119.0         | 88.5   | 81.3   | 88.5                              | 81.3   | 87.9               | 78.4   | 7788               | 88.7   |

## US-410 NINE MILE POINT-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 15 Mar | 993.8 | 1127.9  | PF   | C21  | REFUELLING OUTAGE.                                      |
| 25 Apr | 1.3   | 1.5     | PF   | E31  | RFO-09 CONTINUATION. RECOVERY FROM OVERSPEED TRIP TEST. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 495       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 24        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 993             |           |          | 772   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 380   | 2         |          |
| E. Testing of plant systems or components  | 1               |           |          | 3   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   | 4         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 56        |          |
| Subtotal   | 994             | 0         | 0        | 1155  | 581       | 0        |
| Total  |                 | 994       |          |   | 1736      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1988 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 13. Reactor Auxiliary Systems                  |                    | 0   |
| 14. Safety Systems                             |                    | 14  |
| 15. Reactor Cooling Systems                    |                    | 78  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 4   |
| 31. Turbine and auxiliaries                    |                    | 40  |
| 32. Feedwater and Main Steam System            |                    | 74  |
| 33. Circulating Water System                   |                    | 19  |
| 35. All other I&C Systems                      |                    | 64  |
| 41. Main Generator Systems                     |                    | 42  |
| 42. Electrical Power Supply Systems            |                    | 83  |
| Total  | 0                  | 418   |

# US-338 NORTH ANNA-1

**Operator:** DOMIN (DOMINION VIRGINIA POWER)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 925.0 MW(e)  
**Design Net RUP:** 907.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7418.4 GW(e).h  
**Energy Availability Factor:** 91.4%  
**Load Factor:** 91.3%  
**Operating Factor:** 91.3%  
**Energy Unavailability Factor:** 8.6%  
**Total Off-line Time:** 761 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 692.4 | 489.8 | 693.0 | 669.9 | 691.5 | 667.2 | 688.6 | 689.0 | 241.0 | 535.0 | 665.6 | 695.4 | 7418.4 |
| <b>EAF (%)</b>  | 100.0 | 76.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 36.7  | 81.2  | 100.0 | 100.0 | 91.4   |
| <b>UCF (%)</b>  | 100.0 | 76.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 36.7  | 81.2  | 100.0 | 100.0 | 91.4   |
| <b>LF (%)</b>   | 100.6 | 76.1  | 100.7 | 100.7 | 100.5 | 100.2 | 100.1 | 100.1 | 36.2  | 77.6  | 99.9  | 101.0 | 91.3   |
| <b>OF (%)</b>   | 100.0 | 76.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 36.7  | 81.1  | 100.0 | 100.0 | 91.3   |
| <b>EUF (%)</b>  | 0.0   | 23.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 63.3  | 18.8  | 0.0   | 0.0   | 8.6    |
| <b>PUF (%)</b>  | 0.0   | 23.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 63.3  | 18.8  | 0.0   | 0.0   | 8.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1971      **Lifetime Generation:** 161227.5 GW(e).h  
**Date of First Criticality:** 05 Apr 1978      **Cumulative Energy Availability Factor:** 79.9%  
**Date of Grid Connection:** 17 Apr 1978      **Cumulative Load Factor:** 76.9%  
**Date of Commercial Operation:** 06 Jun 1978      **Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 20.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5310.4         | 872.0          | 71.6   | 62.5   | 71.6                              | 62.5   | 69.5               | 57.8   | 6277               | 71.7   |
| 1984 | 3784.8         | 883.0          | 50.3   | 60.5   | 50.3                              | 60.5   | 48.8               | 56.3   | 4425               | 50.4   |
| 1985 | 5798.9         | 892.0          | 77.9   | 63.0   | 77.9                              | 63.0   | 74.2               | 58.9   | 6820               | 77.9   |
| 1986 | 6310.7         | 893.0          | 83.7   | 65.6   | 83.7                              | 65.6   | 80.7               | 61.7   | 7327               | 83.6   |
| 1987 | 3568.9         | 913.0          | 52.1   | 64.1   | 52.1                              | 64.1   | 44.6               | 59.7   | 4523               | 51.6   |
| 1988 | 6897.3         | 915.0          | 88.6   | 66.6   | 88.6                              | 66.6   | 85.8               | 62.4   | 7760               | 88.3   |
| 1989 | 4303.3         | 915.0          | 57.8   | 65.8   | 57.8                              | 65.8   | 53.7               | 61.6   | 4978               | 56.8   |
| 1990 | 7233.5         | 912.0          | 99.6   | 68.7   | 99.6                              | 68.7   | 90.5               | 64.1   | 8726               | 99.6   |
| 1991 | 5625.8         | 911.0          | 75.2   | 69.2   | 75.2                              | 69.2   | 70.5               | 64.6   | 6549               | 74.8   |
| 1992 | 5358.1         | 858.0          | 81.5   | 70.0   | 81.5                              | 70.0   | 71.1               | 65.0   | 7225               | 82.3   |
| 1993 | 5692.6         | 890.0          | 73.5   | 70.3   | 73.5                              | 70.3   | 73.0               | 65.5   | 6444               | 73.6   |
| 1994 | 6795.7         | 900.0          | 91.5   | 71.6   | 91.6                              | 71.6   | 86.2               | 66.9   | 8012               | 91.5   |
| 1995 | 7839.2         | 896.0          | 99.7   | 73.3   | 99.7                              | 73.3   | 99.9               | 68.8   | 8733               | 99.7   |
| 1996 | 6945.5         | 893.0          | 91.0   | 74.3   | 91.0                              | 74.2   | 88.5               | 69.9   | 7985               | 90.9   |
| 1997 | 7157.5         | 893.0          | 91.3   | 75.1   | 91.3                              | 75.1   | 91.5               | 71.0   | 7992               | 91.2   |
| 1998 | 7217.1         | 893.0          | 92.4   | 76.0   | 92.4                              | 76.0   | 92.3               | 72.1   | 8091               | 92.4   |
| 1999 | 8124.5         | 893.0          | 100.0  | 77.2   | 100.0                             | 77.1   | 103.9              | 73.6   | 8760               | 100.0  |
| 2000 | 7213.1         | 893.0          | 91.1   | 77.8   | 91.1                              | 77.8   | 92.0               | 74.5   | 7997               | 91.0   |
| 2001 | 7120.8         | 925.0          | 91.5   | 78.4   | 91.5                              | 78.4   | 87.9               | 75.1   | 8010               | 91.4   |
| 2002 | 8164.3         | 925.0          | 100.0  | 79.3   | 100.0                             | 79.3   | 100.8              | 76.2   | 8760               | 100.0  |
| 2003 | 6519.9         | 925.0          | 82.2   | 79.5   | 82.2                              | 79.4   | 80.5               | 76.3   | 7200               | 82.2   |
| 2004 | 7418.4         | 925.0          | 91.3   | 79.9   | 91.4                              | 79.9   | 91.3               | 76.9   | 8023               | 91.3   |

**US-338 NORTH ANNA-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 21 Feb | 163.5 | 151.2   | PF   | D42  | UNIT SHUTDOWN FOR REPLACEMENT OF C MAIN TRANSFORMER |
| 12 Sep | 596.5 | 551.8   | PF   | C21  | REFUELLING OUTAGE.                                  |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1978 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 464       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 596             |           |          | 1067  |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 163             |           |          | 123   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 11  | 3         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0   | 2         |          |
| Subtotal   | 759             | 0         | 0        | 1201  | 474       | 0        |
| Total  |                 | 759       |          |   | 1675      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1978 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 17  |
| 12. Reactor I&C Systems             |                    | 3   |
| 13. Reactor Auxiliary Systems       |                    | 9   |
| 14. Safety Systems                  |                    | 21  |
| 15. Reactor Cooling Systems         |                    | 53  |
| 16. Steam generation systems        |                    | 131   |
| 31. Turbine and auxiliaries         |                    | 62  |
| 32. Feedwater and Main Steam System |                    | 18  |
| 33. Circulating Water System        |                    | 4   |
| 41. Main Generator Systems          |                    | 10  |
| 42. Electrical Power Supply Systems |                    | 103   |
| Total                               | 0                  | 431   |

# US-339 NORTH ANNA-2

**Operator:** DOMIN (DOMINION VIRGINIA POWER)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 917.0 MW(e)  
**Design Net RUP:** 907.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7388.1 GW(e).h  
**Energy Availability Factor:** 92.0%  
**Load Factor:** 91.7%  
**Operating Factor:** 92.0%  
**Energy Unavailability Factor:** 8.0%  
**Total Off-line Time:** 707 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May  | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 687.8 | 641.8 | 687.4 | 664.8 | 36.0 | 626.1 | 679.1 | 679.1 | 657.6 | 682.7 | 661.8 | 684.1 | 7388.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 8.2  | 96.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 8.2  | 96.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.0   |
| <b>LF (%)</b>   | 100.8 | 100.6 | 100.8 | 100.8 | 5.3  | 94.8  | 99.5  | 99.5  | 99.6  | 99.9  | 100.2 | 100.3 | 91.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 8.1  | 96.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 91.8 | 3.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 91.8 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.8    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 3.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1970  
**Date of First Criticality:** 12 Jun 1980  
**Date of Grid Connection:** 25 Aug 1980  
**Date of Commercial Operation:** 14 Dec 1980

**Lifetime Generation:** 155687.3 GW(e).h  
**Cumulative Energy Availability Factor:** 84.5%  
**Cumulative Load Factor:** 81.5%  
**Cumulative Unit Capability Factor:** 77.7%  
**Cumulative Energy Unavailability Factor:** 15.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5802.5         | 890.0          | 80.8   | 72.1   | 80.7                              | 72.1   | 74.4               | 66.5   | 7052               | 80.5   |
| 1984 | 4717.2         | 890.0          | 67.1   | 70.9   | 67.1                              | 70.9   | 60.3               | 64.9   | 5896               | 67.1   |
| 1985 | 6813.6         | 892.0          | 94.2   | 75.6   | 94.2                              | 75.6   | 87.2               | 69.4   | 8252               | 94.2   |
| 1986 | 6022.1         | 893.0          | 82.3   | 76.7   | 82.2                              | 76.7   | 77.0               | 70.7   | 7208               | 82.3   |
| 1987 | 5653.4         | 905.0          | 77.4   | 76.8   | 77.4                              | 76.8   | 71.3               | 70.8   | 6783               | 77.4   |
| 1988 | 7884.0         | 915.0          | 99.2   | 79.7   | 99.2                              | 79.6   | 98.1               | 74.3   | 8708               | 99.1   |
| 1989 | 5896.5         | 915.0          | 80.2   | 79.7   | 80.2                              | 79.7   | 73.6               | 74.2   | 6887               | 78.6   |
| 1990 | 5976.6         | 910.0          | 80.0   | 79.7   | 80.0                              | 79.7   | 75.0               | 74.3   | 6982               | 79.7   |
| 1991 | 7684.3         | 909.0          | 97.5   | 81.4   | 97.5                              | 81.4   | 96.5               | 76.3   | 8539               | 97.5   |
| 1992 | 6324.7         | 909.0          | 82.6   | 81.5   | 82.6                              | 81.5   | 79.2               | 76.5   | 7237               | 82.4   |
| 1993 | 6225.2         | 909.0          | 83.6   | 81.6   | 83.6                              | 81.6   | 78.2               | 76.7   | 7303               | 83.4   |
| 1994 | 7490.3         | 887.0          | 97.2   | 82.7   | 97.2                              | 82.7   | 96.4               | 78.1   | 8517               | 97.2   |
| 1995 | 6031.7         | 892.0          | 80.8   | 82.6   | 80.8                              | 82.6   | 77.2               | 78.0   | 7086               | 80.9   |
| 1996 | 6121.5         | 897.0          | 78.1   | 82.3   | 78.1                              | 82.3   | 77.7               | 78.0   | 6859               | 78.1   |
| 1997 | 7834.8         | 897.0          | 99.8   | 83.3   | 99.7                              | 83.4   | 99.7               | 79.3   | 8738               | 99.7   |
| 1998 | 7086.1         | 897.0          | 92.2   | 83.8   | 91.9                              | 83.8   | 90.2               | 79.9   | 8049               | 91.9   |
| 1999 | 7185.1         | 897.0          | 91.7   | 84.3   | 91.7                              | 84.2   | 91.4               | 80.5   | 8034               | 91.7   |
| 2000 | 8018.9         | 897.0          | 99.4   | 85.0   | 99.4                              | 85.0   | 101.8              | 81.5   | 8729               | 99.4   |
| 2001 | 5975.8         | 917.0          | 77.4   | 84.6   | 77.4                              | 84.6   | 74.4               | 81.2   | 6776               | 77.4   |
| 2002 | 5509.7         | 917.0          | 68.5   | 83.9   | 68.5                              | 83.9   | 68.6               | 80.6   | 6000               | 68.5   |
| 2003 | 7262.8         | 917.0          | 90.8   | 84.2   | 90.8                              | 84.2   | 90.4               | 81.0   | 7950               | 90.8   |
| 2004 | 7388.1         | 917.0          | 92.0   | 84.5   | 92.0                              | 84.5   | 91.7               | 81.5   | 8077               | 92.0   |



## US-339 NORTH ANNA-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 02 May | 683.1 | 626.4   | PF   | C21  | SCHEDULED REFUELLING OUTAGE.                                  |
| 10 Jun | 22.5  | 20.6    | UF4  | A12  | AUTOMATIC RX TRIP DUE TO BYPASS REACTOR TRIP BREAKER PROBLEM. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1980 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 22        |          |   | 255       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 683             |           |          | 849   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 84  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 71        | 0        |
| Subtotal   | 683             | 22        | 0        | 936   | 339       | 0        |
| Total  |                 | 705       |          |   | 1275      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1980 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        | 22                 | 3   |
| 13. Reactor Auxiliary Systems                  |                    | 3   |
| 14. Safety Systems                             |                    | 16  |
| 15. Reactor Cooling Systems                    |                    | 12  |
| 16. Steam generation systems                   |                    | 43  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 10  |
| 32. Feedwater and Main Steam System            |                    | 20  |
| 33. Circulating Water System                   |                    | 0   |
| 41. Main Generator Systems                     |                    | 52  |
| 42. Electrical Power Supply Systems            |                    | 88  |
| Total  | 22                 | 249   |

# US-269 OCONEE-1

**Operator:** DUKE (DUKE POWER CO.)  
**Contractor:** B&W (BABCOCK & WILCOX CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 846.0 MW(e)  
**Design Net RUP:** 887.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7260.2 GW(e).h  
**Energy Availability Factor:** 97.3%  
**Load Factor:** 97.7%  
**Operating Factor:** 97.3%  
**Energy Unavailability Factor:** 2.7%  
**Total Off-line Time:** 235 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 427.9 | 602.5 | 640.8 | 621.3 | 640.8 | 612.0 | 634.4 | 630.7 | 556.6 | 635.3 | 617.2 | 640.6 | 7260.2 |
| <b>EAF (%)</b>  | 75.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.7  | 100.0 | 100.0 | 100.0 | 97.3   |
| <b>UCF (%)</b>  | 75.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.7  | 100.0 | 100.0 | 100.0 | 97.3   |
| <b>LF (%)</b>   | 68.0  | 102.3 | 101.8 | 102.1 | 101.8 | 100.5 | 100.8 | 100.2 | 91.4  | 100.8 | 101.3 | 101.8 | 97.7   |
| <b>OF (%)</b>   | 75.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6  | 100.0 | 100.0 | 100.0 | 97.3   |
| <b>EUF (%)</b>  | 24.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.3   | 0.0   | 0.0   | 0.0   | 2.7    |
| <b>PUF (%)</b>  | 0.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.3   | 0.0   | 0.0   | 0.0   | 0.6    |
| <b>UCLF (%)</b> | 24.3  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1967  
**Date of First Criticality:** 19 Apr 1973  
**Date of Grid Connection:** 06 May 1973  
**Date of Commercial Operation:** 15 Jul 1973

**Lifetime Generation:** 176006.9 GW(e).h  
**Cumulative Energy Availability Factor:** 76.9%  
**Cumulative Load Factor:** 74.8%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 23.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5672.0         | 860.0          | 78.4   | 69.1   | 78.4                              | 63.1   | 75.3               | 61.1   | 6804               | 77.7   |
| 1984 | 6173.7         | 860.0          | 83.5   | 70.4   | 83.6                              | 64.9   | 81.7               | 63.0   | 7312               | 83.2   |
| 1985 | 7066.0         | 860.0          | 96.3   | 72.5   | 96.2                              | 67.5   | 93.8               | 65.5   | 8424               | 96.2   |
| 1986 | 4793.9         | 860.0          | 70.2   | 72.4   | 70.2                              | 67.7   | 63.6               | 65.4   | 5870               | 67.0   |
| 1987 | 5031.1         | 860.0          | 76.8   | 72.7   | 76.8                              | 68.4   | 66.8               | 65.5   | 6693               | 76.4   |
| 1988 | 7192.2         | 846.0          | 99.5   | 74.4   | 99.5                              | 70.4   | 96.8               | 67.5   | 8742               | 99.5   |
| 1989 | 5943.1         | 846.0          | 83.0   | 75.0   | 82.9                              | 71.2   | 80.2               | 68.3   | 7264               | 82.9   |
| 1990 | 6454.8         | 846.0          | 88.5   | 75.7   | 88.5                              | 72.2   | 87.1               | 69.4   | 7751               | 88.5   |
| 1991 | 6022.5         | 846.0          | 82.7   | 76.1   | 82.7                              | 72.7   | 81.3               | 70.0   | 7245               | 82.7   |
| 1992 | 6277.7         | 846.0          | 85.3   | 76.6   | 85.3                              | 73.4   | 84.5               | 70.8   | 7494               | 85.3   |
| 1993 | 6525.1         | 846.0          | 89.4   | 77.2   | 89.4                              | 74.2   | 88.0               | 71.6   | 7833               | 89.4   |
| 1994 | 6088.7         | 846.0          | 83.4   | 77.5   | 83.4                              | 74.6   | 82.2               | 72.1   | 7302               | 83.4   |
| 1995 | 6360.5         | 846.0          | 86.1   | 77.9   | 86.1                              | 75.1   | 85.8               | 72.7   | 7537               | 86.0   |
| 1996 | 5567.0         | 846.0          | 75.2   | 77.8   | 75.2                              | 75.1   | 74.9               | 72.8   | 6606               | 75.2   |
| 1997 | 3194.2         | 846.0          | 51.3   | 76.7   | 51.3                              | 74.1   | 43.1               | 71.6   | 4482               | 51.2   |
| 1998 | 5996.4         | 846.0          | 82.8   | 76.9   | 82.8                              | 74.5   | 80.9               | 72.0   | 7255               | 82.8   |
| 1999 | 6212.6         | 846.0          | 85.1   | 77.3   | 85.1                              | 74.9   | 83.8               | 72.4   | 7383               | 84.3   |
| 2000 | 6312.7         | 846.0          | 84.8   | 77.5   | 84.8                              | 75.3   | 84.9               | 72.9   | 7445               | 84.8   |
| 2001 | 6962.6         | 846.0          | 94.0   | 78.1   | 94.0                              | 75.9   | 94.0               | 73.6   | 8210               | 93.7   |
| 2002 | 6607.5         | 846.0          | 88.9   | 78.5   | 88.9                              | 76.4   | 89.2               | 74.2   | 7788               | 88.9   |
| 2003 | 5258.6         | 846.0          | 71.8   | 78.3   | 71.8                              | 76.2   | 71.0               | 74.1   | 6288               | 71.8   |
| 2004 | 7260.2         | 846.0          | 97.3   | 78.9   | 97.3                              | 76.9   | 97.7               | 74.8   | 8549               | 97.3   |

# US-269 OCONEE-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 01 Jan | 76.3  | 64.5    | UF3  | A15  | OUTAGE DELAY OF 3.18 DAYS DUE TO REACTOR COOLANT PUMP SEAL O-RINGS LEAKING. |
| 04 Jan | 52.8  | 44.6    | UF3  | A41  |   |
| 06 Jan | 1.3   | 1.1     | PF   | E31  | TURBINE OVERSPEED TRIP TEST.  |
| 08 Jan | 51.6  | 43.6    | UF2  | A15  | REACTOR COOLANT SYSTEM PIPING LEAK.   |
| 04 Sep | 52.4  | 44.3    | PF   | D31  | INSPECTION OF HEATER DRAIN PIPING.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 180       |          |  | 622       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 912                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 52              |           |          | 166                                      | 3         |          |
| E. Testing of plant systems or components  | 1               |           |          | 25                                       | 1         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 0  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 2  | 0         | 36       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         | 0        |
| Subtotal   | 53              | 180       | 0        | 1105                                     | 627       | 36       |
| Total  |                 | 233       |          |  | 1768      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1973 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 50                                       |
| 12. Reactor I&C Systems                        |                 | 71                                       |
| 13. Reactor Auxiliary Systems                  |                 | 2  |
| 14. Safety Systems                             |                 | 46                                       |
| 15. Reactor Cooling Systems                    | 127             | 131                                      |
| 16. Steam generation systems                   |                 | 176                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 0  |
| 21. Fuel Handling and Storage Facilities       |                 | 0  |
| 31. Turbine and auxiliaries                    |                 | 54                                       |
| 32. Feedwater and Main Steam System            |                 | 22                                       |
| 41. Main Generator Systems                     | 52              | 9  |
| 42. Electrical Power Supply Systems            |                 | 17                                       |
| XX. Miscellaneous Systems                      |                 | 22                                       |
| Total  | 179             | 600                                      |

# US-270 OCONEE-2

**Operator:** DUKE (DUKE POWER CO.)  
**Contractor:** B&W (BABCOCK & WILCOX CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 846.0 MW(e)  
**Design Net RUP:** 887.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5676.1 GW(e).h  
**Energy Availability Factor:** 75.8%  
**Load Factor:** 76.4%  
**Operating Factor:** 75.7%  
**Energy Unavailability Factor:** 24.2%  
**Total Off-line Time:** 2132 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 648.6 | 603.2 | 354.6 | 0.0   | 0.0   | 254.3 | 643.4 | 639.7 | 618.2 | 642.2 | 625.9 | 646.1 | 5676.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 61.3  | 0.0   | 0.0   | 47.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 75.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 61.3  | 0.0   | 0.0   | 47.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 75.8   |
| <b>LF (%)</b>   | 103.0 | 102.4 | 56.3  | 0.0   | 0.0   | 41.8  | 102.2 | 101.6 | 101.5 | 101.9 | 102.7 | 102.6 | 76.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 61.3  | 0.0   | 0.0   | 47.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 75.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 38.7  | 100.0 | 100.0 | 52.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 24.2   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 38.7  | 100.0 | 100.0 | 20.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 32.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1967  
**Date of First Criticality:** 11 Nov 1973  
**Date of Grid Connection:** 05 Dec 1973  
**Date of Commercial Operation:** 09 Sep 1974

**Lifetime Generation:** 174941.8 GW(e).h  
**Cumulative Energy Availability Factor:** 79.4%  
**Cumulative Load Factor:** 77.0%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 20.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5147.0         | 860.0          | 73.3   | 65.7   | 73.2                              | 64.9   | 68.3               | 60.9   | 6348               | 72.5   |
| 1984 | 7298.0         | 860.0          | 100.0  | 69.2   | 96.6                              | 68.4   | 96.6               | 64.5   | 8784               | 100.0  |
| 1985 | 5060.0         | 860.0          | 76.3   | 69.8   | 76.3                              | 69.1   | 67.2               | 64.7   | 6654               | 76.0   |
| 1986 | 5803.1         | 860.0          | 81.4   | 70.8   | 81.4                              | 70.1   | 77.0               | 65.8   | 7169               | 81.8   |
| 1987 | 6228.7         | 860.0          | 98.0   | 72.8   | 98.0                              | 72.3   | 82.7               | 67.1   | 8565               | 97.8   |
| 1988 | 5540.0         | 846.0          | 78.3   | 73.2   | 78.3                              | 72.7   | 74.5               | 67.6   | 6880               | 78.3   |
| 1989 | 6013.1         | 846.0          | 83.1   | 73.9   | 83.1                              | 73.4   | 81.1               | 68.5   | 7272               | 83.0   |
| 1990 | 6269.4         | 846.0          | 85.3   | 74.6   | 85.3                              | 74.1   | 84.6               | 69.5   | 7469               | 85.3   |
| 1991 | 7427.9         | 846.0          | 100.0  | 76.0   | 100.0                             | 75.6   | 100.2              | 71.3   | 8760               | 100.0  |
| 1992 | 5946.9         | 846.0          | 80.9   | 76.3   | 80.9                              | 75.9   | 80.0               | 71.7   | 7103               | 80.9   |
| 1993 | 6236.3         | 846.0          | 84.0   | 76.7   | 83.9                              | 76.3   | 84.1               | 72.4   | 7352               | 83.9   |
| 1994 | 6148.5         | 846.0          | 83.3   | 77.0   | 83.3                              | 76.7   | 83.0               | 72.9   | 7292               | 83.2   |
| 1995 | 6973.9         | 846.0          | 94.3   | 77.8   | 94.3                              | 77.5   | 94.1               | 73.9   | 8263               | 94.3   |
| 1996 | 4432.0         | 846.0          | 60.4   | 77.1   | 60.4                              | 76.7   | 59.6               | 73.3   | 5304               | 60.4   |
| 1997 | 5876.8         | 846.0          | 79.7   | 77.2   | 79.7                              | 76.8   | 79.3               | 73.5   | 6974               | 79.6   |
| 1998 | 5654.7         | 846.0          | 77.4   | 77.2   | 77.4                              | 76.9   | 76.3               | 73.6   | 6776               | 77.4   |
| 1999 | 6257.6         | 846.0          | 84.2   | 77.5   | 84.2                              | 77.2   | 84.4               | 74.1   | 7374               | 84.2   |
| 2000 | 7499.5         | 846.0          | 100.0  | 78.3   | 100.0                             | 78.0   | 100.9              | 75.1   | 8784               | 100.0  |
| 2001 | 6688.4         | 846.0          | 89.5   | 78.7   | 89.5                              | 78.5   | 90.3               | 75.6   | 7836               | 89.5   |
| 2002 | 6611.1         | 846.0          | 88.4   | 79.1   | 88.4                              | 78.8   | 89.2               | 76.1   | 7743               | 88.4   |
| 2003 | 7568.7         | 846.0          | 100.0  | 79.8   | 100.0                             | 79.5   | 102.1              | 77.0   | 8760               | 100.0  |
| 2004 | 5676.1         | 846.0          | 75.8   | 79.7   | 75.8                              | 79.4   | 76.4               | 77.0   | 6652               | 75.7   |

## US-270 OCONEE-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 20 Mar | 1852.6 | 1567.3  | PF   | C    | END-OF-CYCLE 20 REFUELLING AND STEAM GENERATOR/REACTOR VESSEL HEAD REPLACEMENT OUTAGE.  |
| 05 Jun | 206.0  | 174.2   | UF3  | A13  | OUTAGE DELAY OF 8.58 DAYS DUE TO 2A REACTOR BUILDING COOLING UNIT FAN ASSEMBLY FAILURE. |
| 13 Jun | 28.6   | 24.2    | UF3  | A31  | OUTAGE DELAY OF 1.19 DAYS DUE TO MAIN TURBINE TRIP DUE TO LOW BEARING OIL PRESSURE.     |
| 26 Jun | 44.0   | 37.2    | PF   | D    | REPAIR MOTOR SUCTION OIL PUMP DISCHARGE CHECK VALVE.                                    |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 234       |          | 0  | 617       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1852            |           |          | 879                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 43              |           |          | 70                                       | 2         |          |
| E. Testing of plant systems or components  |                 |           |          | 6  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 0  |           | 34       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 0         |          |
| Subtotal   | 1895            | 234       | 0        | 955                                      | 621       | 34       |
| Total  |                 | 2129      |          |  | 1610      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 46                                       |
| 12. Reactor I&C Systems             |                 | 68                                       |
| 13. Reactor Auxiliary Systems       | 205             | 5  |
| 14. Safety Systems                  |                 | 51                                       |
| 15. Reactor Cooling Systems         |                 | 113                                      |
| 16. Steam generation systems        |                 | 128                                      |
| 31. Turbine and auxiliaries         | 28              | 170                                      |
| 32. Feedwater and Main Steam System |                 | 9  |
| 33. Circulating Water System        |                 | 2  |
| 41. Main Generator Systems          |                 | 5  |
| 42. Electrical Power Supply Systems |                 | 15                                       |
| Total                               | 233             | 612                                      |

# US-287 OCONEE-3

**Operator:** DUKE (DUKE POWER CO.)  
**Contractor:** B&W (BABCOCK & WILCOX CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 846.0 MW(e)  
**Design Net RUP:** 887.0 MW(e)  
**Design Discharge Burnup:** 32000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5747.0 GW(e).h  
**Energy Availability Factor:** 76.3%  
**Load Factor:** 77.3%  
**Operating Factor:** 76.3%  
**Energy Unavailability Factor:** 23.7%  
**Total Off-line Time:** 2086 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 644.5 | 550.8 | 637.4 | 601.7 | 645.1 | 622.7 | 639.0 | 633.6 | 613.8 | 158.5 | 0.0   | 0.0   | 5747.0 |
| <b>EAF (%)</b>  | 100.0 | 92.2  | 100.0 | 98.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 25.9  | 0.0   | 0.0   | 76.3   |
| <b>UCF (%)</b>  | 100.0 | 92.2  | 100.0 | 98.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 25.9  | 0.0   | 0.0   | 76.3   |
| <b>LF (%)</b>   | 102.4 | 93.5  | 101.3 | 98.9  | 102.5 | 102.2 | 101.5 | 100.7 | 100.8 | 25.2  | 0.0   | 0.0   | 77.3   |
| <b>OF (%)</b>   | 100.0 | 92.1  | 100.0 | 98.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 25.8  | 0.0   | 0.0   | 76.3   |
| <b>EUF (%)</b>  | 0.0   | 7.8   | 0.0   | 1.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 74.1  | 100.0 | 100.0 | 23.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 74.1  | 100.0 | 100.0 | 23.0   |
| <b>UCLF (%)</b> | 0.0   | 7.8   | 0.0   | 1.9   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1967  
**Date of First Criticality:** 05 Sep 1974  
**Date of Grid Connection:** 18 Sep 1974  
**Date of Commercial Operation:** 16 Dec 1974

**Lifetime Generation:** 171114.1 GW(e).h  
**Cumulative Energy Availability Factor:** 77.9%  
**Cumulative Load Factor:** 76.2%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 22.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 7099.1         | 860.0          | 96.5   | 68.4   | 96.5                              | 67.2   | 94.2               | 65.4   | 8436               | 96.3   |
| 1984 | 5355.5         | 860.0          | 74.2   | 69.0   | 74.2                              | 67.9   | 70.9               | 66.0   | 6474               | 73.7   |
| 1985 | 4860.8         | 860.0          | 69.7   | 69.0   | 69.7                              | 68.0   | 64.5               | 65.8   | 6071               | 69.3   |
| 1986 | 6064.3         | 860.0          | 90.0   | 70.8   | 90.0                              | 69.9   | 80.5               | 67.0   | 7781               | 88.8   |
| 1987 | 5094.4         | 860.0          | 69.8   | 70.7   | 69.8                              | 69.9   | 67.6               | 67.1   | 6068               | 69.3   |
| 1988 | 5965.8         | 846.0          | 81.9   | 71.5   | 81.9                              | 70.7   | 80.3               | 68.0   | 7190               | 81.9   |
| 1989 | 6337.4         | 846.0          | 86.6   | 72.5   | 86.6                              | 71.8   | 85.5               | 69.2   | 7585               | 86.6   |
| 1990 | 7427.8         | 846.0          | 99.5   | 74.1   | 99.5                              | 73.5   | 100.2              | 71.1   | 8712               | 99.5   |
| 1991 | 5594.6         | 846.0          | 86.6   | 74.9   | 86.6                              | 74.2   | 75.5               | 71.3   | 6691               | 76.4   |
| 1992 | 5448.2         | 846.0          | 75.5   | 74.9   | 75.5                              | 74.3   | 73.3               | 71.4   | 6634               | 75.5   |
| 1993 | 7393.8         | 846.0          | 98.7   | 76.1   | 98.7                              | 75.6   | 99.8               | 72.9   | 8647               | 98.7   |
| 1994 | 5670.8         | 846.0          | 77.5   | 76.2   | 77.5                              | 75.7   | 76.5               | 73.1   | 6781               | 77.4   |
| 1995 | 6467.8         | 846.0          | 87.1   | 76.7   | 87.1                              | 76.2   | 87.3               | 73.8   | 7625               | 87.0   |
| 1996 | 5454.0         | 846.0          | 73.2   | 76.6   | 73.2                              | 76.1   | 73.4               | 73.7   | 6429               | 73.2   |
| 1997 | 4652.6         | 846.0          | 64.7   | 76.0   | 64.6                              | 75.6   | 62.8               | 73.3   | 5633               | 64.3   |
| 1998 | 5786.4         | 846.0          | 80.1   | 76.2   | 80.1                              | 75.8   | 78.1               | 73.5   | 7026               | 80.2   |
| 1999 | 7369.5         | 846.0          | 99.0   | 77.1   | 99.0                              | 76.7   | 99.4               | 74.5   | 8676               | 99.0   |
| 2000 | 6577.8         | 846.0          | 88.0   | 77.5   | 88.0                              | 77.1   | 88.5               | 75.0   | 7729               | 88.0   |
| 2001 | 5398.5         | 846.0          | 72.6   | 77.3   | 72.6                              | 76.9   | 72.8               | 75.0   | 6355               | 72.5   |
| 2002 | 7465.5         | 846.0          | 99.2   | 78.1   | 99.2                              | 77.7   | 100.7              | 75.9   | 8688               | 99.2   |
| 2003 | 6318.0         | 846.0          | 85.3   | 78.4   | 85.2                              | 78.0   | 85.3               | 76.2   | 7467               | 85.2   |
| 2004 | 5747.0         | 846.0          | 76.3   | 78.3   | 76.3                              | 77.9   | 77.3               | 76.2   | 6698               | 76.3   |

## US-287 OCONEE-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 26 Feb | 54.6   | 46.2    | UF4  | A31  | UNIT TRIPPED DUE TO FOREIGN MATERIAL LODGED IN A SERVO VALVE OF THE ELECTRO-HYDRAULIC CONTROL SYSTEM |
| 24 Apr | 13.9   | 11.8    | UF2  | A31  | BALANCE TURBINE DUE TO VIBRATION. REACTOR REMAINED CRITICAL.   |
| 09 Oct | 1918.0 | 1622.6  | PF   | C21  | REFUELLING OUTAGE.   |
| 27 Dec | 98.1   | 83.0    | PF   | D21  | OUTAGE EXTENDED DUE TO CORE RELOAD PROBLEMS.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 68        |          | 4  | 569       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1918            |           |          | 906                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 98              |           |          | 131                                      | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 6  | 5         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 92        | 38       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  | 16        | 0        |
| Subtotal   | 2016            | 68        | 0        | 1047                                     | 685       | 38       |
| Total  |                 | 2084      |          |  | 1770      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                                   | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories              |                 | 17                                       |
| 12. Reactor I&C Systems                  |                 | 99                                       |
| 13. Reactor Auxiliary Systems            |                 | 41                                       |
| 14. Safety Systems                       |                 | 27                                       |
| 15. Reactor Cooling Systems              |                 | 79                                       |
| 16. Steam generation systems             |                 | 152                                      |
| 21. Fuel Handling and Storage Facilities |                 | 2  |
| 31. Turbine and auxiliaries              | 68              | 76                                       |
| 32. Feedwater and Main Steam System      |                 | 20                                       |
| 41. Main Generator Systems               |                 | 5  |
| 42. Electrical Power Supply Systems      |                 | 6  |
| XX. Miscellaneous Systems                |                 | 20                                       |
| Total                                    | 68              | 544                                      |

# US-219 OYSTER CREEK

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 619.0 MW(e)  
**Design Net RUP:** 650.0 MW(e)  
**Design Discharge Burnup:** 16500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4847.0 GW(e).h  
**Energy Availability Factor:** 90.8%  
**Load Factor:** 89.1%  
**Operating Factor:** 90.8%  
**Energy Unavailability Factor:** 9.2%  
**Total Off-line Time:** 811 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 468.3 | 441.9 | 470.6 | 433.9 | 378.4 | 414.0 | 444.9 | 447.5 | 288.0 | 462.9 | 123.0 | 473.8 | 4847.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 80.6  | 99.2  | 100.0 | 100.0 | 75.0  | 100.0 | 33.5  | 100.0 | 90.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 80.7  | 99.2  | 100.0 | 100.0 | 75.0  | 100.0 | 33.5  | 100.0 | 90.8   |
| <b>LF (%)</b>   | 101.7 | 102.6 | 102.2 | 97.5  | 82.2  | 92.9  | 96.6  | 97.2  | 64.6  | 100.4 | 27.6  | 102.9 | 89.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 83.5  | 96.0  | 100.0 | 100.0 | 75.0  | 100.0 | 33.5  | 100.0 | 90.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 19.4  | 0.8   | 0.0   | 0.0   | 25.0  | 0.0   | 66.5  | 0.0   | 9.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 19.4  | 0.8   | 0.0   | 0.0   | 0.0   | 0.0   | 66.5  | 0.0   | 7.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 25.0  | 0.0   | 0.0   | 0.0   | 2.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1964  
**Date of First Criticality:** 03 May 1969  
**Date of Grid Connection:** 23 Sep 1969  
**Date of Commercial Operation:** 01 Dec 1969

**Lifetime Generation:** 128059.3 GW(e).h  
**Cumulative Energy Availability Factor:** 70.8%  
**Cumulative Load Factor:** 67.4%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 29.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 225.5          | 620.0          | 11.5   | 68.1   | 11.5                              | 63.4   | 4.2                | 58.9   | 1007               | 11.5   |
| 1984 | 305.2          | 620.0          | 9.6  | 64.2   | 9.6                               | 59.8   | 5.6                | 55.3   | 842                | 9.6    |
| 1985 | 3746.0         | 620.0          | 74.5   | 64.8   | 74.5                              | 60.7   | 69.0               | 56.2   | 6518               | 74.4   |
| 1986 | 1317.7         | 620.0          | 26.7   | 62.6   | 26.7                              | 58.7   | 24.3               | 54.3   | 2310               | 26.4   |
| 1987 | 3113.4         | 620.0          | 62.0   | 62.6   | 62.0                              | 58.9   | 57.3               | 54.5   | 5421               | 61.9   |
| 1988 | 3547.3         | 620.0          | 65.5   | 62.7   | 65.5                              | 59.2   | 65.1               | 55.0   | 5749               | 65.4   |
| 1989 | 2410.1         | 620.0          | 53.6   | 62.3   | 53.6                              | 59.0   | 44.4               | 54.5   | 4686               | 53.5   |
| 1990 | 4305.1         | 620.0          | 87.7   | 63.5   | 87.7                              | 60.3   | 79.3               | 55.7   | 7678               | 87.6   |
| 1991 | 2954.8         | 619.0          | 59.0   | 63.3   | 59.0                              | 60.3   | 54.5               | 55.6   | 5167               | 59.0   |
| 1992 | 4531.8         | 610.0          | 84.9   | 64.2   | 84.9                              | 61.3   | 84.6               | 56.9   | 7463               | 85.0   |
| 1993 | 4667.5         | 610.0          | 87.4   | 65.2   | 87.4                              | 62.4   | 87.3               | 58.1   | 7654               | 87.4   |
| 1994 | 3633.3         | 610.0          | 69.2   | 65.3   | 69.2                              | 62.7   | 68.0               | 58.5   | 6096               | 69.6   |
| 1995 | 5194.1         | 619.0          | 97.2   | 66.5   | 97.2                              | 64.0   | 95.8               | 59.9   | 8511               | 97.2   |
| 1996 | 4339.4         | 619.0          | 80.9   | 67.1   | 80.9                              | 64.6   | 79.8               | 60.7   | 7104               | 80.9   |
| 1997 | 5073.3         | 619.0          | 93.2   | 68.0   | 93.2                              | 65.7   | 93.6               | 61.9   | 8164               | 93.2   |
| 1998 | 4302.2         | 619.0          | 81.0   | 68.5   | 81.0                              | 66.2   | 79.3               | 62.5   | 7094               | 81.0   |
| 1999 | 5388.5         | 619.0          | 100.0  | 69.5   | 100.0                             | 67.3   | 99.4               | 63.7   | 8760               | 100.0  |
| 2000 | 3908.2         | 619.0          | 80.6   | 69.9   | 80.6                              | 67.7   | 71.9               | 64.0   | 7073               | 80.5   |
| 2001 | 5226.4         | 619.0          | 97.0   | 70.7   | 97.0                              | 68.7   | 96.4               | 65.0   | 8497               | 97.0   |
| 2002 | 5031.3         | 619.0          | 93.8   | 71.4   | 93.8                              | 69.4   | 92.8               | 65.8   | 8215               | 93.8   |
| 2003 | 5256.3         | 619.0          | 96.7   | 72.2   | 96.7                              | 70.2   | 96.9               | 66.7   | 8468               | 96.7   |
| 2004 | 4847.0         | 619.0          | 90.8   | 72.7   | 90.8                              | 70.8   | 89.1               | 67.4   | 7973               | 90.8   |



# US-219 OYSTER CREEK

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 26 May | 150.7 | 93.3    | PF   | D31  | TURBINE TAKEN OFFLINE FOR A PLANNED MAINTENANCE OUTAGE. REACTOR SCRAMMED 5/27/04 DUE TO IRM SPIKING WHILE INSERTING SRMS AT 2% POWER. |
| 15 Sep | 180.0 | 111.4   | UF2  | A15  | REPAIR MSIV NS04A   |
| 02 Nov | 478.5 | 296.2   | PF   | C21  | PLANNED REFUELLING OUTAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 179       |          |  | 652       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 36        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 478             |           |          | 1486                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 150             |           |          | 97                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 4  | 32        |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 0  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 15        | 9        |
| J. Grid failure or grid unavailability   |                 |           |          |  | 1         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 68        |          |
| Subtotal   | 628             | 179       | 0        | 1587                                     | 804       | 9        |
| Total  |                 | 807       |          |  | 2400      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 15                                       |
| 13. Reactor Auxiliary Systems       |                 | 10                                       |
| 14. Safety Systems                  |                 | 183                                      |
| 15. Reactor Cooling Systems         | 179             | 161                                      |
| 31. Turbine and auxiliaries         |                 | 36                                       |
| 32. Feedwater and Main Steam System |                 | 70                                       |
| 33. Circulating Water System        |                 | 7  |
| 35. All other I&C Systems           |                 | 7  |
| 41. Main Generator Systems          |                 | 34                                       |
| 42. Electrical Power Supply Systems |                 | 24                                       |
| XX. Miscellaneous Systems           |                 | 5  |
| Total                               | 179             | 552                                      |

# US-255 PALISADES

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 730.0 MW(e)  
**Design Net RUP:** 805.0 MW(e)  
**Design Discharge Burnup:** 28000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5346.1 GW(e).h  
**Energy Availability Factor:** 81.1%  
**Load Factor:** 83.4%  
**Operating Factor:** 81.6%  
**Energy Unavailability Factor:** 18.9%  
**Total Off-line Time:** 1620 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 597.2 | 537.1 | 596.1 | 569.3 | 583.5 | 560.1 | 461.0 | 429.4 | 196.4 | 0.0   | 218.3 | 597.7 | 5346.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 75.3  | 56.1  | 0.0   | 42.1  | 100.0 | 81.1   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 75.3  | 56.1  | 0.0   | 42.1  | 100.0 | 81.1   |
| <b>LF (%)</b>   | 110.0 | 105.7 | 109.8 | 108.5 | 107.4 | 106.6 | 84.9  | 79.1  | 37.4  | 0.0   | 41.5  | 110.1 | 83.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.4  | 57.6  | 0.0   | 44.2  | 100.0 | 81.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 24.7  | 43.9  | 100.0 | 57.9  | 0.0   | 18.9   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 42.0  | 100.0 | 57.9  | 0.0   | 16.7   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 24.7  | 1.9   | 0.0   | 0.0   | 0.0   | 2.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1967  
**Date of First Criticality:** 24 May 1971  
**Date of Grid Connection:** 31 Dec 1971  
**Date of Commercial Operation:** 31 Dec 1971

**Lifetime Generation:** 123524.4 GW(e).h  
**Cumulative Energy Availability Factor:** 59.8%  
**Cumulative Load Factor:** 61.8%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 40.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3770.0         | 635.0          | 60.1   | 68.3   | 60.1                              | 47.7   | 67.8               | 50.5   | 5282               | 60.3   |
| 1984 | 811.5          | 635.0          | 10.0   | 63.9   | 10.0                              | 44.8   | 14.5               | 47.7   | 1334               | 15.2   |
| 1985 | 5301.8         | 658.0          | 82.0   | 65.2   | 82.0                              | 47.5   | 92.0               | 51.0   | 7342               | 83.8   |
| 1986 | 841.2          | 730.0          | 14.9   | 61.4   | 14.9                              | 45.1   | 13.2               | 48.1   | 1323               | 15.1   |
| 1987 | 2634.4         | 730.0          | 45.2   | 60.3   | 45.2                              | 45.1   | 41.2               | 47.6   | 3980               | 45.4   |
| 1988 | 3435.2         | 730.0          | 53.7   | 59.8   | 53.7                              | 45.6   | 53.6               | 48.0   | 4853               | 55.2   |
| 1989 | 3637.8         | 730.0          | 67.4   | 60.3   | 67.4                              | 47.0   | 56.9               | 48.6   | 6019               | 68.7   |
| 1990 | 3008.1         | 730.0          | 56.1   | 60.0   | 56.1                              | 47.5   | 47.0               | 48.5   | 5073               | 57.9   |
| 1991 | 4873.8         | 730.0          | 75.4   | 60.9   | 75.4                              | 49.0   | 76.2               | 50.0   | 6693               | 76.4   |
| 1992 | 4865.1         | 730.0          | 70.5   | 61.4   | 70.5                              | 50.2   | 75.9               | 51.3   | 6293               | 71.6   |
| 1993 | 3545.7         | 730.0          | 50.4   | 60.8   | 50.4                              | 50.2   | 55.4               | 51.5   | 4595               | 52.5   |
| 1994 | 4513.8         | 730.0          | 65.5   | 61.1   | 65.5                              | 50.9   | 70.6               | 52.4   | 5860               | 66.9   |
| 1995 | 4663.5         | 730.0          | 73.0   | 61.6   | 73.0                              | 51.9   | 72.9               | 53.4   | 6491               | 74.1   |
| 1996 | 5314.3         | 730.0          | 79.7   | 62.4   | 79.7                              | 53.1   | 82.9               | 54.6   | 7068               | 80.5   |
| 1997 | 5803.5         | 730.0          | 87.6   | 63.4   | 87.6                              | 54.5   | 90.8               | 56.1   | 7714               | 88.1   |
| 1998 | 5390.6         | 730.0          | 81.1   | 64.1   | 81.1                              | 55.6   | 84.3               | 57.2   | 7142               | 81.5   |
| 1999 | 5128.4         | 730.0          | 78.4   | 64.7   | 78.4                              | 56.4   | 80.2               | 58.1   | 6910               | 78.9   |
| 2000 | 5748.0         | 730.0          | 86.8   | 65.5   | 86.8                              | 57.5   | 89.6               | 59.3   | 7672               | 87.3   |
| 2001 | 2355.6         | 730.0          | 35.1   | 64.4   | 35.2                              | 56.8   | 36.8               | 58.5   | 3118               | 35.6   |
| 2002 | 6369.4         | 730.0          | 94.2   | 65.4   | 93.2                              | 58.0   | 99.6               | 59.9   | 8187               | 93.5   |
| 2003 | 6158.2         | 730.0          | 90.0   | 66.2   | 90.0                              | 59.1   | 96.3               | 61.1   | 7914               | 90.3   |
| 2004 | 5346.1         | 730.0          | 81.1   | 66.7   | 81.1                              | 59.8   | 83.4               | 61.8   | 7164               | 81.6   |

# US-255 PALISADES

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 10 Aug | 150.6  | 115.5   | UF2  | A12  | THE PLANT WAS REMOVED FROM SERVICE TO REPLACE SEALS ON CONTROL ROD DRIVE MECHANISMS. |
| 31 Aug | 37.8   | 29.0    | UF2  | P32  | REMOVED FROM SERVICE DUE TO A FIRE IN THE CONDENSATE PUMP MOTOR.                     |
| 19 Sep | 1429.4 | 1096.3  | PF   | C21  | REFUELLING OUTAGE.   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 150       |          |  | 1763      |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1429            |           |          | 1174                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 170                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          |  | 7         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 12        | 107      |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 7        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 28        |          |
| P. Fire  |                 | 37        |          |  |           |          |
| Subtotal   | 1429            | 187       | 0        | 1345                                     | 1816      | 114      |
| Total  |                 | 1616      |          |  | 3275      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 150             | 141                                      |
| 13. Reactor Auxiliary Systems       |                 | 155                                      |
| 14. Safety Systems                  |                 | 106                                      |
| 15. Reactor Cooling Systems         |                 | 139                                      |
| 16. Steam generation systems        |                 | 479                                      |
| 31. Turbine and auxiliaries         |                 | 109                                      |
| 32. Feedwater and Main Steam System |                 | 101                                      |
| 33. Circulating Water System        |                 | 38                                       |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 61                                       |
| 42. Electrical Power Supply Systems |                 | 281                                      |
| Total                               | 150             | 1610                                     |

# US-528 PALO VERDE-1

**Operator:** ANPP (ARIZONA NUCLEAR POWER PROJECT)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1243.0 MW(e)  
**Design Net RUP:** 1221.0 MW(e)  
**Design Discharge Burnup:** 38000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9235.8 GW(e).h  
**Energy Availability Factor:** 87.3%  
**Load Factor:** 84.6%  
**Operating Factor:** 87.3%  
**Energy Unavailability Factor:** 12.7%  
**Total Off-line Time:** 1115 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 934.6 | 719.1 | 927.9 | 54.0 | 555.2 | 707.8 | 902.3 | 898.6 | 869.0 | 898.4 | 872.6 | 896.3 | 9235.8 |
| <b>EAF (%)</b>  | 100.0 | 85.0  | 100.0 | 6.7  | 69.0  | 85.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.3   |
| <b>UCF (%)</b>  | 100.0 | 85.0  | 100.0 | 6.7  | 69.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 88.5   |
| <b>LF (%)</b>   | 101.1 | 83.1  | 100.3 | 6.0  | 60.0  | 79.1  | 97.6  | 97.2  | 97.1  | 97.1  | 97.5  | 96.9  | 84.6   |
| <b>OF (%)</b>   | 100.0 | 84.9  | 100.0 | 6.7  | 68.8  | 85.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.3   |
| <b>EUF (%)</b>  | 0.0   | 15.0  | 0.0   | 93.3 | 31.0  | 14.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.7   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 93.3 | 31.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3   |
| <b>UCLF (%)</b> | 0.0   | 15.0  | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 14.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1976  
**Date of First Criticality:** 25 May 1985  
**Date of Grid Connection:** 10 Jun 1985  
**Date of Commercial Operation:** 28 Jan 1986

**Lifetime Generation:** 156824.3 GW(e).h  
**Cumulative Energy Availability Factor:** 77.5%  
**Cumulative Load Factor:** 76.1%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 22.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 1127.7         | 1270.0         | 0.0  | 0.0    | 66.2                              | 100.0  | 10.4               | 0.0    | 2019               | 23.7   |
| 1986 | 6264.7         | 1221.0         | 66.6   | 66.6   | 66.6                              | 66.6   | 60.6               | 60.6   | 5349               | 63.1   |
| 1987 | 5268.3         | 1221.0         | 50.9   | 58.6   | 50.9                              | 58.6   | 49.3               | 54.8   | 4500               | 51.4   |
| 1988 | 6668.7         | 1221.0         | 62.8   | 60.0   | 62.8                              | 60.0   | 62.2               | 57.3   | 5585               | 63.6   |
| 1989 | 1796.6         | 1221.0         | 14.1   | 48.5   | 14.1                              | 48.4   | 16.8               | 47.1   | 1522               | 17.4   |
| 1990 | 4719.5         | 1221.0         | 42.6   | 47.3   | 42.6                              | 47.3   | 44.1               | 46.5   | 3925               | 44.8   |
| 1991 | 9312.1         | 1221.0         | 87.1   | 54.0   | 85.8                              | 53.7   | 87.1               | 53.3   | 7567               | 86.4   |
| 1992 | 7118.8         | 1221.0         | 67.2   | 55.9   | 67.2                              | 55.7   | 66.4               | 55.2   | 6010               | 68.4   |
| 1993 | 7514.8         | 1221.0         | 76.1   | 58.4   | 76.1                              | 58.2   | 70.3               | 57.1   | 6665               | 76.1   |
| 1994 | 9772.5         | 1221.0         | 98.8   | 62.9   | 98.8                              | 62.7   | 91.4               | 60.9   | 8656               | 98.8   |
| 1995 | 8526.8         | 1224.0         | 82.1   | 64.8   | 82.1                              | 64.7   | 79.5               | 62.8   | 7244               | 82.7   |
| 1996 | 8713.0         | 1227.0         | 84.4   | 66.6   | 82.0                              | 66.3   | 80.8               | 64.4   | 7246               | 82.5   |
| 1997 | 10737.7        | 1244.0         | 98.8   | 69.3   | 98.8                              | 69.0   | 98.5               | 67.3   | 8658               | 98.8   |
| 1998 | 9575.0         | 1243.0         | 89.0   | 70.9   | 89.0                              | 70.6   | 87.9               | 68.9   | 7819               | 89.3   |
| 1999 | 9653.9         | 1243.0         | 88.8   | 72.2   | 88.8                              | 71.9   | 88.7               | 70.4   | 7774               | 88.7   |
| 2000 | 10966.6        | 1243.0         | 99.8   | 74.1   | 99.8                              | 73.8   | 100.4              | 72.4   | 8770               | 99.8   |
| 2001 | 9559.6         | 1243.0         | 88.0   | 74.9   | 88.0                              | 74.7   | 87.8               | 73.4   | 7712               | 88.0   |
| 2002 | 9705.0         | 1243.0         | 90.1   | 75.8   | 90.1                              | 75.6   | 89.1               | 74.3   | 7890               | 90.1   |
| 2003 | 10587.1        | 1243.0         | 98.2   | 77.1   | 98.2                              | 76.9   | 97.2               | 75.6   | 8604               | 98.2   |
| 2004 | 9235.8         | 1243.0         | 88.5   | 77.7   | 87.3                              | 77.5   | 84.6               | 76.1   | 7669               | 87.3   |

# US-528 PALO VERDE-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 03 Feb | 104.5 | 129.9   | UF2  | A15  | MANUALLY SHUTDOWN THE UNIT DUE TO A SOCKET WELD LEAK ON THE RCS PRESSURE BOUNDARY UPSTREAM OF VALVE SIA-V056.<br>SCHEDULED REFUELLING OUTAGE.<br>AUTOMATIC RX TRIP DUE TO LOSS OF OFF SITE POWER CAUSED BY MAJOR GRID DISTURBANCE. |
| 03 Apr | 903.7 | 1123.3  | PF   | C21  |  |
| 14 Jun | 105.1 | 130.6   | XF   | J    |  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 104       |          |  | 606       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 9         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 903             |           |          | 1181                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 67                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 13        |          |
| J. Grid failure or grid unavailability   |                 |           | 105      |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 27        | 13       |
| Subtotal   | 903             | 104       | 105      | 1248                                     | 655       | 14       |
| Total  |                 | 1112      |          |  | 1917      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 117                                      |
| 13. Reactor Auxiliary Systems       |                 | 5  |
| 14. Safety Systems                  |                 | 18                                       |
| 15. Reactor Cooling Systems         | 104             | 79                                       |
| 16. Steam generation systems        |                 | 60                                       |
| 31. Turbine and auxiliaries         |                 | 6  |
| 32. Feedwater and Main Steam System |                 | 121                                      |
| 35. All other I&C Systems           |                 | 2  |
| 41. Main Generator Systems          |                 | 10                                       |
| 42. Electrical Power Supply Systems |                 | 73                                       |
| XX. Miscellaneous Systems           |                 | 2  |
| Total                               | 104             | 493                                      |

# US-529 PALO VERDE-2

**Operator:** ANPP (ARIZONA NUCLEAR POWER PROJECT)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1243.0 MW(e)  
**Design Net RUP:** 1304.0 MW(e)  
**Design Discharge Burnup:** 38000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10662.1 GW(e).h  
**Energy Availability Factor:** 92.6%  
**Load Factor:** 92.0%  
**Operating Factor:** 92.6%  
**Energy Unavailability Factor:** 7.4%  
**Total Off-line Time:** 646 hours

## 3. 2004 Monthly Performance Data

|                 | Jan    | Feb   | Mar   | Apr   | May    | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|--------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 1005.8 | 603.4 | 702.6 | 975.1 | 1006.9 | 756.1 | 833.0 | 959.6 | 932.1 | 968.9 | 941.3 | 977.3 | 10662.1 |
| <b>EAF (%)</b>  | 100.0  | 59.3  | 75.9  | 100.0 | 100.0  | 82.4  | 90.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6    |
| <b>UCF (%)</b>  | 100.0  | 59.3  | 75.9  | 100.0 | 100.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 94.9    |
| <b>LF (%)</b>   | 108.8  | 69.8  | 70.7  | 101.4 | 101.4  | 78.7  | 83.9  | 96.6  | 97.0  | 97.6  | 97.9  | 98.4  | 92.0    |
| <b>OF (%)</b>   | 100.0  | 64.7  | 73.3  | 100.0 | 100.0  | 82.4  | 90.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6    |
| <b>EUF (%)</b>  | 0.0    | 40.7  | 24.1  | 0.0   | 0.0    | 17.6  | 9.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.4     |
| <b>PUF (%)</b>  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0    | 40.7  | 24.1  | 0.0   | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.1     |
| <b>XUF (%)</b>  | 0.0    | 0.0   | 0.0   | 0.0   | 0.0    | 17.6  | 9.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.3     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1976      **Lifetime Generation:** 156050.2 GW(e).h  
**Date of First Criticality:** 18 Apr 1986      **Cumulative Energy Availability Factor:** 79.0%  
**Date of Grid Connection:** 20 May 1986      **Cumulative Load Factor:** 78.6%  
**Date of Commercial Operation:** 19 Sep 1986      **Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 21.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1987 | 8190.0         | 1221.0         | 77.6   | 77.6   | 77.6                              | 77.6   | 76.6               | 76.6   | 6860               | 78.3   |
| 1988 | 6747.2         | 1221.0         | 62.6   | 70.1   | 62.6                              | 70.1   | 62.9               | 69.7   | 5613               | 63.9   |
| 1989 | 4698.8         | 1221.0         | 44.3   | 61.5   | 44.3                              | 61.5   | 43.9               | 61.1   | 4003               | 45.7   |
| 1990 | 6242.2         | 1221.0         | 58.6   | 60.8   | 58.6                              | 60.8   | 58.4               | 60.4   | 5276               | 60.2   |
| 1991 | 8265.2         | 1221.0         | 76.3   | 63.9   | 76.3                              | 63.9   | 77.3               | 63.8   | 6690               | 76.4   |
| 1992 | 10104.5        | 1221.0         | 94.8   | 69.0   | 94.9                              | 69.0   | 94.2               | 68.9   | 8341               | 95.0   |
| 1993 | 5125.3         | 1221.0         | 50.9   | 66.5   | 50.9                              | 66.5   | 47.9               | 65.9   | 4621               | 52.8   |
| 1994 | 6573.9         | 1221.0         | 66.8   | 66.5   | 66.8                              | 66.5   | 61.5               | 65.3   | 5919               | 67.6   |
| 1995 | 9070.9         | 1224.0         | 84.2   | 68.5   | 84.2                              | 68.5   | 84.6               | 67.5   | 7420               | 84.7   |
| 1996 | 9346.1         | 1227.0         | 85.5   | 70.2   | 85.5                              | 70.2   | 86.7               | 69.4   | 7548               | 85.9   |
| 1997 | 9322.7         | 1244.0         | 87.2   | 71.8   | 87.2                              | 71.8   | 85.5               | 70.9   | 7661               | 87.4   |
| 1998 | 11084.8        | 1243.0         | 100.0  | 74.1   | 100.0                             | 74.1   | 101.8              | 73.5   | 8760               | 100.0  |
| 1999 | 9797.3         | 1243.0         | 89.7   | 75.3   | 89.7                              | 75.3   | 90.0               | 74.8   | 7857               | 89.7   |
| 2000 | 9525.3         | 1243.0         | 88.2   | 76.3   | 88.2                              | 76.3   | 87.2               | 75.7   | 7743               | 88.1   |
| 2001 | 10083.5        | 1243.0         | 91.4   | 77.3   | 91.4                              | 77.3   | 92.6               | 76.8   | 8002               | 91.3   |
| 2002 | 10019.2        | 1243.0         | 91.1   | 78.2   | 91.1                              | 78.2   | 92.0               | 77.8   | 7981               | 91.1   |
| 2003 | 8444.4         | 1243.0         | 77.7   | 78.1   | 77.7                              | 78.1   | 77.6               | 77.8   | 6809               | 77.7   |
| 2004 | 10662.1        | 1319.0         | 94.9   | 79.1   | 92.6                              | 79.0   | 92.0               | 78.6   | 8138               | 92.6   |

## US-529 PALO VERDE-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 19 Feb | 444.0 | 592.7   | UF5  | A16  | MANUALLY TRIPPED RX PER SHUTDOWN PROCEDURE AT 20% POWER DUE TO SG#1 TUBE LEAK.     |
| 14 Jun | 126.6 | 169.0   | XF   | J    | AUTOMATIC RX TRIP DUE TO A LOSS OF OFFSITE POWER CAUSED BY MAJOR GRID DISTURBANCE. |
| 14 Jul | 73.2  | 97.7    | XF   | N    | RX TRIP FOLLOWING A TURBINE ON LOSS OF GENERATOR FIELD DUE TO A LIGHTNING STRIKE.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1987 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 443       |          |  | 167       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 15        |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 1119                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 273                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| J. Grid failure or grid unavailability   |                 |           | 126      |  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 145                                      | 49        |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 73       |  |           |          |
| Subtotal   | 0               | 443       | 199      | 1537                                     | 231       | 0        |
| Total  |                 | 642       |          |  | 1768      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1987 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 27                                       |
| 13. Reactor Auxiliary Systems                  |                 | 8  |
| 14. Safety Systems                             |                 | 2  |
| 15. Reactor Cooling Systems                    |                 | 12                                       |
| 16. Steam generation systems                   | 443             | 6  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 5  |
| 31. Turbine and auxiliaries                    |                 | 11                                       |
| 32. Feedwater and Main Steam System            |                 | 7  |
| 35. All other I&C Systems                      |                 | 2  |
| 41. Main Generator Systems                     |                 | 6  |
| 42. Electrical Power Supply Systems            |                 | 19                                       |
| Total  | 443             | 105                                      |

# US-530 PALO VERDE-3

**Operator:** ANPP (ARIZONA NUCLEAR POWER PROJECT)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1247.0 MW(e)  
**Design Net RUP:** 1304.0 MW(e)  
**Design Discharge Burnup:** 38000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8223.3 GW(e).h  
**Energy Availability Factor:** 76.6%  
**Load Factor:** 75.1%  
**Operating Factor:** 76.6%  
**Energy Unavailability Factor:** 23.4%  
**Total Off-line Time:** 2055 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct  | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|--------|
| <b>GW(e).h</b>  | 945.9 | 832.8 | 708.1 | 916.0 | 908.2 | 511.2 | 919.6 | 919.2 | 890.5 | 25.7 | 0.0   | 646.3 | 8223.3 |
| <b>EAF (%)</b>  | 100.0 | 93.1  | 78.4  | 100.0 | 100.0 | 64.4  | 100.0 | 100.0 | 100.0 | 3.2  | 0.0   | 80.4  | 76.6   |
| <b>UCF (%)</b>  | 100.0 | 93.1  | 78.4  | 100.0 | 100.0 | 85.9  | 100.0 | 100.0 | 100.0 | 3.2  | 0.0   | 80.4  | 78.4   |
| <b>LF (%)</b>   | 101.9 | 96.0  | 76.3  | 102.0 | 97.9  | 56.9  | 99.1  | 99.1  | 99.2  | 2.8  | 0.0   | 69.7  | 75.1   |
| <b>OF (%)</b>   | 100.0 | 94.1  | 77.2  | 100.0 | 100.0 | 64.3  | 100.0 | 100.0 | 100.0 | 3.2  | 0.0   | 80.2  | 76.6   |
| <b>EUF (%)</b>  | 0.0   | 6.9   | 21.6  | 0.0   | 0.0   | 35.6  | 0.0   | 0.0   | 0.0   | 96.8 | 100.0 | 19.6  | 23.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 96.8 | 100.0 | 19.6  | 18.1   |
| <b>UCLF (%)</b> | 0.0   | 6.9   | 21.6  | 0.0   | 0.0   | 14.1  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 3.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.5  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 1.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1976      **Lifetime Generation:** 151287.3 GW(e).h  
**Date of First Criticality:** 25 Oct 1987      **Cumulative Energy Availability Factor:** 82.7%  
**Date of Grid Connection:** 28 Nov 1987      **Cumulative Load Factor:** 82.4%  
**Date of Commercial Operation:** 08 Jan 1988      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 17.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 10035.5        | 1221.0         | 94.9   | 94.9   | 94.9                              | 94.9   | 95.4               | 95.4   | 8177               | 94.9   |
| 1989 | 1328.0         | 1221.0         | 9.0  | 51.6   | 9.0                               | 51.6   | 12.4               | 53.6   | 1096               | 12.5   |
| 1990 | 9636.0         | 1221.0         | 91.6   | 65.0   | 91.6                              | 65.0   | 90.1               | 65.8   | 8048               | 91.9   |
| 1991 | 7518.5         | 1221.0         | 75.3   | 67.6   | 70.8                              | 66.5   | 70.3               | 66.9   | 6272               | 71.6   |
| 1992 | 8386.2         | 1221.0         | 78.7   | 69.8   | 78.7                              | 68.9   | 78.2               | 69.2   | 6923               | 78.8   |
| 1993 | 9393.9         | 1221.0         | 90.1   | 73.2   | 90.1                              | 72.5   | 87.8               | 72.3   | 7898               | 90.2   |
| 1994 | 6824.5         | 1221.0         | 66.3   | 72.2   | 66.4                              | 71.6   | 63.8               | 71.1   | 5920               | 67.6   |
| 1995 | 9386.8         | 1225.0         | 86.6   | 74.0   | 86.6                              | 73.5   | 87.5               | 73.1   | 7628               | 87.1   |
| 1996 | 10789.6        | 1230.0         | 99.5   | 76.9   | 99.0                              | 76.3   | 99.9               | 76.1   | 8699               | 99.0   |
| 1997 | 9456.1         | 1247.0         | 89.1   | 78.2   | 89.1                              | 77.6   | 86.6               | 77.2   | 7820               | 89.3   |
| 1998 | 9600.9         | 1247.0         | 89.3   | 79.2   | 89.3                              | 78.7   | 87.9               | 78.2   | 7835               | 89.4   |
| 1999 | 10956.5        | 1247.0         | 100.0  | 80.9   | 100.0                             | 80.5   | 100.3              | 80.1   | 8760               | 100.0  |
| 2000 | 9888.7         | 1247.0         | 89.9   | 81.6   | 89.9                              | 81.3   | 90.3               | 80.9   | 7898               | 89.9   |
| 2001 | 9170.4         | 1247.0         | 85.0   | 81.9   | 85.0                              | 81.5   | 83.9               | 81.1   | 7439               | 84.9   |
| 2002 | 11137.7        | 1247.0         | 100.0  | 83.1   | 100.0                             | 82.8   | 102.0              | 82.5   | 8760               | 100.0  |
| 2003 | 9554.7         | 1247.0         | 88.0   | 83.4   | 88.0                              | 83.1   | 87.5               | 82.8   | 7712               | 88.0   |
| 2004 | 8223.3         | 1247.0         | 78.4   | 83.1   | 76.6                              | 82.7   | 75.1               | 82.4   | 6729               | 76.6   |



## US-530 PALO VERDE-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 28 Feb | 209.7  | 261.5   | UF2  | A41  | AUTOMATIC TURBINE TRIP ON LOSS OF GENERATOR FIELD DUE TO AN EXCITATION CONTROL SYSTEM FAILURE. FOLLOWING TURBINE TRIP THE RX WAS MANUALLY SHUTDOWN. |
| 07 Jun | 101.6  | 126.7   | UF4  | A31  | AUTOMATIC RX TRIP ON LOW DNBR AFTER TURBINE CONTROL SYSTEM ANOMALY.   |
| 14 Jun | 154.9  | 193.1   | XF   | J    | AUTOMATIC RX TRIP DUE TO LOSS OF OFF SITE POWER CAUSED BY MAJOR GRID DISTURBANCE.   |
| 02 Oct | 1586.6 | 1978.5  | PF   | C21  | REFUELLING OUTAGE   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 311       |          |  | 122       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1586            |           |          | 1072                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 95                                       | 11        |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  |           | 3        |
| J. Grid failure or grid unavailability   |                 |           | 154      |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 27        | 24       |
| Subtotal   | 1586            | 311       | 154      | 1167                                     | 166       | 25       |
| Total  |                 | 2051      |          |  | 1358      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 2  |
| 13. Reactor Auxiliary Systems                  |                 | 7  |
| 14. Safety Systems                             |                 | 12                                       |
| 16. Steam generation systems                   |                 | 2  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    | 101             | 9  |
| 32. Feedwater and Main Steam System            |                 | 5  |
| 41. Main Generator Systems                     | 209             |  |
| 42. Electrical Power Supply Systems            |                 | 40                                       |
| Total  | 310             | 79                                       |

# US-277 PEACH BOTTOM-2

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1112.0 MW(e)  
**Design Net RUP:** 1065.0 MW(e)  
**Design Discharge Burnup:** 27500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8886.1 GW(e).h  
**Energy Availability Factor:** 91.8%  
**Load Factor:** 91.0%  
**Operating Factor:** 91.8%  
**Energy Unavailability Factor:** 8.2%  
**Total Off-line Time:** 718 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 851.2 | 682.3 | 848.2 | 811.8 | 841.7 | 806.0 | 825.3 | 775.5 | 347.6 | 551.3 | 827.1 | 717.9 | 8886.1 |
| <b>EAF (%)</b>  | 100.0 | 88.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 43.3  | 76.4  | 100.0 | 92.6  | 91.8   |
| <b>UCF (%)</b>  | 100.0 | 88.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 43.3  | 76.4  | 100.0 | 92.6  | 91.9   |
| <b>LF (%)</b>   | 102.9 | 88.2  | 102.5 | 101.5 | 101.7 | 100.7 | 99.8  | 93.7  | 43.4  | 66.5  | 103.3 | 86.8  | 91.0   |
| <b>OF (%)</b>   | 100.0 | 88.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 45.4  | 74.2  | 100.0 | 92.6  | 91.8   |
| <b>EUF (%)</b>  | 0.0   | 11.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 56.7  | 23.6  | 0.0   | 7.4   | 8.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 56.7  | 23.6  | 0.0   | 0.0   | 6.6    |
| <b>UCLF (%)</b> | 0.0   | 11.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.4   | 1.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1968  
**Date of First Criticality:** 16 Sep 1973  
**Date of Grid Connection:** 18 Feb 1974  
**Date of Commercial Operation:** 05 Jul 1974

**Lifetime Generation:** 193844.4 GW(e).h  
**Cumulative Energy Availability Factor:** 70.2%  
**Cumulative Load Factor:** 67.3%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 29.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4481.1         | 1051.0         | 49.6   | 62.3   | 49.0                              | 62.3   | 48.7               | 60.8   | 4461               | 50.9   |
| 1984 | 2465.8         | 1051.0         | 28.9   | 59.0   | 28.9                              | 58.9   | 26.7               | 57.4   | 2544               | 29.0   |
| 1985 | 2378.2         | 1051.0         | 28.7   | 56.2   | 28.7                              | 56.2   | 25.8               | 54.5   | 2570               | 29.3   |
| 1986 | 6896.6         | 1051.0         | 79.8   | 58.2   | 79.8                              | 58.1   | 74.9               | 56.2   | 7010               | 80.0   |
| 1987 | 1599.9         | 1051.0         | 16.5   | 55.0   | 16.5                              | 54.9   | 17.4               | 53.2   | 1724               | 19.7   |
| 1988 | 0.0            | 1051.0         | 0.0  | 51.0   | 0.0                               | 51.0   | 0.0                | 49.4   | 0                  | 0.0    |
| 1989 | 3880.9         | 1051.0         | 52.3   | 51.1   | 52.3                              | 51.1   | 42.2               | 48.9   | 4735               | 54.1   |
| 1990 | 6699.8         | 1055.0         | 78.9   | 52.9   | 78.9                              | 52.8   | 72.5               | 50.4   | 6977               | 79.6   |
| 1991 | 5121.0         | 1055.0         | 58.8   | 53.2   | 58.8                              | 53.2   | 55.4               | 50.7   | 5277               | 60.2   |
| 1992 | 5677.9         | 1055.0         | 64.9   | 53.9   | 64.9                              | 53.8   | 61.3               | 51.3   | 5811               | 66.2   |
| 1993 | 7704.1         | 1053.0         | 85.9   | 55.6   | 85.9                              | 55.5   | 83.5               | 53.0   | 7571               | 86.4   |
| 1994 | 7450.7         | 1055.0         | 88.8   | 57.2   | 88.8                              | 57.2   | 80.6               | 54.4   | 7783               | 88.8   |
| 1995 | 9363.4         | 1093.0         | 98.2   | 59.3   | 98.2                              | 59.2   | 97.8               | 56.5   | 8598               | 98.2   |
| 1996 | 7660.6         | 1093.0         | 93.1   | 60.8   | 93.1                              | 60.8   | 79.8               | 57.6   | 8176               | 93.1   |
| 1997 | 9570.3         | 1093.0         | 98.9   | 62.5   | 98.9                              | 62.5   | 100.0              | 59.5   | 8663               | 98.9   |
| 1998 | 7658.8         | 1093.0         | 90.5   | 63.8   | 90.4                              | 63.7   | 80.0               | 60.4   | 7923               | 90.4   |
| 1999 | 9462.3         | 1093.0         | 98.6   | 65.2   | 98.6                              | 65.2   | 98.8               | 62.0   | 8635               | 98.6   |
| 2000 | 8523.0         | 1093.0         | 93.0   | 66.3   | 93.0                              | 66.3   | 88.8               | 63.0   | 8169               | 93.0   |
| 2001 | 9369.2         | 1093.0         | 97.8   | 67.5   | 97.8                              | 67.5   | 97.9               | 64.4   | 8563               | 97.8   |
| 2002 | 8838.9         | 1093.0         | 93.0   | 68.4   | 93.0                              | 68.4   | 92.3               | 65.4   | 8149               | 93.0   |
| 2003 | 9265.8         | 1115.0         | 96.3   | 69.4   | 96.3                              | 69.4   | 94.9               | 66.5   | 8430               | 96.2   |
| 2004 | 8886.1         | 1112.0         | 91.8   | 70.2   | 91.8                              | 70.2   | 91.0               | 67.3   | 8066               | 91.8   |

## US-277 PEACH BOTTOM-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 22 Feb | 77.2  | 85.8    | UF5  | A31  | UNIT 2 WAS MANUALLY SCRAMMED DUE TO LOSS OF CONDENSER VACUUM. AN RFPT EXHAUST TO CONDENSER EXPANSION JOINT FAILED, ALLOWING AIR IN-LEAKAGE TO EXCEED THE CAPACITY OF THE OFF-GAS SYSTEM, RESULTING IN A BUILDUP OF NONCONDENSIBLE GASES IN THE CONDENSER. |
| 14 Sep | 584.1 | 649.5   | PF   | C    |   |
| 22 Dec | 55.0  | 61.2    | UF4  | A31  |   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 132       |          |  | 457       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 584             |           |          | 1403                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 253                                      | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 6  | 0         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 1  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 129                                      | 48        | 14       |
| J. Grid failure or grid unavailability   |                 |           |          |  | 6         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 38                                       | 8         | 1        |
| Subtotal   | 584             | 132       | 0        | 1830                                     | 525       | 15       |
| Total  |                 | 716       |          |  | 2370      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 25                                       |
| 13. Reactor Auxiliary Systems       |                 | 18                                       |
| 14. Safety Systems                  |                 | 52                                       |
| 15. Reactor Cooling Systems         |                 | 119                                      |
| 31. Turbine and auxiliaries         | 132             | 53                                       |
| 32. Feedwater and Main Steam System |                 | 34                                       |
| 35. All other I&C Systems           |                 | 2  |
| 41. Main Generator Systems          |                 | 7  |
| 42. Electrical Power Supply Systems |                 | 60                                       |
| XX. Miscellaneous Systems           |                 | 7  |
| Total                               | 132             | 377                                      |

# US-278 PEACH BOTTOM-3

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1112.0 MW(e)  
**Design Net RUP:** 1065.0 MW(e)  
**Design Discharge Burnup:** 27500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9989.1 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 102.3%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 852.6 | 788.8 | 853.7 | 823.3 | 834.2 | 816.8 | 839.6 | 842.9 | 810.9 | 850.3 | 823.6 | 852.5 | 9989.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 103.1 | 101.9 | 103.2 | 103.0 | 100.8 | 102.0 | 101.5 | 101.9 | 101.3 | 102.6 | 102.9 | 103.0 | 102.3  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1968  
**Date of First Criticality:** 07 Aug 1974  
**Date of Grid Connection:** 01 Sep 1974  
**Date of Commercial Operation:** 23 Dec 1974

**Lifetime Generation:** 192305.5 GW(e).h  
**Cumulative Energy Availability Factor:** 70.8%  
**Cumulative Load Factor:** 69.0%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 29.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2465.7         | 1035.0         | 27.5   | 62.0   | 27.1                              | 61.9   | 27.2               | 62.0   | 2714               | 31.0   |
| 1984 | 7445.5         | 1035.0         | 86.2   | 64.4   | 85.2                              | 64.2   | 81.9               | 64.0   | 7545               | 85.9   |
| 1985 | 3320.8         | 1035.0         | 45.1   | 62.7   | 45.1                              | 62.5   | 36.6               | 61.5   | 3988               | 45.5   |
| 1986 | 4858.8         | 1035.0         | 60.9   | 62.5   | 60.9                              | 62.4   | 53.6               | 60.8   | 5542               | 63.3   |
| 1987 | 1507.7         | 1035.0         | 14.4   | 58.8   | 14.4                              | 58.7   | 16.6               | 57.4   | 1658               | 18.9   |
| 1988 | 0.0            | 1035.0         | 0.0  | 54.6   | 0.0                               | 54.5   | 0.0                | 53.3   | 0                  | 0.0    |
| 1989 | 247.3          | 1035.0         | 0.1  | 51.0   | 0.1                               | 50.9   | 2.7                | 50.0   | 472                | 5.4    |
| 1990 | 7534.1         | 1035.0         | 87.1   | 53.2   | 87.1                              | 53.1   | 83.1               | 52.0   | 7684               | 87.7   |
| 1991 | 5118.9         | 1035.0         | 59.1   | 53.6   | 57.3                              | 53.4   | 56.5               | 52.3   | 5212               | 59.5   |
| 1992 | 7180.9         | 1035.0         | 83.7   | 55.3   | 83.6                              | 55.0   | 79.0               | 53.8   | 7391               | 84.1   |
| 1993 | 6314.0         | 1035.0         | 73.9   | 56.2   | 73.9                              | 56.0   | 69.6               | 54.6   | 6594               | 75.3   |
| 1994 | 8867.4         | 1035.0         | 97.9   | 58.3   | 97.9                              | 58.1   | 97.8               | 56.8   | 8588               | 98.0   |
| 1995 | 7172.5         | 1049.0         | 90.1   | 59.9   | 90.1                              | 59.7   | 78.1               | 57.8   | 7929               | 90.5   |
| 1996 | 9424.7         | 1093.0         | 98.2   | 61.7   | 98.2                              | 61.5   | 98.2               | 59.7   | 8627               | 98.2   |
| 1997 | 7566.6         | 1093.0         | 90.3   | 63.0   | 90.3                              | 62.8   | 79.0               | 60.6   | 7909               | 90.3   |
| 1998 | 8823.6         | 1093.0         | 93.3   | 64.3   | 93.3                              | 64.2   | 92.2               | 62.0   | 8172               | 93.3   |
| 1999 | 8558.6         | 1093.0         | 92.5   | 65.5   | 92.5                              | 65.3   | 89.4               | 63.1   | 8100               | 92.5   |
| 2000 | 9556.8         | 1093.0         | 99.3   | 66.8   | 99.3                              | 66.7   | 99.5               | 64.6   | 8722               | 99.3   |
| 2001 | 8524.4         | 1093.0         | 93.1   | 67.9   | 93.1                              | 67.7   | 89.0               | 65.5   | 8153               | 93.1   |
| 2002 | 9647.4         | 1093.0         | 99.8   | 69.0   | 99.8                              | 68.9   | 100.8              | 66.8   | 8740               | 99.8   |
| 2003 | 8937.8         | 1097.0         | 92.4   | 69.9   | 92.4                              | 69.8   | 93.0               | 67.8   | 8089               | 92.3   |
| 2004 | 9989.1         | 1112.0         | 100.0  | 71.0   | 100.0                             | 70.8   | 102.3              | 69.0   | 8784               | 100.0  |

## US-278 PEACH BOTTOM-3

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          | 9   | 394       | 5        |
| B. Refuelling without a maintenance  |                 |           |          |   | 20        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1471  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 104   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 18  | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 213       | 7        |
| J. Grid failure or grid unavailability   |                 |           |          |   | 12        | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 26  | 0         | 4        |
| Subtotal   | 0               | 0         | 0        | 1628  | 640       | 18       |
| Total  |                 | 0         |          |   | 2286      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 29  |
| 13. Reactor Auxiliary Systems       |                    | 12  |
| 14. Safety Systems                  |                    | 49  |
| 15. Reactor Cooling Systems         |                    | 122   |
| 31. Turbine and auxiliaries         |                    | 53  |
| 32. Feedwater and Main Steam System |                    | 50  |
| 33. Circulating Water System        |                    | 2   |
| 41. Main Generator Systems          |                    | 21  |
| 42. Electrical Power Supply Systems |                    | 58  |
| Total                               | 0                  | 396   |

# US-440 PERRY-1

**Operator:** FENOC (FIRST ENERGY NUCLEAR OPERATING CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1235.0 MW(e)  
**Design Net RUP:** 1205.0 MW(e)  
**Design Discharge Burnup:** 25000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10227.3 GW(e).h  
**Energy Availability Factor:** 95.4%  
**Load Factor:** 94.3%  
**Operating Factor:** 95.4%  
**Energy Unavailability Factor:** 4.6%  
**Total Off-line Time:** 406 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 903.9 | 876.4 | 916.2 | 900.9 | 624.4 | 694.9 | 919.0 | 919.6 | 872.9 | 919.9 | 899.4 | 779.8 | 10227.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 67.7  | 87.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.4  | 95.4    |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 67.7  | 87.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.4  | 95.4    |
| <b>LF (%)</b>   | 98.4  | 102.0 | 99.7  | 101.5 | 68.0  | 78.1  | 100.0 | 100.1 | 98.2  | 100.0 | 101.2 | 84.9  | 94.3    |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 68.8  | 85.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.3  | 95.4    |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 32.3  | 12.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.6   | 4.6     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 32.3  | 12.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.6   | 4.6     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Oct 1974      **Lifetime Generation:** 134622.2 GW(e).h  
**Date of First Criticality:** 06 Jun 1986      **Cumulative Energy Availability Factor:** 78.7%  
**Date of Grid Connection:** 19 Dec 1986      **Cumulative Load Factor:** 76.4%  
**Date of Commercial Operation:** 18 Nov 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 21.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 7233.8         | 1203.0         | 76.3   | 76.3   | 76.3                              | 76.3   | 68.5               | 68.5   | 6664               | 75.9   |
| 1989 | 5357.6         | 1141.0         | 53.4   | 65.2   | 53.4                              | 65.2   | 53.6               | 61.2   | 4776               | 54.5   |
| 1990 | 6638.9         | 1141.0         | 65.3   | 65.2   | 65.3                              | 65.2   | 66.4               | 62.9   | 5723               | 65.3   |
| 1991 | 8975.7         | 1166.0         | 90.7   | 71.6   | 90.7                              | 71.6   | 87.9               | 69.2   | 7949               | 90.7   |
| 1992 | 7168.6         | 1166.0         | 72.6   | 71.8   | 72.6                              | 71.8   | 70.0               | 69.3   | 6383               | 72.7   |
| 1993 | 3973.2         | 1166.0         | 43.9   | 67.2   | 43.9                              | 67.2   | 38.9               | 64.3   | 3853               | 44.0   |
| 1994 | 4591.9         | 1166.0         | 47.3   | 64.3   | 47.3                              | 64.3   | 45.0               | 61.5   | 4151               | 47.4   |
| 1995 | 9112.1         | 1166.0         | 93.4   | 68.0   | 93.4                              | 67.9   | 89.2               | 65.0   | 8174               | 93.3   |
| 1996 | 7482.0         | 1164.0         | 75.9   | 68.8   | 75.9                              | 68.8   | 73.2               | 65.9   | 6673               | 76.0   |
| 1997 | 8151.8         | 1160.0         | 81.9   | 70.1   | 81.9                              | 70.1   | 80.2               | 67.3   | 7178               | 81.9   |
| 1998 | 10188.9        | 1160.0         | 99.1   | 72.8   | 99.1                              | 72.8   | 100.3              | 70.3   | 8684               | 99.1   |
| 1999 | 9124.9         | 1160.0         | 89.6   | 74.2   | 89.6                              | 74.2   | 89.8               | 71.9   | 7850               | 89.6   |
| 2000 | 10085.7        | 1191.0         | 96.9   | 76.0   | 96.9                              | 76.0   | 96.4               | 73.8   | 8506               | 96.8   |
| 2001 | 7781.8         | 1236.0         | 77.9   | 76.1   | 77.9                              | 76.1   | 71.9               | 73.7   | 6708               | 76.6   |
| 2002 | 9974.8         | 1235.0         | 93.6   | 77.3   | 93.6                              | 77.3   | 92.2               | 75.0   | 8196               | 93.6   |
| 2003 | 8553.2         | 1235.0         | 82.4   | 77.7   | 82.4                              | 77.7   | 79.1               | 75.3   | 7217               | 82.4   |
| 2004 | 10227.3        | 1235.0         | 95.4   | 78.8   | 95.4                              | 78.7   | 94.3               | 76.4   | 8378               | 95.4   |

# US-440 PERRY-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 22 May | 332.6 | 410.8   | UF2  | A13  | REACTOR SHUTDOWN DUE TO A FAILED EMERGENCY SERVICE WATER PUMP.  |
| 03 Dec | 71.4  | 88.2    | UF4  | A15  | THE REACTOR RECIRCULATION PUMPS DOWNSHIFTED FROM FAST SPEED TO SLOW SPEED. AUTO SCRAM OCCURRED NINE MINUTES LATER DUE TO OSCILLATION POWER RANGE MONITOR ACTUATION DUE TO LOCAL POWER RANGE MONITOR OSCILLATIONS. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 404       |          |  | 452       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 21        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1124                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 233                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 9         |          |
| Z. Others  |                 |           |          |  | 10        |          |
| Subtotal   | 0               | 404       | 0        | 1357                                     | 492       | 0        |
| Total  |                 | 404       |          |  | 1849      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 11                                       |
| 13. Reactor Auxiliary Systems       | 332             |  |
| 14. Safety Systems                  |                 | 0  |
| 15. Reactor Cooling Systems         | 71              | 51                                       |
| 31. Turbine and auxiliaries         |                 | 76                                       |
| 32. Feedwater and Main Steam System |                 | 0  |
| 33. Circulating Water System        |                 | 14                                       |
| 35. All other I&C Systems           |                 | 9  |
| 41. Main Generator Systems          |                 | 41                                       |
| 42. Electrical Power Supply Systems |                 | 73                                       |
| XX. Miscellaneous Systems           |                 | 144                                      |
| Total                               | 403             | 419                                      |

# US-293 PILGRIM-1

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 684.0 MW(e)  
**Design Net RUP:** 655.0 MW(e)  
**Design Discharge Burnup:** 19000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 5939.3 GW(e).h  
**Energy Availability Factor:** 99.3%  
**Load Factor:** 98.9%  
**Operating Factor:** 99.3%  
**Energy Unavailability Factor:** 0.7%  
**Total Off-line Time:** 63 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 513.0 | 479.8 | 455.6 | 494.5 | 510.3 | 489.1 | 502.2 | 507.7 | 480.3 | 507.4 | 487.8 | 511.6 | 5939.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 91.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 91.6  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.3   |
| <b>LF (%)</b>   | 100.8 | 100.8 | 89.5  | 100.6 | 100.3 | 99.3  | 98.7  | 99.8  | 97.5  | 99.6  | 99.0  | 100.5 | 98.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 91.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 8.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 8.4   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.7    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1968  
**Date of First Criticality:** 16 Jun 1972  
**Date of Grid Connection:** 19 Jul 1972  
**Date of Commercial Operation:** 01 Dec 1972

**Lifetime Generation:** 118198.6 GW(e).h  
**Cumulative Energy Availability Factor:** 66.6%  
**Cumulative Load Factor:** 62.5%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 33.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4711.9         | 670.0          | 87.3   | 62.6   | 87.3                              | 62.4   | 80.3               | 58.1   | 7640               | 87.2   |
| 1984 | 3.5            | 669.0          | 1.4  | 57.5   | 1.3                               | 57.3   | 0.1                | 53.2   | 34                 | 0.4    |
| 1985 | 4951.0         | 667.0          | 93.3   | 60.2   | 91.5                              | 59.9   | 84.7               | 55.7   | 8013               | 91.5   |
| 1986 | 1027.5         | 670.0          | 18.9   | 57.3   | 18.9                              | 56.9   | 17.5               | 52.9   | 1646               | 18.8   |
| 1987 | 0.0            | 670.0          | 0.0  | 53.4   | 0.0                               | 53.1   | 0.0                | 49.4   | 0                  | 0.0    |
| 1988 | 0.0            | 670.0          | 0.0  | 50.1   | 0.0                               | 49.8   | 0.0                | 46.3   | 0                  | 0.0    |
| 1989 | 1707.8         | 670.0          | 56.3   | 50.4   | 56.3                              | 50.2   | 29.1               | 45.3   | 4919               | 56.2   |
| 1990 | 4243.2         | 670.0          | 77.5   | 51.9   | 77.5                              | 51.7   | 72.3               | 46.8   | 6784               | 77.4   |
| 1991 | 3424.5         | 670.0          | 69.9   | 52.9   | 63.7                              | 52.3   | 58.3               | 47.4   | 5572               | 63.6   |
| 1992 | 4742.0         | 670.0          | 84.3   | 54.5   | 84.3                              | 53.9   | 80.6               | 49.1   | 7400               | 84.2   |
| 1993 | 4340.8         | 670.0          | 79.1   | 55.6   | 78.6                              | 55.1   | 74.0               | 50.2   | 6880               | 78.5   |
| 1994 | 3824.1         | 670.0          | 69.4   | 56.3   | 69.4                              | 55.8   | 65.2               | 50.9   | 6069               | 69.3   |
| 1995 | 4485.8         | 670.0          | 79.5   | 57.3   | 79.5                              | 56.8   | 76.4               | 52.0   | 6962               | 79.5   |
| 1996 | 5324.3         | 670.0          | 95.0   | 58.9   | 95.0                              | 58.4   | 90.5               | 53.6   | 8345               | 95.0   |
| 1997 | 4310.4         | 670.0          | 78.1   | 59.6   | 78.1                              | 59.2   | 73.4               | 54.4   | 6840               | 78.1   |
| 1998 | 5698.4         | 670.0          | 100.0  | 61.2   | 100.0                             | 60.8   | 97.1               | 56.1   | 8760               | 100.0  |
| 1999 | 4473.3         | 670.0          | 81.6   | 61.9   | 81.6                              | 61.5   | 76.2               | 56.8   | 7141               | 81.5   |
| 2000 | 5512.3         | 670.0          | 96.3   | 63.2   | 96.3                              | 62.8   | 93.7               | 58.1   | 8454               | 96.2   |
| 2001 | 5144.0         | 660.0          | 90.0   | 64.1   | 89.9                              | 63.7   | 89.0               | 59.2   | 7884               | 90.0   |
| 2002 | 5769.1         | 653.0          | 100.0  | 65.3   | 100.0                             | 64.9   | 100.9              | 60.5   | 8760               | 100.0  |
| 2003 | 4977.2         | 671.0          | 85.8   | 65.9   | 85.8                              | 65.6   | 84.7               | 61.3   | 7548               | 86.2   |
| 2004 | 5939.3         | 684.0          | 99.3   | 67.0   | 99.3                              | 66.6   | 98.9               | 62.5   | 8721               | 99.3   |



# US-293 PILGRIM-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 22 Mar | 62.1  | 42.5    | PF   | D32  | PLANNED SHUTDOWN TO REPLACE THE PILOT VALVES ON TWO OF THE MAIN STEAM RELIEF VALVES. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 643       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1493                                     | 2         |          |
| D. Inspection, maintenance or repair without refuelling                              | 62              |           |          | 162                                      | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 59                                       | 1         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          |  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 45                                       | 5         | 162      |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 22       |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 59        | 6        |
| Subtotal   | 62              | 0         | 0        | 1759                                     | 724       | 190      |
| Total  |                 | 62        |          |  | 2673      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 6  |
| 12. Reactor I&C Systems             |                 | 36                                       |
| 13. Reactor Auxiliary Systems       |                 | 117                                      |
| 14. Safety Systems                  |                 | 13                                       |
| 15. Reactor Cooling Systems         |                 | 162                                      |
| 31. Turbine and auxiliaries         |                 | 67                                       |
| 32. Feedwater and Main Steam System |                 | 59                                       |
| 35. All other I&C Systems           |                 | 2  |
| 41. Main Generator Systems          |                 | 48                                       |
| 42. Electrical Power Supply Systems |                 | 66                                       |
| XX. Miscellaneous Systems           |                 | 11                                       |
| Total                               | 0               | 587                                      |

# US-266 POINT BEACH-1

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 516.0 MW(e)  
**Design Net RUP:** 497.0 MW(e)  
**Design Discharge Burnup:** 27000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3631.0 GW(e).h  
**Energy Availability Factor:** 81.9%  
**Load Factor:** 80.1%  
**Operating Factor:** 81.8%  
**Energy Unavailability Factor:** 18.1%  
**Total Off-line Time:** 1598 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 381.2 | 353.7 | 374.9 | 20.6 | 0.0   | 245.6 | 378.6 | 380.0 | 365.5 | 381.6 | 368.6 | 380.8 | 3631.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 7.3  | 0.0   | 75.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 81.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 7.3  | 0.0   | 75.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 81.9   |
| <b>LF (%)</b>   | 99.3  | 98.5  | 97.7  | 5.5  | 0.0   | 66.1  | 98.6  | 99.0  | 98.4  | 99.3  | 99.2  | 99.2  | 80.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 6.8  | 0.0   | 74.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 81.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 92.7 | 100.0 | 24.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 18.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 92.7 | 100.0 | 24.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 18.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1967      **Lifetime Generation:** 113880.7 GW(e).h  
**Date of First Criticality:** 02 Nov 1970      **Cumulative Energy Availability Factor:** 80.7%  
**Date of Grid Connection:** 06 Nov 1970      **Cumulative Load Factor:** 77.2%  
**Date of Commercial Operation:** 21 Dec 1970      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 19.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2384.9         | 495.0          | 74.3   | 82.1   | 74.3                              | 77.7   | 55.0               | 69.5   | 6498               | 74.2   |
| 1984 | 3109.2         | 485.0          | 72.6   | 81.5   | 72.6                              | 77.3   | 73.0               | 69.7   | 6379               | 72.6   |
| 1985 | 3354.2         | 485.0          | 78.7   | 81.3   | 78.6                              | 77.4   | 78.9               | 70.3   | 6917               | 79.0   |
| 1986 | 3770.1         | 485.0          | 88.7   | 81.7   | 88.7                              | 78.1   | 88.7               | 71.4   | 7786               | 88.9   |
| 1987 | 3567.1         | 485.0          | 83.6   | 81.8   | 83.6                              | 78.4   | 84.0               | 72.2   | 7348               | 83.9   |
| 1988 | 3831.0         | 485.0          | 88.5   | 82.2   | 88.5                              | 79.0   | 89.9               | 73.1   | 7787               | 88.6   |
| 1989 | 3606.2         | 485.0          | 87.8   | 82.5   | 87.8                              | 79.4   | 84.9               | 73.7   | 7706               | 88.0   |
| 1990 | 3531.7         | 485.0          | 83.8   | 82.6   | 83.8                              | 79.6   | 83.1               | 74.2   | 7362               | 84.0   |
| 1991 | 3628.7         | 485.0          | 85.7   | 82.7   | 85.7                              | 79.9   | 85.4               | 74.7   | 7524               | 85.9   |
| 1992 | 3605.6         | 485.0          | 84.1   | 82.8   | 84.1                              | 80.1   | 84.6               | 75.2   | 7409               | 84.3   |
| 1993 | 3804.8         | 485.0          | 88.8   | 83.0   | 88.8                              | 80.5   | 89.6               | 75.8   | 7799               | 89.0   |
| 1994 | 3905.1         | 485.0          | 92.0   | 83.4   | 92.0                              | 80.9   | 91.9               | 76.4   | 8071               | 92.1   |
| 1995 | 3792.4         | 485.0          | 88.5   | 83.6   | 88.5                              | 81.2   | 89.3               | 77.0   | 7768               | 88.7   |
| 1996 | 4003.3         | 485.0          | 93.0   | 84.0   | 93.0                              | 81.7   | 94.0               | 77.6   | 8173               | 93.0   |
| 1997 | 853.5          | 485.0          | 21.3   | 81.7   | 21.3                              | 79.5   | 20.1               | 75.5   | 1872               | 21.4   |
| 1998 | 2584.2         | 485.0          | 62.7   | 81.0   | 62.7                              | 78.9   | 60.8               | 75.0   | 5489               | 62.7   |
| 1999 | 3489.3         | 489.0          | 80.0   | 81.0   | 80.0                              | 78.9   | 81.5               | 75.2   | 7070               | 80.7   |
| 2000 | 4134.6         | 510.0          | 96.1   | 81.5   | 95.6                              | 79.5   | 92.3               | 75.8   | 8391               | 95.5   |
| 2001 | 3702.1         | 510.0          | 87.0   | 81.7   | 87.0                              | 79.8   | 82.9               | 76.0   | 7611               | 86.9   |
| 2002 | 3975.8         | 510.0          | 91.0   | 82.0   | 91.0                              | 80.1   | 89.0               | 76.5   | 7964               | 90.9   |
| 2003 | 4343.0         | 515.0          | 97.5   | 82.5   | 97.5                              | 80.7   | 96.3               | 77.1   | 8538               | 97.5   |
| 2004 | 3631.0         | 516.0          | 81.9   | 82.5   | 81.9                              | 80.7   | 80.1               | 77.2   | 7186               | 81.8   |

**US-266 POINT BEACH-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description |
|--------|--------|---------|------|------|-------------|
| 03 Apr | 1597.3 | 817.8   | PF   | C21  | REFUELLING. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 145       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1597            |           |          | 1097  |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 63  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 2   |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 1   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   |           | 36       |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0   | 206       | 1        |
| Subtotal   | 1597            | 0         | 0        | 1163  | 352       | 39       |
| Total  |                 | 1597      |          |   | 1554      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1971 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 1   |
| 12. Reactor I&C Systems             |                    | 0   |
| 15. Reactor Cooling Systems         |                    | 10  |
| 16. Steam generation systems        |                    | 69  |
| 31. Turbine and auxiliaries         |                    | 18  |
| 32. Feedwater and Main Steam System |                    | 18  |
| 41. Main Generator Systems          |                    | 9   |
| 42. Electrical Power Supply Systems |                    | 3   |
| Total                               | 0                  | 128   |

# US-301 POINT BEACH-2

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 518.0 MW(e)  
**Design Net RUP:** 497.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4384.9 GW(e).h  
**Energy Availability Factor:** 97.5%  
**Load Factor:** 96.4%  
**Operating Factor:** 97.4%  
**Energy Unavailability Factor:** 2.5%  
**Total Off-line Time:** 225 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 387.7 | 360.7 | 385.9 | 374.8 | 325.1 | 374.5 | 380.7 | 383.3 | 372.7 | 352.9 | 300.2 | 386.3 | 4384.9 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 85.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 84.4  | 100.0 | 97.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 85.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 84.4  | 100.0 | 97.5   |
| <b>LF (%)</b>   | 100.6 | 100.0 | 100.1 | 100.6 | 84.4  | 100.4 | 98.8  | 99.5  | 99.9  | 91.4  | 80.5  | 100.2 | 96.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 85.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 84.2  | 100.0 | 97.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 14.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.6  | 0.0   | 2.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 14.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.6  | 0.0   | 2.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1968      **Lifetime Generation:** 112932.7 GW(e).h  
**Date of First Criticality:** 30 May 1972      **Cumulative Energy Availability Factor:** 83.8%  
**Date of Grid Connection:** 02 Aug 1972      **Cumulative Load Factor:** 81.4%  
**Date of Commercial Operation:** 01 Oct 1972      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 16.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3016.3         | 495.0          | 74.5   | 85.0   | 74.5                              | 84.4   | 69.6               | 81.4   | 6245               | 71.3   |
| 1984 | 3512.4         | 495.0          | 86.0   | 85.0   | 86.0                              | 84.5   | 80.8               | 81.4   | 7405               | 84.3   |
| 1985 | 3603.1         | 485.0          | 86.8   | 85.2   | 86.8                              | 84.7   | 84.8               | 81.6   | 7491               | 85.5   |
| 1986 | 3417.6         | 485.0          | 82.1   | 85.0   | 82.1                              | 84.5   | 80.4               | 81.5   | 7186               | 82.0   |
| 1987 | 3606.1         | 485.0          | 85.9   | 85.0   | 85.5                              | 84.6   | 84.9               | 81.8   | 7478               | 85.4   |
| 1988 | 3718.7         | 485.0          | 88.0   | 85.2   | 88.0                              | 84.8   | 87.3               | 82.1   | 7626               | 86.8   |
| 1989 | 3485.1         | 485.0          | 82.9   | 85.1   | 82.9                              | 84.7   | 82.0               | 82.1   | 7107               | 81.1   |
| 1990 | 3793.5         | 485.0          | 89.1   | 85.3   | 89.1                              | 84.9   | 89.3               | 82.5   | 7713               | 88.0   |
| 1991 | 3689.2         | 485.0          | 87.6   | 85.4   | 87.6                              | 85.1   | 86.8               | 82.7   | 7569               | 86.4   |
| 1992 | 3668.2         | 485.0          | 86.6   | 85.5   | 86.6                              | 85.1   | 86.1               | 82.9   | 7492               | 85.3   |
| 1993 | 3844.5         | 485.0          | 90.9   | 85.7   | 90.9                              | 85.4   | 90.5               | 83.2   | 7883               | 90.0   |
| 1994 | 3752.3         | 485.0          | 90.3   | 85.9   | 90.3                              | 85.6   | 88.3               | 83.5   | 7827               | 89.3   |
| 1995 | 3386.0         | 485.0          | 83.4   | 85.8   | 83.4                              | 85.5   | 79.7               | 83.3   | 7158               | 81.7   |
| 1996 | 2950.3         | 485.0          | 78.0   | 85.5   | 78.0                              | 85.2   | 69.3               | 82.7   | 6653               | 75.7   |
| 1997 | 825.5          | 485.0          | 21.4   | 83.0   | 21.4                              | 82.7   | 19.4               | 80.2   | 1788               | 20.4   |
| 1998 | 3123.8         | 485.0          | 75.5   | 82.7   | 75.5                              | 82.4   | 73.5               | 80.0   | 6609               | 75.4   |
| 1999 | 3578.5         | 498.0          | 82.6   | 82.7   | 82.5                              | 82.4   | 82.0               | 80.0   | 7195               | 82.1   |
| 2000 | 3527.4         | 512.0          | 80.9   | 82.6   | 80.9                              | 82.4   | 78.4               | 80.0   | 7094               | 80.8   |
| 2001 | 4343.0         | 512.0          | 98.5   | 83.2   | 98.6                              | 82.9   | 96.8               | 80.6   | 8631               | 98.5   |
| 2002 | 4004.3         | 512.0          | 90.7   | 83.4   | 90.7                              | 83.2   | 89.3               | 80.9   | 7934               | 90.6   |
| 2003 | 3713.3         | 517.0          | 85.6   | 83.5   | 85.6                              | 83.3   | 82.0               | 80.9   | 7469               | 85.3   |
| 2004 | 4384.9         | 518.0          | 97.5   | 84.0   | 97.5                              | 83.8   | 96.4               | 81.4   | 8559               | 97.4   |

## US-301 POINT BEACH-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 15 May | 110.1 | 56.6    | UF2  | Z    | UNIT TAKEN OFFLINE AFTER A DIVER WAS DRAWN TOWARDS THE PLANT INTAKE STRUCTURE IN LAKE MICHIGAN DURING SCHEDULED INSPECTIONS. |
| 19 Nov | 113.5 | 58.3    | UF2  | A32  | SECONDARY SYSTEM LEAK CAP060656.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 113       |          |  | 123       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1130                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 45                                       | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 6  |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 3  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 4         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  | 44        | 1        |
| Z. Others  |                 | 110       |          |  |           |          |
| Subtotal   | 0               | 223       | 0        | 1184                                     | 172       | 1        |
| Total  |                 | 223       |          |  | 1357      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 3  |
| 12. Reactor I&C Systems             |                 | 34                                       |
| 14. Safety Systems                  |                 | 0  |
| 15. Reactor Cooling Systems         |                 | 39                                       |
| 16. Steam generation systems        |                 | 18                                       |
| 31. Turbine and auxiliaries         |                 | 8  |
| 32. Feedwater and Main Steam System | 113             | 7  |
| 42. Electrical Power Supply Systems |                 | 10                                       |
| Total                               | 113             | 119                                      |

# US-282 PRAIRIE ISLAND-1

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 522.0 MW(e)  
**Design Net RUP:** 530.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3602.1 GW(e).h  
**Energy Availability Factor:** 79.9%  
**Load Factor:** 78.6%  
**Operating Factor:** 79.9%  
**Energy Unavailability Factor:** 20.1%  
**Total Off-line Time:** 1767 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep  | Oct   | Nov  | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|------|-------|--------|
| <b>GW(e).h</b>  | 405.7 | 362.0 | 406.5 | 380.6 | 384.8 | 354.9 | 389.6 | 362.4 | 88.9 | 0.0   | 63.2 | 403.5 | 3602.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 30.0 | 0.0   | 28.1 | 100.0 | 79.9   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 30.0 | 0.0   | 28.1 | 100.0 | 79.9   |
| <b>LF (%)</b>   | 104.5 | 99.6  | 104.7 | 101.4 | 99.1  | 94.4  | 100.3 | 93.3  | 23.6 | 0.0   | 16.8 | 103.9 | 78.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 32.8 | 0.0   | 25.3 | 100.0 | 79.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 70.0 | 100.0 | 71.9 | 0.0   | 20.1   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 70.0 | 100.0 | 71.9 | 0.0   | 20.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0  | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1968  
**Date of First Criticality:** 01 Dec 1973  
**Date of Grid Connection:** 04 Dec 1973  
**Date of Commercial Operation:** 16 Dec 1973

**Lifetime Generation:** 117295.1 GW(e).h  
**Cumulative Energy Availability Factor:** 85.2%  
**Cumulative Load Factor:** 84.6%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 14.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3888.9         | 503.0          | 87.2   | 77.5   | 87.2                              | 77.5   | 88.3               | 75.3   | 7621               | 87.0   |
| 1984 | 4159.4         | 503.0          | 94.3   | 79.0   | 94.3                              | 79.0   | 94.1               | 77.0   | 8285               | 94.3   |
| 1985 | 3678.5         | 503.0          | 83.4   | 79.4   | 83.4                              | 79.4   | 83.5               | 77.5   | 7333               | 83.7   |
| 1986 | 3819.6         | 503.0          | 89.6   | 80.2   | 89.6                              | 80.2   | 86.7               | 78.2   | 7870               | 89.8   |
| 1987 | 3590.3         | 503.0          | 82.2   | 80.3   | 82.2                              | 80.3   | 81.5               | 78.4   | 7232               | 82.6   |
| 1988 | 3823.4         | 503.0          | 89.3   | 80.9   | 89.3                              | 80.9   | 86.5               | 79.0   | 7800               | 88.8   |
| 1989 | 4392.3         | 503.0          | 99.8   | 82.1   | 99.7                              | 82.1   | 99.7               | 80.3   | 8737               | 99.7   |
| 1990 | 3829.7         | 503.0          | 81.7   | 82.0   | 81.7                              | 82.0   | 86.9               | 80.6   | 7764               | 88.6   |
| 1991 | 3987.1         | 505.0          | 90.5   | 82.5   | 90.5                              | 82.5   | 90.1               | 81.2   | 7943               | 90.7   |
| 1992 | 3497.8         | 503.0          | 77.4   | 82.3   | 77.4                              | 82.2   | 79.2               | 81.1   | 6844               | 77.9   |
| 1993 | 4378.0         | 505.0          | 96.8   | 83.0   | 96.8                              | 83.0   | 99.0               | 82.0   | 8480               | 96.8   |
| 1994 | 3718.2         | 513.0          | 82.8   | 83.0   | 82.8                              | 83.0   | 82.7               | 82.0   | 7258               | 82.9   |
| 1995 | 4519.0         | 513.0          | 99.9   | 83.8   | 99.9                              | 83.7   | 100.6              | 82.9   | 8752               | 99.9   |
| 1996 | 3741.6         | 513.0          | 92.9   | 84.2   | 92.2                              | 84.1   | 83.0               | 82.9   | 7327               | 83.4   |
| 1997 | 3522.8         | 513.0          | 79.5   | 84.0   | 79.5                              | 83.9   | 78.4               | 82.7   | 6965               | 79.5   |
| 1998 | 4209.2         | 514.0          | 90.8   | 84.2   | 90.8                              | 84.2   | 93.5               | 83.1   | 7948               | 90.7   |
| 1999 | 4068.8         | 522.0          | 87.2   | 84.3   | 87.2                              | 84.3   | 89.0               | 83.3   | 7643               | 87.2   |
| 2000 | 4536.5         | 522.0          | 96.7   | 84.8   | 96.7                              | 84.8   | 98.9               | 83.9   | 8499               | 96.8   |
| 2001 | 3641.7         | 522.0          | 78.8   | 84.6   | 78.8                              | 84.6   | 79.6               | 83.8   | 6890               | 78.7   |
| 2002 | 4373.2         | 522.0          | 94.4   | 84.9   | 94.4                              | 84.9   | 95.6               | 84.2   | 8268               | 94.4   |
| 2003 | 4596.3         | 519.0          | 98.4   | 85.4   | 98.4                              | 85.4   | 101.1              | 84.8   | 8619               | 98.4   |
| 2004 | 3602.1         | 522.0          | 79.9   | 85.2   | 79.9                              | 85.2   | 78.6               | 84.6   | 7017               | 79.9   |

**US-282 PRAIRIE ISLAND-1****6. 2004 Outages**

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 10 Sep | 1763.6 | 920.6   | PF   | C21  | REFUELLING OUTAGE.   |
| 23 Nov | 2.6    | 1.4     | PF   | E31  | PERFORM REQUIRED SP 1036 TURBINE OVERSPEED TRIP EXERCISES. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 329       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1763            |           |          | 661   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 84  |           |          |
| E. Testing of plant systems or components  | 2               |           |          | 7   | 1         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 0   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 28        | 1        |
| Subtotal   | 1765            | 0         | 0        | 752   | 360       | 1        |
| Total  |                 | 1765      |          |   | 1113      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1973 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 17  |
| 12. Reactor I&C Systems             |                    | 32  |
| 14. Safety Systems                  |                    | 11  |
| 15. Reactor Cooling Systems         |                    | 8   |
| 16. Steam generation systems        |                    | 43  |
| 31. Turbine and auxiliaries         |                    | 140   |
| 32. Feedwater and Main Steam System |                    | 39  |
| 35. All other I&C Systems           |                    | 9   |
| 41. Main Generator Systems          |                    | 1   |
| 42. Electrical Power Supply Systems |                    | 9   |
| XX. Miscellaneous Systems           |                    | 0   |
| Total                               | 0                  | 309   |

# US-306 PRAIRIE ISLAND-2

**Operator:** NUCMAN (NUCLEAR MANAGEMENT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 522.0 MW(e)  
**Design Net RUP:** 530.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4660.3 GW(e).h  
**Energy Availability Factor:** 99.5%  
**Load Factor:** 101.6%  
**Operating Factor:** 99.5%  
**Energy Unavailability Factor:** 0.5%  
**Total Off-line Time:** 47 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 406.3 | 380.3 | 406.6 | 373.5 | 391.8 | 377.1 | 388.4 | 390.8 | 380.8 | 400.8 | 360.6 | 403.2 | 4660.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.6  | 100.0 | 99.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.6  | 100.0 | 99.5   |
| <b>LF (%)</b>   | 104.6 | 104.7 | 104.7 | 99.5  | 100.9 | 100.3 | 100.0 | 100.6 | 101.3 | 103.1 | 96.0  | 103.8 | 101.6  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.5  | 100.0 | 99.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.4   | 0.0   | 0.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.4   | 0.0   | 0.5    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1969  
**Date of First Criticality:** 17 Dec 1974  
**Date of Grid Connection:** 21 Dec 1974  
**Date of Commercial Operation:** 21 Dec 1974

**Lifetime Generation:** 117072.1 GW(e).h  
**Cumulative Energy Availability Factor:** 87.7%  
**Cumulative Load Factor:** 87.5%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 12.3%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3716.3         | 500.0          | 86.5   | 80.7   | 86.5                              | 80.6   | 84.8               | 80.1   | 7574               | 86.5   |
| 1984 | 3906.0         | 500.0          | 89.2   | 81.5   | 89.2                              | 81.5   | 88.9               | 80.9   | 7830               | 89.1   |
| 1985 | 3612.5         | 500.0          | 93.0   | 82.5   | 92.9                              | 82.5   | 82.5               | 81.1   | 7378               | 84.2   |
| 1986 | 3854.0         | 500.0          | 90.5   | 83.2   | 90.6                              | 83.2   | 88.0               | 81.6   | 7930               | 90.5   |
| 1987 | 4462.2         | 500.0          | 100.0  | 84.5   | 100.0                             | 84.5   | 101.9              | 83.2   | 8760               | 100.0  |
| 1988 | 3886.2         | 500.0          | 88.2   | 84.7   | 88.2                              | 84.7   | 88.5               | 83.6   | 7773               | 88.5   |
| 1989 | 3887.2         | 500.0          | 96.9   | 85.5   | 96.9                              | 85.5   | 88.7               | 83.9   | 7798               | 89.0   |
| 1990 | 3803.7         | 500.0          | 83.3   | 85.4   | 83.3                              | 85.4   | 86.8               | 84.1   | 7602               | 86.8   |
| 1991 | 4480.4         | 502.0          | 100.0  | 86.3   | 100.0                             | 86.2   | 101.9              | 85.1   | 8760               | 100.0  |
| 1992 | 3223.5         | 500.0          | 73.5   | 85.5   | 73.5                              | 85.5   | 73.4               | 84.5   | 6516               | 74.2   |
| 1993 | 3746.2         | 503.0          | 83.5   | 85.5   | 83.5                              | 85.4   | 85.0               | 84.5   | 7338               | 83.8   |
| 1994 | 4553.0         | 512.0          | 99.7   | 86.2   | 99.7                              | 86.2   | 101.5              | 85.4   | 8734               | 99.7   |
| 1995 | 3968.2         | 512.0          | 87.5   | 86.2   | 87.5                              | 86.2   | 88.5               | 85.5   | 7666               | 87.5   |
| 1996 | 4485.1         | 512.0          | 99.2   | 86.8   | 98.6                              | 86.8   | 99.7               | 86.2   | 8653               | 98.5   |
| 1997 | 3642.9         | 512.0          | 82.0   | 86.6   | 82.0                              | 86.6   | 81.2               | 86.0   | 7180               | 82.0   |
| 1998 | 3333.7         | 512.0          | 74.8   | 86.1   | 74.8                              | 86.1   | 74.3               | 85.5   | 6555               | 74.8   |
| 1999 | 4597.4         | 522.0          | 99.2   | 86.7   | 99.2                              | 86.6   | 100.5              | 86.1   | 8690               | 99.2   |
| 2000 | 4182.3         | 522.0          | 89.0   | 86.8   | 89.0                              | 86.7   | 91.2               | 86.3   | 7820               | 89.0   |
| 2001 | 4271.0         | 522.0          | 91.7   | 87.0   | 91.7                              | 86.9   | 93.4               | 86.6   | 8031               | 91.7   |
| 2002 | 4296.0         | 522.0          | 92.4   | 87.2   | 92.4                              | 87.1   | 93.9               | 86.8   | 8082               | 92.3   |
| 2003 | 4241.0         | 522.0          | 92.0   | 87.3   | 92.0                              | 87.3   | 92.7               | 87.0   | 8058               | 92.0   |
| 2004 | 4660.3         | 522.0          | 99.5   | 87.7   | 99.5                              | 87.7   | 101.6              | 87.5   | 8737               | 99.5   |



## US-306 PRAIRIE ISLAND-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 17 Nov | 46.4  | 24.2    | UF2  | A14  | REPAIR LEAKS IN 22 AND 23 CONTAINMENT FAN COIL UNITS. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 46        |          |   | 214       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 606             |           |          |   |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 99              |           |          |   |           |          |
| E. Testing of plant systems or components  | 5               |           |          |   |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 18        | 1        |
| Subtotal   | 0               | 46        | 0        | 710   | 233       | 1        |
| Total  |                 | 46        |          |   | 944       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1974 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 0   |
| 12. Reactor I&C Systems             |                    | 48  |
| 13. Reactor Auxiliary Systems       |                    | 0   |
| 14. Safety Systems                  | 46                 | 2   |
| 15. Reactor Cooling Systems         |                    | 42  |
| 16. Steam generation systems        |                    | 7   |
| 31. Turbine and auxiliaries         |                    | 81  |
| 32. Feedwater and Main Steam System |                    | 4   |
| 33. Circulating Water System        |                    | 2   |
| 35. All other I&C Systems           |                    | 0   |
| 41. Main Generator Systems          |                    | 7   |
| 42. Electrical Power Supply Systems |                    | 5   |
| Total                               | 46                 | 198   |

# US-254 QUAD CITIES-1

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 855.0 MW(e)  
**Design Net RUP:** 789.0 MW(e)  
**Design Discharge Burnup:** 20900 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6502.8 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 86.6%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 556.4 | 520.0 | 554.4 | 533.9 | 551.5 | 528.4 | 542.8 | 544.7 | 526.5 | 553.1 | 537.1 | 553.9 | 6502.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 87.5  | 87.4  | 87.2  | 86.8  | 86.7  | 85.8  | 85.3  | 85.6  | 85.5  | 86.8  | 87.3  | 87.1  | 86.6   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1967  
**Date of First Criticality:** 18 Oct 1971  
**Date of Grid Connection:** 12 Apr 1972  
**Date of Commercial Operation:** 18 Feb 1973

**Lifetime Generation:** 153582.4 GW(e).h  
**Cumulative Energy Availability Factor:** 74.2%  
**Cumulative Load Factor:** 69.2%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 25.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5776.4         | 769.0          | 94.7   | 69.2   | 94.7                              | 69.0   | 85.7               | 62.7   | 8258               | 94.3   |
| 1984 | 3358.5         | 769.0          | 53.4   | 67.7   | 53.4                              | 67.5   | 49.7               | 61.5   | 4687               | 53.4   |
| 1985 | 6072.3         | 769.0          | 94.1   | 69.9   | 94.1                              | 69.7   | 90.1               | 63.9   | 8242               | 94.1   |
| 1986 | 4426.2         | 769.0          | 68.9   | 69.8   | 68.9                              | 69.7   | 65.7               | 64.0   | 6035               | 68.9   |
| 1987 | 4456.1         | 769.0          | 70.1   | 69.9   | 70.1                              | 69.7   | 66.1               | 64.2   | 6141               | 70.1   |
| 1988 | 5662.0         | 769.0          | 93.4   | 71.4   | 93.4                              | 71.3   | 83.8               | 65.5   | 8199               | 93.3   |
| 1989 | 4280.4         | 769.0          | 73.4   | 71.5   | 73.4                              | 71.4   | 63.5               | 65.4   | 6428               | 73.4   |
| 1990 | 5345.6         | 769.0          | 83.1   | 72.2   | 83.1                              | 72.1   | 79.4               | 66.2   | 7276               | 83.1   |
| 1991 | 3549.5         | 769.0          | 56.6   | 71.3   | 55.8                              | 71.2   | 52.7               | 65.4   | 4882               | 55.7   |
| 1992 | 4166.1         | 769.0          | 70.1   | 71.3   | 70.1                              | 71.1   | 61.7               | 65.2   | 6158               | 70.1   |
| 1993 | 5042.5         | 769.0          | 78.8   | 71.7   | 78.8                              | 71.5   | 74.9               | 65.7   | 6902               | 78.8   |
| 1994 | 1670.2         | 769.0          | 28.9   | 69.6   | 28.9                              | 69.5   | 24.8               | 63.8   | 2526               | 28.8   |
| 1995 | 5886.2         | 769.0          | 90.6   | 70.6   | 90.6                              | 70.5   | 87.4               | 64.8   | 7934               | 90.6   |
| 1996 | 2680.6         | 769.0          | 42.9   | 69.4   | 42.9                              | 69.3   | 39.7               | 63.8   | 3769               | 42.9   |
| 1997 | 5565.5         | 769.0          | 88.7   | 70.2   | 88.7                              | 70.1   | 82.6               | 64.5   | 7764               | 88.6   |
| 1998 | 3142.9         | 769.0          | 49.1   | 69.3   | 49.1                              | 69.2   | 46.7               | 63.8   | 4299               | 49.1   |
| 1999 | 6337.6         | 769.0          | 93.7   | 70.3   | 93.7                              | 70.2   | 94.1               | 65.0   | 8210               | 93.7   |
| 2000 | 6168.1         | 769.0          | 93.8   | 71.2   | 93.8                              | 71.0   | 91.3               | 66.0   | 8242               | 93.8   |
| 2001 | 6710.9         | 769.0          | 99.2   | 72.2   | 99.2                              | 72.0   | 99.6               | 67.2   | 8691               | 99.2   |
| 2002 | 5709.5         | 776.0          | 86.6   | 72.7   | 86.6                              | 72.6   | 84.0               | 67.7   | 7564               | 86.3   |
| 2003 | 6810.2         | 855.0          | 92.4   | 73.4   | 92.4                              | 73.3   | 90.9               | 68.6   | 8013               | 91.5   |
| 2004 | 6502.8         | 855.0          | 100.0  | 74.3   | 100.0                             | 74.2   | 86.6               | 69.2   | 8784               | 100.0  |

# US-254 QUAD CITIES-1

## 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 428       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 77        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1185                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 162                                      | 4         |          |
| E. Testing of plant systems or components  |                 |           |          | 8  | 8         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 6         | 2        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  | 50        | 2        |
| Subtotal   | 0               | 0         | 0        | 1355                                     | 573       | 4        |
| Total  | 0               |           |          | 1932                                     |           |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 23                                       |
| 13. Reactor Auxiliary Systems       |                 | 3  |
| 14. Safety Systems                  |                 | 9  |
| 15. Reactor Cooling Systems         |                 | 115                                      |
| 31. Turbine and auxiliaries         |                 | 79                                       |
| 32. Feedwater and Main Steam System |                 | 23                                       |
| 41. Main Generator Systems          |                 | 18                                       |
| 42. Electrical Power Supply Systems |                 | 39                                       |
| XX. Miscellaneous Systems           |                 | 13                                       |
| Total                               | 0               | 322                                      |

# US-265 QUAD CITIES-2

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 855.0 MW(e)  
**Design Net RUP:** 789.0 MW(e)  
**Design Discharge Burnup:** 20900 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6179.4 GW(e).h  
**Energy Availability Factor:** 90.5%  
**Load Factor:** 82.3%  
**Operating Factor:** 90.6%  
**Energy Unavailability Factor:** 9.5%  
**Total Off-line Time:** 829 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar  | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 646.5 | 471.4 | 14.4 | 550.5 | 570.4 | 547.8 | 564.3 | 566.7 | 547.8 | 571.6 | 554.7 | 573.5 | 6179.4 |
| <b>EAF (%)</b>  | 100.0 | 79.1  | 7.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.5   |
| <b>UCF (%)</b>  | 100.0 | 79.1  | 7.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.5   |
| <b>LF (%)</b>   | 101.6 | 79.2  | 2.3  | 89.5  | 89.7  | 89.0  | 88.7  | 89.1  | 89.0  | 89.7  | 90.1  | 90.2  | 82.3   |
| <b>OF (%)</b>   | 100.0 | 79.3  | 7.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.6   |
| <b>EUF (%)</b>  | 0.0   | 20.9  | 92.8 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.5    |
| <b>PUF (%)</b>  | 0.0   | 20.9  | 89.4 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 3.4  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Feb 1967      **Lifetime Generation:** 148514.5 GW(e).h  
**Date of First Criticality:** 26 Apr 1972      **Cumulative Energy Availability Factor:** 72.2%  
**Date of Grid Connection:** 23 May 1972      **Cumulative Load Factor:** 67.0%  
**Date of Commercial Operation:** 10 Mar 1973      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 27.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3158.5         | 769.0          | 64.2   | 65.1   | 64.2                              | 65.0   | 46.9               | 58.7   | 5620               | 64.2   |
| 1984 | 4984.4         | 769.0          | 77.9   | 66.2   | 77.9                              | 66.1   | 73.8               | 60.1   | 6837               | 77.8   |
| 1985 | 4560.7         | 769.0          | 71.3   | 66.7   | 71.3                              | 66.6   | 67.7               | 60.7   | 6247               | 71.3   |
| 1986 | 4728.0         | 769.0          | 74.2   | 67.2   | 74.2                              | 67.1   | 70.2               | 61.4   | 6399               | 73.0   |
| 1987 | 4953.0         | 769.0          | 78.1   | 68.0   | 78.1                              | 67.9   | 73.5               | 62.3   | 6832               | 78.0   |
| 1988 | 4178.9         | 769.0          | 70.5   | 68.2   | 70.5                              | 68.1   | 61.9               | 62.3   | 6193               | 70.5   |
| 1989 | 5743.1         | 769.0          | 95.5   | 69.9   | 95.5                              | 69.8   | 85.3               | 63.7   | 8363               | 95.5   |
| 1990 | 4373.6         | 769.0          | 70.4   | 69.9   | 70.4                              | 69.8   | 64.9               | 63.8   | 6186               | 70.6   |
| 1991 | 5285.2         | 769.0          | 88.3   | 70.9   | 88.3                              | 70.9   | 78.5               | 64.6   | 7731               | 88.3   |
| 1992 | 3464.2         | 769.0          | 64.0   | 70.6   | 64.0                              | 70.5   | 51.3               | 63.9   | 5621               | 64.0   |
| 1993 | 3111.8         | 769.0          | 51.8   | 69.6   | 51.8                              | 69.6   | 46.2               | 63.0   | 4538               | 51.8   |
| 1994 | 4013.3         | 769.0          | 65.7   | 69.4   | 65.7                              | 69.4   | 59.6               | 62.8   | 5745               | 65.6   |
| 1995 | 2497.0         | 769.0          | 45.3   | 68.3   | 45.3                              | 68.3   | 37.1               | 61.7   | 3966               | 45.3   |
| 1996 | 4666.8         | 769.0          | 98.8   | 69.7   | 72.3                              | 68.5   | 69.1               | 62.0   | 6348               | 72.3   |
| 1997 | 2627.7         | 769.0          | 42.3   | 68.5   | 42.3                              | 67.4   | 39.0               | 61.0   | 3718               | 42.4   |
| 1998 | 3819.6         | 769.0          | 59.0   | 68.2   | 58.2                              | 67.0   | 56.7               | 60.9   | 5095               | 58.2   |
| 1999 | 6596.7         | 769.0          | 97.5   | 69.3   | 97.5                              | 68.2   | 97.9               | 62.3   | 8537               | 97.5   |
| 2000 | 6220.6         | 769.0          | 92.9   | 70.2   | 92.9                              | 69.1   | 92.1               | 63.4   | 8156               | 92.9   |
| 2001 | 6273.8         | 769.0          | 91.9   | 70.9   | 91.9                              | 69.9   | 93.1               | 64.5   | 8058               | 92.0   |
| 2002 | 6556.8         | 833.0          | 90.4   | 71.7   | 90.4                              | 70.7   | 89.9               | 65.4   | 7852               | 89.6   |
| 2003 | 6975.1         | 855.0          | 94.0   | 72.5   | 94.0                              | 71.5   | 93.1               | 66.4   | 8181               | 93.4   |
| 2004 | 6179.4         | 855.0          | 90.5   | 73.1   | 90.5                              | 72.2   | 82.3               | 67.0   | 7955               | 90.6   |

## US-265 QUAD CITIES-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 24 Feb | 801.9 | 692.9   | PF   | C21  | REFUELLING OUTAGE.   |
| 28 Mar | 1.2   | 1.0     | PF   | E31  | PLANNED MAIN TURBINE OVERSPEED TESTING.                                  |
| 30 Mar | 25.0  | 21.6    | UF2  | A31  | Q2F60-OCCURRED DURING TURBINE THRUST BEARING WEAR DETECTOR SURVEILLANCE. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 25        |          |   | 552       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 801             |           |          | 1046  | 68        |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 151   |           |          |
| E. Testing of plant systems or components  | 1               |           |          | 3   | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 11        | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 106   | 74        | 72       |
| Subtotal   | 802             | 25        | 0        | 1306  | 721       | 72       |
| Total  |                 | 827       |          |   | 2099      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004<br>Hours Lost | 1972 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 9   |
| 12. Reactor I&C Systems                        |                    | 14  |
| 13. Reactor Auxiliary Systems                  |                    | 5   |
| 14. Safety Systems                             |                    | 20  |
| 15. Reactor Cooling Systems                    |                    | 77  |
| 16. Steam generation systems                   |                    | 13  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 8   |
| 21. Fuel Handling and Storage Facilities       |                    | 21  |
| 31. Turbine and auxiliaries                    | 25                 | 95  |
| 32. Feedwater and Main Steam System            |                    | 47  |
| 33. Circulating Water System                   |                    | 9   |
| 35. All other I&C Systems                      |                    | 1   |
| 41. Main Generator Systems                     |                    | 39  |
| 42. Electrical Power Supply Systems            |                    | 79  |
| XX. Miscellaneous Systems                      |                    | 50  |
| Total  | 25                 | 487   |

# US-244 R.E. GINNA

**Operator:** CONST (CONSTELLATION NUCLEAR GROUP)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 480.0 MW(e)  
**Design Net RUP:** 470.0 MW(e)  
**Design Discharge Burnup:** 27000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4308.5 GW(e).h  
**Energy Availability Factor:** 99.4%  
**Load Factor:** 102.2%  
**Operating Factor:** 99.4%  
**Energy Unavailability Factor:** 0.6%  
**Total Off-line Time:** 51 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 369.0 | 345.5 | 369.6 | 357.1 | 369.0 | 355.4 | 363.6 | 360.4 | 351.5 | 338.9 | 358.2 | 370.4 | 4308.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.0  | 100.0 | 100.0 | 99.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.0  | 100.0 | 100.0 | 99.4   |
| <b>LF (%)</b>   | 103.3 | 103.4 | 103.5 | 103.5 | 103.3 | 102.8 | 101.8 | 100.9 | 101.7 | 94.8  | 103.6 | 103.7 | 102.2  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.2  | 100.0 | 100.0 | 99.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.0   | 0.0   | 0.0   | 0.6    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.0   | 0.0   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1966      **Lifetime Generation:** 115942.4 GW(e).h  
**Date of First Criticality:** 08 Nov 1969      **Cumulative Energy Availability Factor:** 80.3%  
**Date of Grid Connection:** 02 Dec 1969      **Cumulative Load Factor:** 80.2%  
**Date of Commercial Operation:** 01 Jul 1970      **Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 19.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3040.1         | 470.0          | 74.9   | 75.7   | 74.9                              | 68.9   | 73.8               | 68.2   | 6529               | 74.5   |
| 1984 | 3156.8         | 470.0          | 77.2   | 75.8   | 77.2                              | 69.5   | 76.5               | 68.8   | 6779               | 77.2   |
| 1985 | 3620.3         | 470.0          | 87.9   | 76.6   | 87.9                              | 70.7   | 87.9               | 70.1   | 7700               | 87.9   |
| 1986 | 3610.3         | 470.0          | 87.5   | 77.3   | 87.4                              | 71.7   | 87.7               | 71.1   | 7659               | 87.4   |
| 1987 | 3797.7         | 470.0          | 91.3   | 78.1   | 91.3                              | 72.9   | 92.2               | 72.4   | 7994               | 91.3   |
| 1988 | 3533.2         | 470.0          | 86.5   | 78.5   | 86.5                              | 73.6   | 85.6               | 73.1   | 7592               | 86.4   |
| 1989 | 3073.5         | 470.0          | 75.0   | 78.3   | 75.0                              | 73.7   | 74.6               | 73.2   | 6569               | 75.0   |
| 1990 | 3451.4         | 470.0          | 83.6   | 78.6   | 83.6                              | 74.2   | 83.8               | 73.7   | 7325               | 83.6   |
| 1991 | 3483.3         | 470.0          | 86.0   | 79.0   | 86.0                              | 74.7   | 84.6               | 74.2   | 7536               | 86.0   |
| 1992 | 3483.4         | 470.0          | 85.8   | 79.3   | 85.8                              | 75.2   | 84.4               | 74.7   | 7536               | 85.8   |
| 1993 | 3499.4         | 470.0          | 85.7   | 79.5   | 85.7                              | 75.7   | 85.0               | 75.1   | 7509               | 85.7   |
| 1994 | 3373.7         | 470.0          | 82.4   | 79.7   | 82.4                              | 76.0   | 81.9               | 75.4   | 7219               | 82.4   |
| 1995 | 3638.6         | 470.0          | 88.8   | 80.0   | 88.8                              | 76.5   | 88.4               | 75.9   | 7776               | 88.8   |
| 1996 | 2898.1         | 470.0          | 70.4   | 79.7   | 70.4                              | 76.2   | 70.2               | 75.7   | 6175               | 70.3   |
| 1997 | 3894.7         | 480.0          | 91.7   | 80.1   | 91.7                              | 76.8   | 92.6               | 76.3   | 8011               | 91.4   |
| 1998 | 4308.6         | 480.0          | 100.0  | 80.8   | 100.0                             | 77.7   | 102.5              | 77.3   | 8760               | 100.0  |
| 1999 | 3534.1         | 480.0          | 85.3   | 81.0   | 85.3                              | 77.9   | 84.0               | 77.5   | 7444               | 85.0   |
| 2000 | 3814.1         | 480.0          | 91.0   | 81.3   | 91.0                              | 78.4   | 90.5               | 77.9   | 8001               | 91.1   |
| 2001 | 4286.3         | 480.0          | 100.0  | 81.9   | 100.0                             | 79.1   | 101.9              | 78.7   | 8760               | 100.0  |
| 2002 | 3843.3         | 480.0          | 90.4   | 82.2   | 90.4                              | 79.4   | 91.4               | 79.1   | 7951               | 90.8   |
| 2003 | 3868.6         | 480.0          | 90.1   | 82.4   | 90.1                              | 79.8   | 92.0               | 79.5   | 7925               | 90.5   |
| 2004 | 4308.5         | 480.0          | 99.4   | 83.0   | 99.4                              | 80.3   | 102.2              | 80.2   | 8733               | 99.4   |

## US-244 R.E. GINNA

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 16 Oct | 50.5  | 25.1    | UF2  | A32  | SEAL WELD LEAK REPAIR OF CHARGING CHECK VALVE 9314. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1971 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 50        |          |  | 222       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1188            |           |          |  |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 82              |           |          |  | 2         |          |
| E. Testing of plant systems or components  | 1               |           |          |  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 0         | 20       |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 12        |          |
| Subtotal   | 0               | 50        | 0        | 1271                                     | 238       | 20       |
| Total  |                 | 50        |          |  | 1529      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1971 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 1  |
| 12. Reactor I&C Systems             |                 | 17                                       |
| 13. Reactor Auxiliary Systems       |                 | 2  |
| 14. Safety Systems                  |                 | 17                                       |
| 15. Reactor Cooling Systems         |                 | 10                                       |
| 16. Steam generation systems        |                 | 44                                       |
| 31. Turbine and auxiliaries         |                 | 42                                       |
| 32. Feedwater and Main Steam System | 50              | 36                                       |
| 33. Circulating Water System        |                 | 5  |
| 35. All other I&C Systems           |                 | 1  |
| 42. Electrical Power Supply Systems |                 | 19                                       |
| Total                               | 50              | 194                                      |

# US-458 RIVER BEND-1

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 966.0 MW(e)  
**Design Net RUP:** 934.0 MW(e)  
**Design Discharge Burnup:** 27500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7427.4 GW(e).h  
**Energy Availability Factor:** 88.2%  
**Load Factor:** 87.5%  
**Operating Factor:** 88.3%  
**Energy Unavailability Factor:** 11.8%  
**Total Off-line Time:** 1026 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 722.3 | 688.9 | 732.1 | 706.1 | 694.6 | 698.1 | 714.8 | 643.6 | 690.9 | 304.1 | 162.0 | 669.8 | 7427.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.7  | 100.0 | 42.3  | 29.5  | 93.0  | 88.2   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.7  | 100.0 | 42.3  | 29.5  | 93.0  | 88.2   |
| <b>LF (%)</b>   | 100.5 | 102.5 | 101.9 | 101.7 | 96.6  | 100.4 | 99.5  | 89.5  | 99.3  | 42.3  | 23.3  | 93.2  | 87.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 93.7  | 100.0 | 45.5  | 27.6  | 93.0  | 88.3   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.3   | 0.0   | 57.7  | 70.5  | 7.0   | 11.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 35.9  | 70.5  | 0.0   | 8.8    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.3   | 0.0   | 21.9  | 0.0   | 7.0   | 3.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1977  
**Date of First Criticality:** 31 Oct 1985  
**Date of Grid Connection:** 03 Dec 1985  
**Date of Commercial Operation:** 16 Jun 1986

**Lifetime Generation:** 119072.6 GW(e).h  
**Cumulative Energy Availability Factor:** 80.8%  
**Cumulative Load Factor:** 78.2%  
**Cumulative Unit Capability Factor:** 78.4%  
**Cumulative Energy Unavailability Factor:** 19.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 22.6           | 936.0          | 0.0  | 0.0    | 0.3                               | 100.0  | 0.3                | 0.0    | 180                | 2.1    |
| 1986 | 2995.4         | 936.0          | 0.0  | 0.0    | 56.7                              | 100.0  | 36.5               | 0.0    | 4221               | 48.2   |
| 1987 | 4964.4         | 936.0          | 66.7   | 66.7   | 66.7                              | 66.7   | 60.5               | 60.5   | 5836               | 66.6   |
| 1988 | 7249.0         | 936.0          | 92.8   | 79.8   | 92.8                              | 79.7   | 88.2               | 74.4   | 8149               | 92.8   |
| 1989 | 4785.0         | 936.0          | 66.9   | 75.5   | 66.9                              | 75.5   | 58.4               | 69.0   | 5853               | 66.8   |
| 1990 | 5592.6         | 936.0          | 75.8   | 75.5   | 75.8                              | 75.6   | 68.2               | 68.8   | 6642               | 75.8   |
| 1991 | 6687.2         | 936.0          | 85.7   | 77.6   | 85.7                              | 77.6   | 81.6               | 71.4   | 7507               | 85.7   |
| 1992 | 2762.7         | 936.0          | 36.5   | 70.7   | 36.5                              | 70.7   | 33.6               | 65.1   | 3210               | 36.5   |
| 1993 | 5257.9         | 936.0          | 69.4   | 70.5   | 69.4                              | 70.5   | 64.1               | 64.9   | 6076               | 69.4   |
| 1994 | 4886.2         | 936.0          | 62.3   | 69.5   | 62.3                              | 69.5   | 59.6               | 64.3   | 5455               | 62.3   |
| 1995 | 7930.8         | 936.0          | 99.4   | 72.8   | 99.4                              | 72.8   | 96.7               | 67.9   | 8704               | 99.4   |
| 1996 | 6860.3         | 936.0          | 84.2   | 74.0   | 84.2                              | 74.0   | 83.4               | 69.4   | 7391               | 84.1   |
| 1997 | 6822.7         | 936.0          | 84.8   | 75.0   | 84.8                              | 75.0   | 83.2               | 70.7   | 7427               | 84.8   |
| 1998 | 7833.5         | 936.0          | 95.9   | 76.7   | 95.9                              | 76.7   | 95.5               | 72.8   | 8404               | 95.9   |
| 1999 | 5704.8         | 936.0          | 74.0   | 76.5   | 74.0                              | 76.5   | 69.6               | 72.5   | 6476               | 73.9   |
| 2000 | 7352.7         | 936.0          | 88.8   | 77.4   | 88.8                              | 77.4   | 89.4               | 73.7   | 7795               | 88.7   |
| 2001 | 7811.8         | 936.0          | 92.4   | 78.4   | 92.4                              | 78.4   | 95.3               | 75.2   | 8120               | 92.7   |
| 2002 | 8472.4         | 966.0          | 97.9   | 79.6   | 97.9                              | 79.6   | 100.1              | 76.8   | 8579               | 97.9   |
| 2003 | 7653.2         | 966.0          | 91.8   | 80.4   | 91.8                              | 80.4   | 90.4               | 77.6   | 8050               | 91.9   |
| 2004 | 7427.4         | 966.0          | 88.2   | 80.8   | 88.2                              | 80.8   | 87.5               | 78.2   | 7758               | 88.3   |



# US-458 RIVER BEND-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 15 Aug | 46.2  | 45.2    | UF4  | A42  | AUTOMATIC SCRAM INITIATED BY MAIN TURBINE TRIP. THE TURBINE TRIP RESULTED FROM A SWITCHYARD FAULT ORIGINATING IN THE OFFSITE 230 KV NETWORK. |
| 01 Oct | 160.9 | 157.4   | UF4  | A31  | AN AUTOMATIC REACTOR SCRAM OCCURRED AS A RESULT OF A MAIN TURBINE TRIP.  |
| 21 Oct | 738.0 | 721.8   | PF   | C21  | REFUELLING OUTAGE.   |
| 21 Nov | 27.7  | 27.1    | PF   | E31  | MAIN GENERATOR TAKEN OFF-LINE FOR SCHEDULED OVERSPEED TESTING AND REPAIRS. REACTOR REMAINED CRITICAL   |
| 10 Dec | 51.4  | 50.3    | UF4  | A17  | AUTOMATIC REACTOR SCRAM RESULTED FROM THE FAILURE OF A NON-SAFETY RELATED INSTRUMENT POWER SUPPLY.   |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 258       |          | 6  | 386       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 30        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 738             |           |          | 893                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 199                                      | 10        |          |
| E. Testing of plant systems or components  | 27              |           |          | 14                                       | 6         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 14                                       | 179       |          |
| Subtotal   | 765             | 258       | 0        | 1126                                     | 611       | 0        |
| Total  |                 | 1023      |          |  | 1737      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 58                                       |
| 13. Reactor Auxiliary Systems                  |                 | 4  |
| 15. Reactor Cooling Systems                    |                 | 109                                      |
| 17. Safety I&C Systems (excluding reactor I&C) | 51              | 11                                       |
| 31. Turbine and auxiliaries                    | 160             | 49                                       |
| 32. Feedwater and Main Steam System            |                 | 38                                       |
| 33. Circulating Water System                   |                 | 4  |
| 35. All other I&C Systems                      |                 | 13                                       |
| 41. Main Generator Systems                     |                 | 29                                       |
| 42. Electrical Power Supply Systems            | 46              | 35                                       |
| XX. Miscellaneous Systems                      |                 | 6  |
| Total  | 257             | 356                                      |

# US-272 SALEM-1

**Operator:** PSEG (PUBLIC SERVICE ELECTRIC & GAS CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1096.0 MW(e)  
**Design Net RUP:** 1090.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7452.7 GW(e).h  
**Energy Availability Factor:** 77.6%  
**Load Factor:** 75.3%  
**Operating Factor:** 77.0%  
**Energy Unavailability Factor:** 22.4%  
**Total Off-line Time:** 2018 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 804.7 | 772.0 | 804.6 | 0.0   | 0.0   | 605.3 | 868.9 | 871.1 | 726.3 | 876.0 | 848.5 | 275.3 | 7452.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 93.5  | 0.0   | 0.0   | 88.8  | 100.0 | 100.0 | 90.0  | 100.0 | 100.0 | 54.8  | 77.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 93.5  | 0.0   | 0.0   | 88.8  | 100.0 | 100.0 | 90.0  | 100.0 | 100.0 | 54.8  | 77.6   |
| <b>LF (%)</b>   | 98.7  | 101.2 | 98.7  | 0.0   | 0.0   | 76.7  | 100.8 | 101.0 | 87.0  | 101.5 | 101.7 | 31.9  | 75.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 96.2  | 0.0   | 0.0   | 86.0  | 100.0 | 100.0 | 89.6  | 100.0 | 100.0 | 52.8  | 77.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 6.5   | 100.0 | 100.0 | 11.2  | 0.0   | 0.0   | 10.0  | 0.0   | 0.0   | 45.2  | 22.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 6.5   | 100.0 | 100.0 | 7.0   | 0.0   | 0.0   | 10.0  | 0.0   | 0.0   | 0.0   | 18.1   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.1   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 45.2  | 4.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1968  
**Date of First Criticality:** 11 Dec 1976  
**Date of Grid Connection:** 25 Dec 1976  
**Date of Commercial Operation:** 30 Jun 1977

**Lifetime Generation:** 158158.6 GW(e).h  
**Cumulative Energy Availability Factor:** 63.0%  
**Cumulative Load Factor:** 59.6%  
**Cumulative Unit Capability Factor:** 77.6%  
**Cumulative Energy Unavailability Factor:** 37.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 5408.8         | 1079.0         | 57.6   | 54.6   | 57.6                              | 53.8   | 57.2               | 49.4   | 5127               | 58.5   |
| 1984 | 2160.1         | 1079.0         | 27.1   | 50.6   | 27.1                              | 49.9   | 22.8               | 45.6   | 2378               | 27.1   |
| 1985 | 9007.5         | 1079.0         | 95.2   | 56.2   | 95.2                              | 55.6   | 95.3               | 51.8   | 8345               | 95.3   |
| 1986 | 7084.0         | 1083.0         | 78.6   | 58.7   | 78.6                              | 58.2   | 74.7               | 54.3   | 6921               | 79.0   |
| 1987 | 6216.6         | 1106.0         | 73.1   | 60.2   | 72.6                              | 59.6   | 64.2               | 55.3   | 6362               | 72.6   |
| 1988 | 7418.6         | 1106.0         | 77.9   | 61.8   | 77.9                              | 61.3   | 76.4               | 57.3   | 6841               | 77.9   |
| 1989 | 6213.3         | 1106.0         | 69.2   | 62.4   | 69.2                              | 62.0   | 64.1               | 57.9   | 6059               | 69.2   |
| 1990 | 5999.2         | 1106.0         | 67.0   | 62.8   | 67.0                              | 62.4   | 61.9               | 58.2   | 5868               | 67.0   |
| 1991 | 6810.3         | 1106.0         | 74.0   | 63.6   | 74.0                              | 63.2   | 70.3               | 59.1   | 6479               | 74.0   |
| 1992 | 5307.8         | 1106.0         | 58.0   | 63.2   | 58.0                              | 62.9   | 54.6               | 58.8   | 5090               | 57.9   |
| 1993 | 5870.6         | 1106.0         | 65.6   | 63.4   | 65.6                              | 63.0   | 60.6               | 58.9   | 5746               | 65.6   |
| 1994 | 5779.3         | 1106.0         | 67.0   | 63.6   | 67.0                              | 63.3   | 59.7               | 58.9   | 5865               | 67.0   |
| 1995 | 2554.4         | 1106.0         | 30.1   | 61.7   | 30.1                              | 61.4   | 26.4               | 57.1   | 2632               | 30.0   |
| 1996 | 0.0            | 1106.0         | 0.0  | 58.4   | 0.0                               | 58.1   | 0.0                | 54.1   | 0                  | 0.0    |
| 1997 | 0.0            | 1106.0         | 0.0  | 55.5   | 0.0                               | 55.2   | 0.0                | 51.3   | 0                  | 0.0    |
| 1998 | 6475.6         | 1106.0         | 70.8   | 56.2   | 70.8                              | 56.0   | 66.8               | 52.1   | 6199               | 70.8   |
| 1999 | 8009.2         | 1106.0         | 87.5   | 57.6   | 87.5                              | 57.4   | 82.7               | 53.5   | 7663               | 87.5   |
| 2000 | 8952.6         | 1106.0         | 94.8   | 59.3   | 94.8                              | 59.0   | 92.2               | 55.2   | 8328               | 94.8   |
| 2001 | 7709.4         | 1088.0         | 80.9   | 60.2   | 80.9                              | 60.0   | 80.9               | 56.2   | 7116               | 81.2   |
| 2002 | 8620.6         | 1096.0         | 89.5   | 61.3   | 89.5                              | 61.1   | 89.8               | 57.6   | 7855               | 89.7   |
| 2003 | 9096.7         | 1096.0         | 95.8   | 62.7   | 95.8                              | 62.5   | 94.7               | 59.0   | 8401               | 95.9   |
| 2004 | 7452.7         | 1127.0         | 77.6   | 63.2   | 77.6                              | 63.0   | 75.3               | 59.6   | 6766               | 77.0   |

# US-272 SALEM-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 30 Mar | 1562.6 | 1736.0  | PF   | C21  | REFUELLING OUTAGE.  |
| 19 Jun | 13.0   | 14.4    | UF2  | A31  | DIGITAL EHC DRIVER CARD FAILURE.  |
| 23 Jun | 16.4   | 18.2    | UF2  | A41  | REPAIR #1 EXCITER BEARING.  |
| 25 Sep | 75.0   | 83.3    | PF   | D32  | MAINTENANCE ON FEEDWATER REGULATING VALVES AND DIGITAL ELECTRO HYDRAULIC CONTROL SYSTEM |
| 04 Dec | 300.0  | 333.3   | UF2  | Z    | UNIT SHUTDOWN DUE TO OIL SPILL IN RIVER.  |
| 20 Dec | 51.0   | 56.7    | UF2  | A32  | MAINTENANCE ON 11 STEAM GENERATOR FEED PUMP. REACTOR REMAINED CRITICAL.                 |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1977 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 80        |          |   | 1523      |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling  | 1562            |           |          | 1068  |           |          |
| D. Inspection, maintenance or repair without refuelling  | 75              |           |          | 113   | 42        |          |
| E. Testing of plant systems or components  |                 |           |          | 1   | 1         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 136       | 38       |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 15  | 114       | 0        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |   | 5         |          |
| Z. Others  |                 | 300       |          |   |           |          |
| Subtotal   | 1637            | 380       | 0        | 1197  | 1832      | 39       |
| Total  |                 | 2017      |          |   | 3068      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1977 to 2004<br>Average Hours Lost Per Year |
|--|-----------------|---|
| 11. Reactor and Accessories                    |                 | 1   |
| 12. Reactor I&C Systems                        |                 | 95  |
| 13. Reactor Auxiliary Systems                  |                 | 7   |
| 14. Safety Systems                             |                 | 19  |
| 15. Reactor Cooling Systems                    |                 | 102   |
| 16. Steam generation systems                   |                 | 546   |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 4   |
| 31. Turbine and auxiliaries                    | 13              | 283   |
| 32. Feedwater and Main Steam System            | 51              | 128   |
| 33. Circulating Water System                   |                 | 63  |
| 35. All other I&C Systems                      |                 | 7   |
| 41. Main Generator Systems                     | 16              | 124   |
| 42. Electrical Power Supply Systems            |                 | 34  |
| XX. Miscellaneous Systems                      |                 | 4   |
| Total  | 80              | 1417  |

# US-311 SALEM-2

**Operator:** PSEG (PUBLIC SERVICE ELECTRIC & GAS CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1116.0 MW(e)  
**Design Net RUP:** 1115.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8799.8 GW(e).h  
**Energy Availability Factor:** 90.3%  
**Load Factor:** 89.8%  
**Operating Factor:** 90.4%  
**Energy Unavailability Factor:** 9.7%  
**Total Off-line Time:** 839 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 842.3 | 799.7 | 816.6 | 784.0 | 543.7 | 795.7 | 584.5 | 837.5 | 627.9 | 837.7 | 810.0 | 520.2 | 8799.8 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 99.2  | 100.0 | 66.3  | 100.0 | 71.7  | 100.0 | 84.1  | 100.0 | 100.0 | 64.1  | 90.3   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 99.2  | 100.0 | 66.3  | 100.0 | 71.7  | 100.0 | 84.1  | 100.0 | 100.0 | 64.1  | 90.3   |
| <b>LF (%)</b>   | 101.4 | 103.0 | 98.4  | 97.7  | 65.5  | 99.0  | 70.4  | 100.9 | 78.1  | 100.8 | 100.8 | 62.6  | 89.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 99.2  | 100.0 | 66.8  | 99.9  | 72.0  | 100.0 | 84.3  | 100.0 | 100.0 | 64.5  | 90.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.8   | 0.0   | 33.7  | 0.0   | 28.3  | 0.0   | 15.9  | 0.0   | 0.0   | 35.9  | 9.7    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 33.7  | 0.0   | 28.3  | 0.0   | 15.9  | 0.0   | 0.0   | 35.9  | 9.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1968  
**Date of First Criticality:** 08 Aug 1980  
**Date of Grid Connection:** 03 Jun 1981  
**Date of Commercial Operation:** 13 Oct 1981

**Lifetime Generation:** 137867.2 GW(e).h  
**Cumulative Energy Availability Factor:** 65.2%  
**Cumulative Load Factor:** 60.6%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 34.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 775.2          | 1106.0         | 12.7   | 55.1   | 12.6                              | 55.1   | 8.0                | 45.0   | 1078               | 12.3   |
| 1984 | 3225.7         | 1106.0         | 36.4   | 48.9   | 36.4                              | 48.9   | 33.2               | 41.1   | 3192               | 36.3   |
| 1985 | 5033.8         | 1106.0         | 56.2   | 50.7   | 56.2                              | 50.7   | 52.0               | 43.8   | 4923               | 56.2   |
| 1986 | 5317.7         | 1106.0         | 61.6   | 52.9   | 61.6                              | 52.9   | 54.9               | 46.0   | 5388               | 61.5   |
| 1987 | 6176.6         | 1106.0         | 72.4   | 56.1   | 72.4                              | 56.1   | 63.8               | 49.0   | 6338               | 72.4   |
| 1988 | 5982.2         | 1106.0         | 66.5   | 57.6   | 66.5                              | 57.6   | 61.6               | 50.8   | 5838               | 66.5   |
| 1989 | 7824.6         | 1106.0         | 84.7   | 61.0   | 84.7                              | 61.0   | 80.8               | 54.5   | 7419               | 84.7   |
| 1990 | 5446.1         | 1106.0         | 72.2   | 62.2   | 72.2                              | 62.2   | 56.2               | 54.7   | 5163               | 58.9   |
| 1991 | 7662.3         | 1106.0         | 82.0   | 64.2   | 82.1                              | 64.2   | 79.1               | 57.1   | 7188               | 82.1   |
| 1992 | 4744.6         | 1106.0         | 53.0   | 63.2   | 53.1                              | 63.2   | 48.8               | 56.4   | 4657               | 53.0   |
| 1993 | 5575.5         | 1106.0         | 60.9   | 63.0   | 60.9                              | 63.0   | 57.5               | 56.5   | 5328               | 60.8   |
| 1994 | 5606.8         | 1106.0         | 69.4   | 63.5   | 69.4                              | 63.5   | 57.9               | 56.6   | 6076               | 69.4   |
| 1995 | 2071.7         | 1106.0         | 25.8   | 60.8   | 25.8                              | 60.8   | 21.4               | 54.1   | 2261               | 25.8   |
| 1996 | 0.0            | 1106.0         | 0.0  | 56.8   | 0.0                               | 56.8   | 0.0                | 50.5   | 0                  | 0.0    |
| 1997 | 2564.3         | 1106.0         | 32.4   | 55.2   | 32.4                              | 55.2   | 26.5               | 49.0   | 2834               | 32.4   |
| 1998 | 7797.2         | 1106.0         | 83.2   | 56.9   | 83.2                              | 56.9   | 80.5               | 50.8   | 7287               | 83.2   |
| 1999 | 7949.4         | 1106.0         | 84.8   | 58.4   | 84.8                              | 58.4   | 82.0               | 52.5   | 7431               | 84.8   |
| 2000 | 8381.7         | 1106.0         | 89.0   | 60.0   | 89.0                              | 60.0   | 86.3               | 54.3   | 7819               | 89.0   |
| 2001 | 9517.6         | 1086.0         | 99.7   | 62.0   | 99.7                              | 62.0   | 100.0              | 56.6   | 8736               | 99.7   |
| 2002 | 8367.4         | 1092.0         | 86.8   | 63.1   | 86.8                              | 63.2   | 87.5               | 58.0   | 7620               | 87.0   |
| 2003 | 8095.6         | 1094.0         | 83.7   | 64.1   | 83.7                              | 64.1   | 84.5               | 59.2   | 7355               | 84.0   |
| 2004 | 8799.8         | 1116.0         | 90.3   | 65.2   | 90.3                              | 65.2   | 89.8               | 60.6   | 7945               | 90.4   |

**US-311 SALEM-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 13 Mar | 6.0   | 6.8     | PF   | D31  | TURBINE WAS TAKEN OFFLINE FOR MAINTENANCE ON THE 22BF19 VALVE. THE UNIT REMAINED CRITICAL. |
| 21 May | 248.0 | 280.0   | UF2  | A42  | 2B 230 VITAL BUS TRANSFORMER FAILURE.  |
| 13 Jul | 55.0  | 62.1    | UF2  | A35  | STEAM GENERATOR FEED WATER CONTROL VALVE FAILURE - 21BF19                                  |
| 15 Jul | 123.0 | 138.9   | UF2  | A35  | STEAM GENERATOR FEED WATER CONTROL VALVE FAILURE - 23BF19                                  |
| 21 Jul | 30.0  | 33.9    | UF2  | A31  | ELECTRO HYDRAULIC CONTROL LEAK REACTOR REMAINED CRITICAL.                                  |
| 09 Sep | 99.0  | 111.8   | UF2  | A41  | GENERATOR TRIP.  |
| 18 Sep | 14.0  | 15.8    | UF2  | A32  | FEEDWATER CHECK VALVE RETEST - REACTOR REMAINED CRITICAL.                                  |
| 03 Dec | 264.0 | 298.1   | UF2  | Z    | UNIT SHUTDOWN DUE TO OIL SPILL IN RIVER.   |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 569       |          |   | 1293      |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 1031  |           |          |
| D. Inspection, maintenance or repair without refuelling  | 6               |           |          | 131   | 29        |          |
| E. Testing of plant systems or components  |                 |           |          | 0   | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 19        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 5   | 352       |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           |          |   | 6         |          |
| Z. Others  |                 | 264       |          |   | 3         |          |
| Subtotal   | 6               | 833       | 0        | 1167  | 1712      | 0        |
| Total  |                 | 839       |          |   | 2879      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1981 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 0   |
| 12. Reactor I&C Systems                        |                    | 52  |
| 13. Reactor Auxiliary Systems                  |                    | 6   |
| 14. Safety Systems                             |                    | 62  |
| 15. Reactor Cooling Systems                    |                    | 91  |
| 16. Steam generation systems                   |                    | 241   |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    | 30                 | 126   |
| 32. Feedwater and Main Steam System            | 14                 | 128   |
| 33. Circulating Water System                   |                    | 8   |
| 35. All other I&C Systems                      | 178                | 4   |
| 41. Main Generator Systems                     | 99                 | 327   |
| 42. Electrical Power Supply Systems            | 248                | 225   |
| XX. Miscellaneous Systems                      |                    | 10  |
| Total  | 569                | 1282  |

# US-361 SAN ONOFRE-2

**Operator:** SCE (SOUTHERN CALIFORNIA EDISON)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1070.0 MW(e)  
**Design Net RUP:** 1070.0 MW(e)  
**Design Discharge Burnup:** 34800 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8068.0 GW(e).h  
**Energy Availability Factor:** 82.7%  
**Load Factor:** 85.8%  
**Operating Factor:** 82.7%  
**Energy Unavailability Factor:** 17.3%  
**Total Off-line Time:** 1521 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 837.9 | 224.5 | 0.0   | 527.3 | 833.5 | 807.2 | 836.5 | 833.6 | 805.5 | 835.0 | 692.7 | 834.3 | 8068.0 |
| <b>EAF (%)</b>  | 100.0 | 27.6  | 0.0   | 75.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.1  | 100.0 | 82.7   |
| <b>UCF (%)</b>  | 100.0 | 27.6  | 0.0   | 75.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.1  | 100.0 | 82.7   |
| <b>LF (%)</b>   | 105.3 | 30.1  | 0.0   | 68.5  | 104.7 | 104.8 | 105.1 | 104.7 | 104.6 | 104.7 | 89.9  | 104.8 | 85.8   |
| <b>OF (%)</b>   | 100.0 | 29.3  | 0.0   | 73.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.1  | 100.0 | 82.7   |
| <b>EUF (%)</b>  | 0.0   | 72.4  | 100.0 | 25.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.9  | 0.0   | 17.3   |
| <b>PUF (%)</b>  | 0.0   | 72.4  | 100.0 | 17.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.6   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 7.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.9  | 0.0   | 1.7    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1974  
**Date of First Criticality:** 26 Jul 1982  
**Date of Grid Connection:** 20 Sep 1982  
**Date of Commercial Operation:** 08 Aug 1983

**Lifetime Generation:** 163614.0 GW(e).h  
**Cumulative Energy Availability Factor:** 80.9%  
**Cumulative Load Factor:** 81.1%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 19.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3660.4         | 1083.0         | 0.0  | 0.0    | 52.0                              | 100.0  | 38.6               | 0.0    | 4236               | 48.4   |
| 1984 | 5272.6         | 1070.0         | 58.9   | 58.9   | 58.9                              | 58.9   | 56.1               | 56.1   | 5167               | 58.8   |
| 1985 | 5174.0         | 1070.0         | 58.4   | 58.6   | 58.4                              | 58.6   | 55.2               | 55.6   | 5114               | 58.4   |
| 1986 | 6371.3         | 1070.0         | 71.5   | 63.0   | 71.6                              | 62.9   | 68.0               | 59.8   | 6266               | 71.5   |
| 1987 | 6247.3         | 1070.0         | 69.3   | 64.5   | 69.3                              | 64.5   | 66.7               | 61.5   | 6067               | 69.3   |
| 1988 | 9002.7         | 1070.0         | 93.8   | 70.4   | 93.8                              | 70.4   | 95.8               | 68.3   | 8237               | 93.8   |
| 1989 | 5237.7         | 1070.0         | 56.6   | 68.1   | 56.6                              | 68.1   | 55.9               | 66.3   | 4956               | 56.6   |
| 1990 | 8309.7         | 1070.0         | 87.4   | 70.9   | 87.4                              | 70.9   | 88.7               | 69.5   | 7657               | 87.4   |
| 1991 | 5769.4         | 1070.0         | 64.4   | 70.0   | 64.4                              | 70.0   | 61.6               | 68.5   | 5637               | 64.3   |
| 1992 | 8795.2         | 1070.0         | 93.5   | 72.7   | 93.5                              | 72.7   | 93.6               | 71.3   | 8214               | 93.5   |
| 1993 | 7655.0         | 1070.0         | 82.3   | 73.6   | 82.4                              | 73.6   | 81.7               | 72.3   | 7213               | 82.3   |
| 1994 | 9309.2         | 1070.0         | 100.0  | 76.0   | 99.3                              | 76.0   | 99.3               | 74.8   | 8760               | 100.0  |
| 1995 | 6496.0         | 1070.0         | 70.8   | 75.6   | 70.8                              | 75.6   | 69.3               | 74.3   | 6197               | 70.7   |
| 1996 | 8550.2         | 1070.0         | 91.3   | 76.8   | 91.3                              | 76.8   | 91.0               | 75.6   | 8016               | 91.3   |
| 1997 | 6656.3         | 1070.0         | 70.8   | 76.4   | 70.8                              | 76.4   | 71.0               | 75.3   | 6197               | 70.7   |
| 1998 | 8430.2         | 1070.0         | 89.0   | 77.2   | 88.9                              | 77.2   | 89.9               | 76.2   | 7792               | 88.9   |
| 1999 | 8243.5         | 1070.0         | 85.0   | 77.7   | 85.0                              | 77.7   | 87.9               | 77.0   | 7447               | 85.0   |
| 2000 | 8524.2         | 1070.0         | 89.0   | 78.4   | 89.0                              | 78.4   | 90.7               | 77.8   | 7818               | 89.0   |
| 2001 | 9492.0         | 1070.0         | 97.5   | 79.4   | 97.5                              | 79.4   | 101.3              | 79.1   | 8538               | 97.5   |
| 2002 | 8510.5         | 1070.0         | 87.0   | 79.8   | 87.0                              | 79.8   | 90.8               | 79.7   | 7618               | 87.0   |
| 2003 | 9712.5         | 1070.0         | 99.0   | 80.8   | 99.0                              | 80.8   | 103.6              | 80.9   | 8671               | 99.0   |
| 2004 | 8068.0         | 1070.0         | 82.7   | 80.9   | 82.7                              | 80.9   | 85.8               | 81.1   | 7263               | 82.7   |

## US-361 SAN ONOFRE-2

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 09 Feb | 1372.0 | 1468.0  | PF   | C21  | REFUELLING OUTAGE.   |
| 10 Apr | 56.0   | 59.9    | UF5  | A32  | MANUALLY TRIPPED REACTOR IN RESPONSE TO A LOSS OF MAIN FEEDWATER.  |
| 19 Nov | 93.0   | 99.5    | UF4  | A42  | ELECTRICAL GROUND ON ISOPHASE BUS CAUSED AUTOMATIC GENERATOR TRIP, AUTOMATIC TURBINE TRIP, AND AUTOMATIC REACTOR TRIP. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 149       |          | 2  | 350       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 43        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1372            |           |          | 1083                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 140                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 5  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 36        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 32                                       | 28        |          |
| L. Human factor related  |                 |           |          |  |           | 1        |
| Subtotal   | 1372            | 149       | 0        | 1262                                     | 458       | 0        |
| Total  |                 | 1521      |          |  | 1720      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 2  |
| 12. Reactor I&C Systems             |                 | 21                                       |
| 13. Reactor Auxiliary Systems       |                 | 3  |
| 14. Safety Systems                  |                 | 2  |
| 15. Reactor Cooling Systems         |                 | 91                                       |
| 16. Steam generation systems        |                 | 82                                       |
| 31. Turbine and auxiliaries         |                 | 18                                       |
| 32. Feedwater and Main Steam System | 56              | 71                                       |
| 41. Main Generator Systems          |                 | 42                                       |
| 42. Electrical Power Supply Systems | 93              | 10                                       |
| XX. Miscellaneous Systems           |                 | 1  |
| Total                               | 149             | 343                                      |

# US-362 SAN ONOFRE-3

**Operator:** SCE (SOUTHERN CALIFORNIA EDISON)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1080.0 MW(e)  
**Design Net RUP:** 1070.0 MW(e)  
**Design Discharge Burnup:** 34800 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6985.6 GW(e).h  
**Energy Availability Factor:** 72.2%  
**Load Factor:** 73.6%  
**Operating Factor:** 72.2%  
**Energy Unavailability Factor:** 27.8%  
**Total Off-line Time:** 2440 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec  | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|--------|
| <b>GW(e).h</b>  | 637.3 | 766.8 | 831.7 | 806.1 | 829.6 | 730.0 | 830.4 | 826.8 | 691.5 | 0.0   | 0.0   | 35.4 | 6985.6 |
| <b>EAF (%)</b>  | 77.0  | 100.0 | 100.0 | 100.0 | 100.0 | 92.2  | 100.0 | 100.0 | 86.7  | 0.0   | 0.0   | 12.2 | 72.2   |
| <b>UCF (%)</b>  | 77.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.7  | 0.0   | 0.0   | 12.2 | 72.9   |
| <b>LF (%)</b>   | 79.3  | 102.0 | 103.5 | 103.8 | 103.2 | 93.9  | 103.3 | 102.9 | 88.9  | 0.0   | 0.0   | 4.4  | 73.6   |
| <b>OF (%)</b>   | 77.0  | 100.0 | 100.0 | 100.0 | 100.0 | 92.2  | 100.0 | 100.0 | 88.3  | 0.0   | 0.0   | 10.8 | 72.2   |
| <b>EUF (%)</b>  | 23.0  | 0.0   | 0.0   | 0.0   | 0.0   | 7.8   | 0.0   | 0.0   | 13.3  | 100.0 | 100.0 | 87.8 | 27.8   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.3  | 100.0 | 100.0 | 87.8 | 25.2   |
| <b>UCLF (%)</b> | 23.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 2.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0  | 0.6    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1974  
**Date of First Criticality:** 29 Aug 1983  
**Date of Grid Connection:** 25 Sep 1983  
**Date of Commercial Operation:** 01 Apr 1984

**Lifetime Generation:** 158173.9 GW(e).h  
**Cumulative Energy Availability Factor:** 81.8%  
**Cumulative Load Factor:** 80.5%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 18.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 997.2          | 1082.0         | 0.0  | 0.0    | 91.7                              | 100.0  | 11.3               | 0.0    | 1642               | 20.1   |
| 1984 | 4666.7         | 1080.0         | 0.0  | 0.0    | 72.1                              | 100.0  | 49.2               | 0.0    | 4708               | 53.6   |
| 1985 | 3735.9         | 1080.0         | 53.8   | 53.8   | 53.8                              | 53.8   | 39.5               | 39.5   | 4708               | 53.7   |
| 1986 | 6760.6         | 1080.0         | 80.7   | 67.2   | 80.7                              | 67.2   | 71.5               | 55.5   | 7067               | 80.7   |
| 1987 | 7523.6         | 1080.0         | 79.8   | 71.4   | 79.8                              | 71.4   | 79.5               | 63.5   | 6987               | 79.8   |
| 1988 | 6146.0         | 1080.0         | 65.1   | 69.8   | 65.1                              | 69.8   | 64.8               | 63.8   | 5714               | 65.1   |
| 1989 | 8840.6         | 1080.0         | 93.9   | 74.6   | 93.9                              | 74.6   | 93.4               | 69.7   | 8224               | 93.9   |
| 1990 | 6602.0         | 1080.0         | 70.3   | 73.9   | 70.3                              | 73.9   | 69.8               | 69.7   | 6159               | 70.3   |
| 1991 | 8693.2         | 1080.0         | 92.4   | 76.6   | 92.4                              | 76.6   | 91.9               | 72.9   | 8094               | 92.4   |
| 1992 | 6830.8         | 1080.0         | 74.4   | 76.3   | 74.4                              | 76.3   | 72.0               | 72.8   | 6533               | 74.4   |
| 1993 | 7128.2         | 1080.0         | 76.4   | 76.3   | 76.4                              | 76.3   | 75.3               | 73.1   | 6689               | 76.4   |
| 1994 | 9147.7         | 1080.0         | 99.8   | 78.7   | 99.8                              | 78.6   | 96.7               | 75.4   | 8742               | 99.8   |
| 1995 | 7501.6         | 1080.0         | 81.9   | 78.9   | 81.9                              | 78.9   | 79.3               | 75.8   | 7175               | 81.9   |
| 1996 | 8838.6         | 1080.0         | 94.6   | 80.3   | 94.6                              | 80.3   | 93.2               | 77.2   | 8313               | 94.6   |
| 1997 | 6842.9         | 1080.0         | 72.6   | 79.7   | 72.6                              | 79.7   | 72.3               | 76.9   | 6357               | 72.6   |
| 1998 | 9058.6         | 1080.0         | 94.8   | 80.7   | 94.8                              | 80.7   | 95.7               | 78.2   | 8304               | 94.8   |
| 1999 | 8416.5         | 1080.0         | 87.4   | 81.2   | 87.4                              | 81.2   | 89.0               | 78.9   | 7658               | 87.4   |
| 2000 | 9633.8         | 1080.0         | 100.0  | 82.4   | 100.0                             | 82.4   | 101.5              | 80.3   | 8784               | 100.0  |
| 2001 | 5679.3         | 1080.0         | 58.9   | 81.0   | 58.9                              | 81.0   | 60.0               | 79.1   | 5170               | 59.0   |
| 2002 | 9548.2         | 1080.0         | 98.8   | 82.0   | 98.8                              | 82.0   | 100.9              | 80.4   | 8658               | 98.8   |
| 2003 | 8596.3         | 1080.0         | 88.4   | 82.3   | 88.4                              | 82.3   | 90.9               | 80.9   | 7741               | 88.4   |
| 2004 | 6985.6         | 1080.0         | 72.8   | 81.8   | 72.2                              | 81.8   | 73.6               | 80.5   | 6344               | 72.2   |



## US-362 SAN ONOFRE-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description   |
|--------|--------|---------|------|------|---|
| 24 Jan | 171.0  | 184.7   | UF2  | A13  | SHUTDOWN NEEDED TO REPAIR A MINOR LEAK IN THE CHEMICAL AND VOLUME CONTROL SYSTEM INSIDE THE CONTAINMENT BUILDING.                 |
| 04 Jun | 56.0   | 60.5    | XF5  | N    | PLANT OPERATORS MANUALLY TRIPPED THE REACTOR DUE TO DEGRADED CIRCULATIONG WATER PUMP SUCTION CAUSED BY HEAVY INFLUX OF SEA GRASS. |
| 27 Sep | 2213.0 | 2390.0  | PF   | C21  | REFUELLING OUTAGE.  |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 171       |          |   | 474       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 1         |          |
| C. Inspection, maintenance or repair combined with refuelling  | 2213            |           |          | 906   |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 84  |           |          |
| E. Testing of plant systems or components  |                 |           |          | 6   |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |   | 6         |          |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 56       |   |           |          |
| Subtotal   | 2213            | 171       | 56       | 996   | 481       | 0        |
| Total  |                 | 2440      |          |   | 1477      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004<br>Hours Lost | 1983 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 12. Reactor I&C Systems             |                    | 41  |
| 13. Reactor Auxiliary Systems       | 171                |   |
| 14. Safety Systems                  |                    | 57  |
| 15. Reactor Cooling Systems         |                    | 73  |
| 16. Steam generation systems        |                    | 64  |
| 31. Turbine and auxiliaries         |                    | 12  |
| 32. Feedwater and Main Steam System |                    | 13  |
| 41. Main Generator Systems          |                    | 42  |
| 42. Electrical Power Supply Systems |                    | 40  |
| Total                               | 171                | 342   |

# US-443 SEABROOK-1

**Operator:** FPL (FLORIDA POWER & LIGHT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1155.0 MW(e)  
**Design Net RUP:** 1149.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10177.0 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 100.3%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 861.3 | 805.7 | 861.9 | 833.5 | 862.9 | 835.4 | 861.3 | 862.4 | 833.6 | 862.5 | 833.9 | 862.6 | 10177.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>LF (%)</b>   | 100.2 | 100.2 | 100.3 | 100.4 | 100.4 | 100.5 | 100.2 | 100.4 | 100.2 | 100.2 | 100.3 | 100.4 | 100.3   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1976  
**Date of First Criticality:** 13 Jun 1989  
**Date of Grid Connection:** 29 May 1990  
**Date of Commercial Operation:** 19 Aug 1990

**Lifetime Generation:** 122631.3 GW(e).h  
**Cumulative Energy Availability Factor:** 85.2%  
**Cumulative Load Factor:** 83.7%  
**Cumulative Unit Capability Factor:** 79.7%  
**Cumulative Energy Unavailability Factor:** 14.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1990 | 4094.0         | 1151.0         | 0.0  | 0.0    | 87.9                              | 100.0  | 40.6               | 0.0    | 4125               | 47.1   |
| 1991 | 6814.4         | 1150.0         | 73.0   | 73.0   | 73.0                              | 73.0   | 67.6               | 67.6   | 6394               | 73.0   |
| 1992 | 7868.4         | 1150.0         | 80.3   | 76.6   | 80.3                              | 76.6   | 77.9               | 72.8   | 7056               | 80.3   |
| 1993 | 9046.8         | 1150.0         | 92.4   | 81.9   | 92.4                              | 81.9   | 89.8               | 78.4   | 8094               | 92.4   |
| 1994 | 6203.5         | 1150.0         | 62.3   | 77.0   | 62.3                              | 77.0   | 61.6               | 74.2   | 5466               | 62.4   |
| 1995 | 8380.6         | 1150.0         | 85.2   | 78.6   | 85.2                              | 78.6   | 83.2               | 76.0   | 7465               | 85.2   |
| 1996 | 9844.2         | 1158.0         | 99.0   | 82.0   | 99.0                              | 82.0   | 96.8               | 79.5   | 8690               | 98.9   |
| 1997 | 7945.7         | 1158.0         | 79.2   | 81.6   | 79.2                              | 81.6   | 78.3               | 79.3   | 6929               | 79.1   |
| 1998 | 8388.4         | 1158.0         | 83.3   | 81.8   | 83.3                              | 81.8   | 82.7               | 79.8   | 7294               | 83.3   |
| 1999 | 8685.7         | 1156.0         | 86.3   | 82.3   | 86.3                              | 82.3   | 85.8               | 80.4   | 7564               | 86.3   |
| 2000 | 7921.5         | 1155.0         | 78.7   | 82.0   | 78.7                              | 82.0   | 78.1               | 80.2   | 6910               | 78.7   |
| 2001 | 8692.2         | 1155.0         | 90.6   | 82.8   | 87.9                              | 82.5   | 85.9               | 80.7   | 7703               | 87.9   |
| 2002 | 9293.4         | 1155.0         | 92.2   | 83.5   | 92.2                              | 83.3   | 91.9               | 81.6   | 8083               | 92.3   |
| 2003 | 9275.4         | 1155.0         | 92.7   | 84.3   | 92.7                              | 84.0   | 91.7               | 82.4   | 8121               | 92.7   |
| 2004 | 10177.0        | 1155.0         | 100.0  | 85.4   | 100.0                             | 85.2   | 100.3              | 83.7   | 8784               | 100.0  |

# US-443 SEABROOK-1

## 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1990 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 354       |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 879                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 16                                       | 1         |          |
| E. Testing of plant systems or components  |                 |           |          | 0  | 7         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  | 4         | 15       |
| Subtotal   | 0               | 0         | 0        | 895                                      | 366       | 15       |
| Total  | 0               |           |          | 1276                                     |           |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1990 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 13. Reactor Auxiliary Systems                  |                 | 116                                      |
| 15. Reactor Cooling Systems                    |                 | 56                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 5  |
| 31. Turbine and auxiliaries                    |                 | 43                                       |
| 32. Feedwater and Main Steam System            |                 | 23                                       |
| 35. All other I&C Systems                      |                 | 26                                       |
| 41. Main Generator Systems                     |                 | 53                                       |
| 42. Electrical Power Supply Systems            |                 | 26                                       |
| Total  | 0               | 348                                      |

# US-327 SEQUOYAH-1

**Operator:** TVA (TENNESSEE VALLEY AUTHORITY)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1148.0 MW(e)  
**Design Net RUP:** 1148.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9290.5 GW(e).h  
**Energy Availability Factor:** 91.4%  
**Load Factor:** 92.1%  
**Operating Factor:** 91.4%  
**Energy Unavailability Factor:** 8.6%  
**Total Off-line Time:** 757 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 871.9 | 821.0 | 726.2 | 845.2 | 869.0 | 832.3 | 854.9 | 853.3 | 831.1 | 665.0 | 241.9 | 878.7 | 9290.5 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 84.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.4  | 34.3  | 100.0 | 91.4   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 84.5  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.4  | 34.3  | 100.0 | 91.4   |
| <b>LF (%)</b>   | 102.1 | 102.8 | 85.0  | 102.4 | 101.7 | 100.7 | 100.1 | 99.9  | 100.5 | 77.8  | 29.3  | 102.9 | 92.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 84.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 77.3  | 34.4  | 100.0 | 91.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 15.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.6  | 65.7  | 0.0   | 8.6    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 22.6  | 65.7  | 0.0   | 7.3    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 15.5  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1970  
**Date of First Criticality:** 05 Jul 1980  
**Date of Grid Connection:** 22 Jul 1980  
**Date of Commercial Operation:** 01 Jul 1981

**Lifetime Generation:** 154024.7 GW(e).h  
**Cumulative Energy Availability Factor:** 67.4%  
**Cumulative Load Factor:** 65.2%  
**Cumulative Unit Capability Factor:** 77.8%  
**Cumulative Energy Unavailability Factor:** 32.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 7340.9         | 1139.0         | 78.3   | 65.9   | 78.2                              | 65.9   | 73.6               | 61.7   | 6791               | 77.5   |
| 1984 | 6104.7         | 1148.0         | 69.1   | 66.9   | 69.1                              | 66.9   | 60.5               | 61.3   | 5992               | 68.2   |
| 1985 | 4076.1         | 1148.0         | 44.7   | 61.4   | 44.7                              | 61.3   | 40.5               | 56.1   | 3760               | 42.9   |
| 1986 | 0.0            | 1148.0         | 0.0  | 49.0   | 0.0                               | 49.0   | 0.0                | 44.8   | 0                  | 0.0    |
| 1987 | 0.0            | 1148.0         | 0.0  | 40.8   | 0.0                               | 40.8   | 0.0                | 37.3   | 0                  | 0.0    |
| 1988 | 127.7          | 1148.0         | 6.3  | 35.9   | 6.3                               | 35.9   | 1.3                | 32.1   | 282                | 3.2    |
| 1989 | 9550.6         | 1148.0         | 98.5   | 43.7   | 98.5                              | 43.7   | 95.0               | 40.0   | 8624               | 98.4   |
| 1990 | 6840.7         | 1148.0         | 74.0   | 47.1   | 74.0                              | 47.1   | 68.0               | 43.1   | 6406               | 73.1   |
| 1991 | 7270.1         | 1122.0         | 77.6   | 50.1   | 77.6                              | 50.1   | 74.0               | 46.2   | 6774               | 77.3   |
| 1992 | 8402.5         | 1122.0         | 88.2   | 53.5   | 88.2                              | 53.5   | 85.3               | 49.7   | 7734               | 88.0   |
| 1993 | 1290.5         | 1122.0         | 14.8   | 50.3   | 14.8                              | 50.3   | 13.1               | 46.7   | 1219               | 13.9   |
| 1994 | 6111.6         | 1111.0         | 66.0   | 51.5   | 66.0                              | 51.5   | 62.8               | 47.9   | 5774               | 65.9   |
| 1995 | 6829.5         | 1111.0         | 75.6   | 53.2   | 75.6                              | 53.2   | 70.2               | 49.4   | 6620               | 75.6   |
| 1996 | 9293.5         | 1112.0         | 95.1   | 55.9   | 95.1                              | 55.9   | 95.1               | 52.4   | 8344               | 95.0   |
| 1997 | 8324.3         | 1117.0         | 85.5   | 57.8   | 85.5                              | 57.8   | 85.1               | 54.4   | 7486               | 85.5   |
| 1998 | 8905.7         | 1118.0         | 91.0   | 59.7   | 91.0                              | 59.7   | 90.9               | 56.6   | 7966               | 90.9   |
| 1999 | 9987.0         | 1122.0         | 100.0  | 61.9   | 100.0                             | 61.9   | 101.6              | 59.0   | 8760               | 100.0  |
| 2000 | 7720.5         | 1122.0         | 79.5   | 62.8   | 79.5                              | 62.8   | 78.3               | 60.1   | 6988               | 79.6   |
| 2001 | 9019.0         | 1122.0         | 91.2   | 64.2   | 91.2                              | 64.2   | 91.8               | 61.6   | 7988               | 91.2   |
| 2002 | 9953.5         | 1124.0         | 100.0  | 65.9   | 100.0                             | 65.9   | 101.1              | 63.5   | 8760               | 100.0  |
| 2003 | 7351.1         | 1125.0         | 73.6   | 66.3   | 73.6                              | 66.3   | 74.6               | 64.0   | 6443               | 73.6   |
| 2004 | 9290.5         | 1148.0         | 91.4   | 67.4   | 91.4                              | 67.4   | 92.1               | 65.2   | 8027               | 91.4   |

# US-327 SEQUOYAH-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 15 Mar | 115.4 | 132.7   | UF4  | A42  | AUTO TURBINE/REACTOR TRIP DUE TO A GROUND ON AN INCORRECTLY ABANDONED CABLE ON A TRANSFORMER PROTECTIVE RELAY COIL CIRCUIT. |
| 25 Oct | 640.6 | 736.7   | PF   | C21  | REFUELLING OUTAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1981 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 115       |          |  | 693       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 20        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 640             |           |          | 863                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 14                                       | 30        |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          |  | 4         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 46                                       | 380       |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 58                                       | 679       |          |
| L. Human factor related  |                 |           |          |  | 4         |          |
| Subtotal   | 640             | 115       | 0        | 982                                      | 1810      | 0        |
| Total  |                 | 755       |          |  | 2792      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1981 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 24                                       |
| 13. Reactor Auxiliary Systems       |                 | 18                                       |
| 14. Safety Systems                  |                 | 16                                       |
| 15. Reactor Cooling Systems         |                 | 68                                       |
| 16. Steam generation systems        |                 | 4  |
| 31. Turbine and auxiliaries         |                 | 35                                       |
| 32. Feedwater and Main Steam System |                 | 360                                      |
| 35. All other I&C Systems           |                 | 7  |
| 41. Main Generator Systems          |                 | 108                                      |
| 42. Electrical Power Supply Systems | 115             | 34                                       |
| Total                               | 115             | 674                                      |

# US-328 SEQUOYAH-2

**Operator:** TVA (TENNESSEE VALLEY AUTHORITY)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1124.0 MW(e)  
**Design Net RUP:** 1148.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9464.9 GW(e).h  
**Energy Availability Factor:** 95.1%  
**Load Factor:** 95.9%  
**Operating Factor:** 95.1%  
**Energy Unavailability Factor:** 4.9%  
**Total Off-line Time:** 431 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 322.5 | 801.5 | 854.5 | 825.0 | 847.9 | 811.4 | 835.1 | 832.4 | 813.1 | 844.6 | 819.6 | 857.2 | 9464.9 |
| <b>EAF (%)</b>  | 42.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.1   |
| <b>UCF (%)</b>  | 42.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.1   |
| <b>LF (%)</b>   | 38.6  | 102.5 | 102.2 | 102.1 | 101.4 | 100.3 | 99.9  | 99.5  | 100.5 | 100.9 | 101.3 | 102.5 | 95.9   |
| <b>OF (%)</b>   | 42.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.1   |
| <b>EUF (%)</b>  | 58.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.9    |
| <b>PUF (%)</b>  | 32.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.8    |
| <b>UCLF (%)</b> | 25.2  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1970  
**Date of First Criticality:** 05 Nov 1981  
**Date of Grid Connection:** 23 Dec 1981  
**Date of Commercial Operation:** 01 Jun 1982

**Lifetime Generation:** 154993.5 GW(e).h  
**Cumulative Energy Availability Factor:** 72.1%  
**Cumulative Load Factor:** 68.9%  
**Cumulative Unit Capability Factor:** 77.9%  
**Cumulative Energy Unavailability Factor:** 27.9%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 6691.4         | 1133.0         | 72.8   | 72.8   | 72.8                              | 72.8   | 67.4               | 67.4   | 6346               | 72.4   |
| 1984 | 6403.3         | 1148.0         | 69.8   | 71.3   | 69.8                              | 71.3   | 63.5               | 65.4   | 6112               | 69.6   |
| 1985 | 5625.0         | 1148.0         | 59.8   | 67.4   | 59.8                              | 67.4   | 55.9               | 62.3   | 5223               | 59.6   |
| 1986 | 0.0            | 1148.0         | 0.0  | 50.5   | 0.0                               | 50.5   | 0.0                | 46.7   | 0                  | 0.0    |
| 1987 | 0.0            | 1148.0         | 0.0  | 40.4   | 0.0                               | 40.4   | 0.0                | 37.3   | 0                  | 0.0    |
| 1988 | 3934.7         | 1148.0         | 59.4   | 43.6   | 59.4                              | 43.6   | 39.0               | 37.6   | 5097               | 58.0   |
| 1989 | 6067.7         | 1148.0         | 70.7   | 47.5   | 70.7                              | 47.5   | 60.3               | 40.8   | 6103               | 69.7   |
| 1990 | 7185.5         | 1148.0         | 79.1   | 51.4   | 79.1                              | 51.4   | 71.5               | 44.7   | 6864               | 78.4   |
| 1991 | 9318.9         | 1122.0         | 96.9   | 56.4   | 96.9                              | 56.4   | 94.8               | 50.1   | 8482               | 96.8   |
| 1992 | 7276.1         | 1122.0         | 80.3   | 58.8   | 80.3                              | 58.7   | 73.8               | 52.5   | 7031               | 80.0   |
| 1993 | 2094.4         | 1122.0         | 26.3   | 55.9   | 26.3                              | 55.8   | 21.3               | 49.7   | 2213               | 25.3   |
| 1994 | 5849.4         | 1106.0         | 61.9   | 56.3   | 61.8                              | 56.3   | 60.4               | 50.5   | 5415               | 61.8   |
| 1995 | 8887.7         | 1106.0         | 92.2   | 59.0   | 92.1                              | 59.0   | 91.7               | 53.6   | 8064               | 92.1   |
| 1996 | 7682.5         | 1108.0         | 78.6   | 60.4   | 78.6                              | 60.4   | 78.9               | 55.4   | 6894               | 78.5   |
| 1997 | 8725.6         | 1117.0         | 91.5   | 62.4   | 91.5                              | 62.4   | 89.2               | 57.6   | 8001               | 91.3   |
| 1998 | 9799.6         | 1117.0         | 98.8   | 64.7   | 98.8                              | 64.7   | 100.1              | 60.3   | 8656               | 98.8   |
| 1999 | 8979.0         | 1117.0         | 93.7   | 66.4   | 93.7                              | 66.4   | 91.8               | 62.1   | 8203               | 93.6   |
| 2000 | 9058.3         | 1117.0         | 92.9   | 67.8   | 92.9                              | 67.8   | 92.3               | 63.7   | 8158               | 92.9   |
| 2001 | 9939.9         | 1117.0         | 100.0  | 69.5   | 100.0                             | 69.5   | 101.6              | 65.7   | 8760               | 100.0  |
| 2002 | 8542.0         | 1119.0         | 87.3   | 70.4   | 87.3                              | 70.4   | 87.1               | 66.8   | 7640               | 87.2   |
| 2003 | 8258.3         | 1126.0         | 84.6   | 71.1   | 84.6                              | 71.1   | 83.7               | 67.6   | 7401               | 84.5   |
| 2004 | 9464.9         | 1124.0         | 95.1   | 72.2   | 95.1                              | 72.1   | 95.9               | 68.9   | 8353               | 95.1   |

## US-328 SEQUOYAH-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 01 Jan | 186.7 | 210.4   | UF3  | A41  | UNIT 2 REMAINED OFFLINE AND IN MODE 3 FOR GENERATOR HYDROGEN LEAGAGE REPAIRS. REPAIRS TO THE SOURCE OF THE LEAGE WERE PERFORMED AND THE UNIT WAS RETURNED TO SERVICE.              |
| 15 Jan | 243.9 | 274.9   | PF   | D41  | UNIT 2 INITIATED MANUAL SHUTDOWN FOR A MAIN GENERATOR HYDROGEN LEAK INTO THE STATOR COOLING WATER SYSTEM. THE SOURCE OF THE LEAKAGE WAS REPAIRED AND UNIT WAS RETURNED TO SERVICE. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1982 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 186       |          |  | 547       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 25        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 762                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 243             |           |          | 32                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 518       |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 487       |          |
| Subtotal   | 243             | 186       | 0        | 795                                      | 1577      | 0        |
| Total  |                 | 429       |          |  | 2372      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1982 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 5  |
| 13. Reactor Auxiliary Systems                  |                 | 10                                       |
| 14. Safety Systems                             |                 | 1  |
| 15. Reactor Cooling Systems                    |                 | 58                                       |
| 16. Steam generation systems                   |                 | 31                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 32                                       |
| 32. Feedwater and Main Steam System            |                 | 59                                       |
| 35. All other I&C Systems                      |                 | 2  |
| 41. Main Generator Systems                     | 186             | 310                                      |
| 42. Electrical Power Supply Systems            |                 | 21                                       |
| Total  | 186             | 531                                      |

# US-400 SHEARON HARRIS-1

**Operator:** PROGRESS (Progress Energy Corporation)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 900.0 MW(e)  
**Design Net RUP:** 900.0 MW(e)  
**Design Discharge Burnup:** 31500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7008.4 GW(e).h  
**Energy Availability Factor:** 87.5%  
**Load Factor:** 88.7%  
**Operating Factor:** 87.5%  
**Energy Unavailability Factor:** 12.5%  
**Total Off-line Time:** 1097 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 696.1 | 651.1 | 691.5 | 640.5 | 378.3 | 655.5 | 674.1 | 676.5 | 658.4 | 324.2 | 268.6 | 693.6 | 7008.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 57.9  | 100.0 | 100.0 | 100.0 | 100.0 | 45.2  | 48.2  | 100.0 | 87.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 57.9  | 100.0 | 100.0 | 100.0 | 100.0 | 45.2  | 48.2  | 100.0 | 87.5   |
| <b>LF (%)</b>   | 104.0 | 103.9 | 103.3 | 99.0  | 56.5  | 101.2 | 100.7 | 101.0 | 101.6 | 48.4  | 41.5  | 103.6 | 88.7   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 57.8  | 100.0 | 100.0 | 100.0 | 100.0 | 48.2  | 44.9  | 100.0 | 87.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 42.1  | 0.0   | 0.0   | 0.0   | 0.0   | 54.8  | 51.8  | 0.0   | 12.5   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 54.8  | 51.8  | 0.0   | 8.9    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 42.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1974      **Lifetime Generation:** 109530.1 GW(e).h  
**Date of First Criticality:** 03 Jan 1987      **Cumulative Energy Availability Factor:** 86.2%  
**Date of Grid Connection:** 19 Jan 1987      **Cumulative Load Factor:** 84.8%  
**Date of Commercial Operation:** 02 May 1987      **Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 13.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 5345.6         | 860.0          | 73.6   | 73.6   | 73.6                              | 73.6   | 70.8               | 70.8   | 6458               | 73.5   |
| 1989 | 5638.8         | 860.0          | 78.5   | 76.0   | 78.5                              | 76.0   | 74.8               | 72.8   | 6873               | 78.5   |
| 1990 | 6339.0         | 860.0          | 89.2   | 80.4   | 89.2                              | 80.4   | 84.1               | 76.6   | 7812               | 89.2   |
| 1991 | 5927.4         | 860.0          | 80.8   | 80.5   | 80.8                              | 80.5   | 78.7               | 77.1   | 7080               | 80.8   |
| 1992 | 5427.9         | 860.0          | 74.0   | 79.2   | 74.0                              | 79.2   | 71.9               | 76.1   | 6501               | 74.0   |
| 1993 | 7527.7         | 860.0          | 99.5   | 82.6   | 99.6                              | 82.6   | 99.9               | 80.0   | 8721               | 99.6   |
| 1994 | 6065.1         | 860.0          | 82.2   | 82.5   | 82.2                              | 82.5   | 80.5               | 80.1   | 7195               | 82.1   |
| 1995 | 5966.3         | 860.0          | 83.1   | 82.6   | 83.1                              | 82.6   | 79.2               | 80.0   | 7279               | 83.1   |
| 1996 | 7067.7         | 860.0          | 95.3   | 84.0   | 94.6                              | 83.9   | 93.6               | 81.5   | 8301               | 94.5   |
| 1997 | 5909.0         | 860.0          | 79.2   | 83.5   | 79.2                              | 83.5   | 78.4               | 81.2   | 6934               | 79.2   |
| 1998 | 6711.6         | 860.0          | 90.1   | 84.1   | 90.1                              | 84.1   | 89.1               | 81.9   | 7891               | 90.1   |
| 1999 | 7244.1         | 860.0          | 96.9   | 85.2   | 96.9                              | 85.1   | 96.2               | 83.1   | 8484               | 96.8   |
| 2000 | 6878.0         | 860.0          | 92.2   | 85.7   | 92.2                              | 85.7   | 91.0               | 83.7   | 8098               | 92.2   |
| 2001 | 5401.5         | 860.0          | 72.3   | 84.8   | 72.3                              | 84.7   | 71.7               | 82.8   | 6335               | 72.3   |
| 2002 | 7835.0         | 900.0          | 99.0   | 85.8   | 98.7                              | 85.7   | 99.4               | 84.0   | 8643               | 98.7   |
| 2003 | 7236.9         | 900.0          | 92.3   | 86.2   | 92.3                              | 86.1   | 91.8               | 84.5   | 8082               | 92.3   |
| 2004 | 7008.4         | 900.0          | 87.5   | 86.3   | 87.5                              | 86.2   | 88.7               | 84.8   | 7687               | 87.5   |



# US-400 SHEARON HARRIS-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 06 May | 313.4 | 282.1   | UF4  | A12  | A FAILED STATIONARY GRIPPER REGULATION CARD FOR SHUTDOWN BANK C CAUSED THE INSERTION OF FOUR CONTROL RODS CREATING A HIGH FLUX RATE (NEGATIVE) SIGNAL TO THE REACTOR PROTECTION SYSTEM. |
| 15 Oct | 781.6 | 703.4   | PF   | C21  | REFUELLING OUTAGE.  |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 313       |          |  | 173       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 2         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 781             |           |          | 871                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 84                                       | 8         |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 3         | 5        |
| Subtotal   | 781             | 313       | 0        | 956                                      | 186       | 5        |
| Total  |                 | 1094      |          |  | 1147      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        | 313             | 16                                       |
| 15. Reactor Cooling Systems                    |                 | 1  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 73                                       |
| 32. Feedwater and Main Steam System            |                 | 54                                       |
| 41. Main Generator Systems                     |                 | 13                                       |
| 42. Electrical Power Supply Systems            |                 | 2  |
| XX. Miscellaneous Systems                      |                 | 6  |
| Total  | 313             | 167                                      |

# US-498 SOUTH TEXAS-1

**Operator:** STP (STP Nuclear Operating Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1250.0 MW(e)  
**Design Net RUP:** 1250.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 11103.6 GW(e).h  
**Energy Availability Factor:** 99.2%  
**Load Factor:** 101.1%  
**Operating Factor:** 99.2%  
**Energy Unavailability Factor:** 0.8%  
**Total Off-line Time:** 72 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 850.5 | 898.0 | 955.6 | 919.0 | 953.0 | 918.2 | 945.8 | 946.4 | 918.7 | 952.8 | 924.4 | 921.2 | 11103.6 |
| <b>EAF (%)</b>  | 90.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.2    |
| <b>UCF (%)</b>  | 90.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.2    |
| <b>LF (%)</b>   | 91.5  | 103.2 | 102.8 | 102.2 | 102.5 | 102.0 | 101.7 | 101.8 | 102.1 | 102.3 | 102.7 | 99.0  | 101.1   |
| <b>OF (%)</b>   | 90.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.2    |
| <b>EUF (%)</b>  | 9.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 9.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1975  
**Date of First Criticality:** 08 Mar 1988  
**Date of Grid Connection:** 30 Mar 1988  
**Date of Commercial Operation:** 25 Aug 1988

**Lifetime Generation:** 136261.9 GW(e).h  
**Cumulative Energy Availability Factor:** 77.5%  
**Cumulative Load Factor:** 76.1%  
**Cumulative Unit Capability Factor:** 78.8%  
**Cumulative Energy Unavailability Factor:** 22.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 2791.5         | 1250.0         | 0.0  | 0.0    | 91.6                              | 100.0  | 27.2               | 0.0    | 2404               | 29.3   |
| 1989 | 6307.7         | 1250.0         | 63.1   | 63.1   | 63.1                              | 63.1   | 57.6               | 57.6   | 5524               | 63.1   |
| 1990 | 6072.9         | 1251.0         | 59.4   | 61.2   | 59.4                              | 61.2   | 55.4               | 56.5   | 5198               | 59.3   |
| 1991 | 7239.8         | 1251.0         | 69.3   | 63.9   | 69.3                              | 63.9   | 66.1               | 59.7   | 6069               | 69.3   |
| 1992 | 7265.1         | 1251.0         | 68.7   | 65.1   | 68.7                              | 65.1   | 66.1               | 61.3   | 6033               | 68.7   |
| 1993 | 666.0          | 1251.0         | 7.7  | 53.6   | 7.7                               | 53.6   | 6.1                | 50.3   | 676                | 7.7    |
| 1994 | 8251.4         | 1251.0         | 78.2   | 57.7   | 78.2                              | 57.7   | 75.3               | 54.4   | 6842               | 78.1   |
| 1995 | 9301.8         | 1251.0         | 86.5   | 61.8   | 86.5                              | 61.8   | 84.9               | 58.8   | 7570               | 86.4   |
| 1996 | 10226.8        | 1251.0         | 93.5   | 65.8   | 93.5                              | 65.8   | 93.1               | 63.1   | 8213               | 93.5   |
| 1997 | 9873.2         | 1251.0         | 91.6   | 68.7   | 91.6                              | 68.7   | 90.1               | 66.1   | 8019               | 91.5   |
| 1998 | 10859.9        | 1250.0         | 99.8   | 71.8   | 99.8                              | 71.8   | 99.2               | 69.4   | 8739               | 99.8   |
| 1999 | 9645.4         | 1250.0         | 89.7   | 73.4   | 89.7                              | 73.4   | 88.1               | 71.1   | 7857               | 89.7   |
| 2000 | 8591.9         | 1250.0         | 78.6   | 73.8   | 78.6                              | 73.8   | 78.3               | 71.7   | 6905               | 78.6   |
| 2001 | 10338.2        | 1250.0         | 94.1   | 75.4   | 94.1                              | 75.4   | 94.4               | 73.4   | 8240               | 94.1   |
| 2002 | 10867.9        | 1253.0         | 97.8   | 77.0   | 97.9                              | 77.0   | 99.0               | 75.3   | 8573               | 97.9   |
| 2003 | 6858.8         | 1250.0         | 62.3   | 76.0   | 62.3                              | 76.0   | 62.6               | 74.4   | 5433               | 62.0   |
| 2004 | 11103.6        | 1250.0         | 99.2   | 77.5   | 99.2                              | 77.5   | 101.1              | 76.1   | 8712               | 99.2   |

# US-498 SOUTH TEXAS-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 23 Jan | 71.2  | 91.1    | UF4  | A35  | AUTOMATIC REACTOR TRIP CAUSED BY HIGH WATER LEVEL IN STEAM GENERATOR 1B. THE EVENT WAS INDUCED BY THE FAILURE OF A FERRO RESONANT TRANSFORMER IN THE INVERTER, WHICH SUPPLIES POWER TO DISTRIBUTION PANEL 1201. THE INVERTER WAS REPLACED. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 71        |          |  | 932       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 21        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 757                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 92                                       | 60        |          |
| E. Testing of plant systems or components  |                 |           |          | 8  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 22        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 0  |           |          |
| Subtotal   | 0               | 71        | 0        | 857                                      | 1035      | 0        |
| Total  |                 | 71        |          |  | 1892      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 2  |
| 13. Reactor Auxiliary Systems                  |                 | 7  |
| 14. Safety Systems                             |                 | 548                                      |
| 15. Reactor Cooling Systems                    |                 | 14                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 189                                      |
| 31. Turbine and auxiliaries                    |                 | 24                                       |
| 32. Feedwater and Main Steam System            |                 | 27                                       |
| 35. All other I&C Systems                      | 71              | 6  |
| 41. Main Generator Systems                     |                 | 97                                       |
| 42. Electrical Power Supply Systems            |                 | 8  |
| Total  | 71              | 922                                      |

# US-499 SOUTH TEXAS-2

**Operator:** STP (STP Nuclear Operating Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1250.0 MW(e)  
**Design Net RUP:** 1250.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10304.1 GW(e).h  
**Energy Availability Factor:** 92.3%  
**Load Factor:** 93.8%  
**Operating Factor:** 92.5%  
**Energy Unavailability Factor:** 7.7%  
**Total Off-line Time:** 663 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 948.6 | 888.2 | 913.3 | 61.4 | 950.1 | 915.8 | 942.2 | 942.8 | 913.8 | 949.7 | 923.0 | 955.2 | 10304.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 96.7  | 9.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.3    |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 96.7  | 9.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.3    |
| <b>LF (%)</b>   | 102.0 | 102.1 | 98.2  | 6.8  | 102.2 | 101.8 | 101.3 | 101.4 | 101.5 | 102.0 | 102.6 | 102.7 | 93.8    |
| <b>OF (%)</b>   | 100.0 | 100.0 | 96.8  | 11.1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.5    |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 3.3   | 90.9 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.7     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 3.3   | 85.3 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 7.3     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 5.6  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.5     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Sep 1975  
**Date of First Criticality:** 12 Mar 1989  
**Date of Grid Connection:** 11 Apr 1989  
**Date of Commercial Operation:** 19 Jun 1989

**Lifetime Generation:** 131445.1 GW(e).h  
**Cumulative Energy Availability Factor:** 79.6%  
**Cumulative Load Factor:** 78.1%  
**Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 20.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 3026.7         | 1250.0         | 0.0  | 0.0    | 77.7                              | 100.0  | 29.1               | 0.0    | 2845               | 34.2   |
| 1990 | 6452.2         | 1251.0         | 62.8   | 62.8   | 62.8                              | 62.8   | 58.9               | 58.9   | 5494               | 62.7   |
| 1991 | 7268.0         | 1251.0         | 70.0   | 66.4   | 70.0                              | 66.4   | 66.3               | 62.6   | 6134               | 70.0   |
| 1992 | 10341.0        | 1251.0         | 97.3   | 76.7   | 97.3                              | 76.7   | 94.1               | 73.1   | 8548               | 97.3   |
| 1993 | 690.3          | 1251.0         | 8.0  | 59.6   | 8.0                               | 59.6   | 6.3                | 56.4   | 702                | 8.0    |
| 1994 | 5991.0         | 1251.0         | 58.2   | 59.3   | 58.2                              | 59.3   | 54.7               | 56.1   | 5098               | 58.2   |
| 1995 | 9923.1         | 1251.0         | 91.2   | 64.6   | 91.2                              | 64.6   | 90.5               | 61.8   | 7985               | 91.2   |
| 1996 | 10457.9        | 1251.0         | 95.3   | 69.0   | 95.3                              | 69.0   | 95.2               | 66.6   | 8373               | 95.3   |
| 1997 | 9972.9         | 1251.0         | 92.4   | 71.9   | 92.4                              | 71.9   | 91.0               | 69.6   | 8093               | 92.4   |
| 1998 | 9983.9         | 1250.0         | 92.5   | 74.2   | 92.5                              | 74.2   | 91.2               | 72.0   | 8096               | 92.4   |
| 1999 | 9799.3         | 1250.0         | 91.7   | 76.0   | 91.7                              | 76.0   | 89.5               | 73.8   | 8034               | 91.7   |
| 2000 | 10557.2        | 1250.0         | 96.2   | 77.8   | 96.2                              | 77.8   | 96.1               | 75.8   | 8449               | 96.2   |
| 2001 | 9537.6         | 1250.0         | 88.5   | 78.7   | 88.5                              | 78.7   | 87.1               | 76.8   | 7751               | 88.5   |
| 2002 | 8219.8         | 1250.0         | 75.9   | 78.5   | 75.9                              | 78.5   | 75.1               | 76.6   | 6663               | 76.1   |
| 2003 | 8920.2         | 1250.0         | 81.1   | 78.7   | 81.1                              | 78.7   | 81.5               | 77.0   | 7112               | 81.2   |
| 2004 | 10304.1        | 1250.0         | 92.3   | 79.6   | 92.3                              | 79.6   | 93.8               | 78.1   | 8121               | 92.5   |

**US-499 SOUTH TEXAS-2****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description                                      |
|--------|-------|---------|------|------|--|
| 31 Mar | 623.0 | 797.4   | PF   | C21  | REFUELLING OUTAGE.                               |
| 26 Apr | 39.5  | 50.6    | UF3  | Z    | OUTAGE EXTENDED FOR CORRECTIVE MAINTENANCE WORK. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 656       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 623             |           |          | 966   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 100   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 3         |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |   | 8         |          |
| Z. Others  |                 | 39        |          |   |           |          |
| Subtotal   | 623             | 39        | 0        | 1069  | 678       | 0        |
| Total  |                 | 662       |          |   | 1747      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1989 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 12. Reactor I&C Systems                        |                    | 3   |
| 13. Reactor Auxiliary Systems                  |                    | 13  |
| 14. Safety Systems                             |                    | 252   |
| 15. Reactor Cooling Systems                    |                    | 1   |
| 16. Steam generation systems                   |                    | 20  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 9   |
| 31. Turbine and auxiliaries                    |                    | 131   |
| 32. Feedwater and Main Steam System            |                    | 61  |
| 33. Circulating Water System                   |                    | 2   |
| 35. All other I&C Systems                      |                    | 11  |
| 41. Main Generator Systems                     |                    | 55  |
| 42. Electrical Power Supply Systems            |                    | 56  |
| Total  | 0                  | 614   |

# US-335 ST. LUCIE-1

**Operator:** FPL (FLORIDA POWER & LIGHT CO.)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 839.0 MW(e)  
**Design Net RUP:** 830.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6324.3 GW(e).h  
**Energy Availability Factor:** 85.6%  
**Load Factor:** 85.8%  
**Operating Factor:** 85.6%  
**Energy Unavailability Factor:** 14.4%  
**Total Off-line Time:** 1266 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 638.5 | 596.8 | 413.0 | 75.8 | 635.6 | 609.5 | 633.7 | 631.5 | 267.4 | 573.8 | 612.4 | 636.2 | 6324.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 64.5  | 20.0 | 100.0 | 100.0 | 100.0 | 100.0 | 46.6  | 94.6  | 100.0 | 100.0 | 85.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 64.5  | 20.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 90.5   |
| <b>LF (%)</b>   | 102.3 | 102.2 | 66.2  | 12.6 | 101.8 | 100.9 | 101.5 | 101.2 | 44.3  | 91.8  | 101.4 | 101.9 | 85.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 66.8  | 17.5 | 100.0 | 100.0 | 100.0 | 100.0 | 48.2  | 92.9  | 100.0 | 100.0 | 85.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 35.5  | 80.0 | 0.0   | 0.0   | 0.0   | 0.0   | 53.4  | 5.4   | 0.0   | 0.0   | 14.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 35.5  | 80.0 | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 9.6    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 53.4  | 5.4   | 0.0   | 0.0   | 4.8    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jul 1970  
**Date of First Criticality:** 22 Apr 1976  
**Date of Grid Connection:** 07 May 1976  
**Date of Commercial Operation:** 21 Dec 1976

**Lifetime Generation:** 163749.7 GW(e).h  
**Cumulative Energy Availability Factor:** 80.8%  
**Cumulative Load Factor:** 80.8%  
**Cumulative Unit Capability Factor:** 77.5%  
**Cumulative Energy Unavailability Factor:** 19.2%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 1099.5         | 820.0          | 15.4   | 68.3   | 15.4                              | 68.2   | 15.3               | 68.9   | 1350               | 15.4   |
| 1984 | 4243.3         | 822.0          | 60.8   | 67.3   | 58.6                              | 67.0   | 58.8               | 67.6   | 5154               | 58.7   |
| 1985 | 5868.6         | 825.0          | 80.4   | 68.8   | 80.4                              | 68.5   | 81.2               | 69.2   | 7067               | 80.7   |
| 1986 | 7052.0         | 829.0          | 95.7   | 71.6   | 95.7                              | 71.4   | 97.1               | 72.1   | 8351               | 95.3   |
| 1987 | 5719.2         | 839.0          | 77.8   | 72.2   | 77.8                              | 72.0   | 77.8               | 72.6   | 6812               | 77.8   |
| 1988 | 6256.0         | 839.0          | 84.4   | 73.2   | 84.4                              | 73.0   | 84.9               | 73.7   | 7407               | 84.3   |
| 1989 | 6947.3         | 839.0          | 94.3   | 74.9   | 94.3                              | 74.7   | 94.5               | 75.3   | 8257               | 94.3   |
| 1990 | 4503.5         | 839.0          | 64.3   | 74.1   | 64.3                              | 74.0   | 61.3               | 74.3   | 5463               | 62.4   |
| 1991 | 5793.3         | 839.0          | 81.0   | 74.6   | 80.9                              | 74.4   | 78.8               | 74.6   | 7089               | 80.9   |
| 1992 | 7142.2         | 839.0          | 96.5   | 76.0   | 96.5                              | 75.9   | 96.9               | 76.1   | 8479               | 96.5   |
| 1993 | 5440.5         | 839.0          | 76.6   | 76.0   | 76.2                              | 75.9   | 74.0               | 75.9   | 6678               | 76.2   |
| 1994 | 6183.6         | 839.0          | 86.8   | 76.7   | 86.8                              | 76.5   | 84.1               | 76.4   | 7600               | 86.8   |
| 1995 | 5519.4         | 839.0          | 76.2   | 76.6   | 76.2                              | 76.5   | 75.1               | 76.3   | 6662               | 76.1   |
| 1996 | 5222.0         | 839.0          | 73.8   | 76.5   | 73.8                              | 76.4   | 70.9               | 76.1   | 6472               | 73.7   |
| 1997 | 5717.7         | 839.0          | 78.1   | 76.6   | 78.1                              | 76.4   | 77.8               | 76.1   | 6842               | 78.1   |
| 1998 | 7035.5         | 839.0          | 95.8   | 77.5   | 95.8                              | 77.3   | 95.7               | 77.0   | 8393               | 95.8   |
| 1999 | 6532.7         | 839.0          | 89.9   | 78.0   | 88.5                              | 77.8   | 88.9               | 77.6   | 7752               | 88.5   |
| 2000 | 7513.7         | 839.0          | 100.0  | 79.0   | 100.0                             | 78.8   | 102.0              | 78.6   | 8784               | 100.0  |
| 2001 | 6709.8         | 839.0          | 90.4   | 79.4   | 90.4                              | 79.3   | 91.3               | 79.1   | 7915               | 90.4   |
| 2002 | 6919.4         | 839.0          | 93.2   | 80.0   | 93.2                              | 79.8   | 94.1               | 79.7   | 8163               | 93.2   |
| 2003 | 7504.8         | 839.0          | 100.0  | 80.7   | 100.0                             | 80.6   | 102.1              | 80.6   | 8760               | 100.0  |
| 2004 | 6324.3         | 839.0          | 90.5   | 81.1   | 85.6                              | 80.8   | 85.8               | 80.8   | 7518               | 85.6   |

# US-335 ST. LUCIE-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 21 Mar | 839.6 | 704.4   | PF   | C21  | START OF THE SL-1-19 REFUELLING OUTAGE.  |
| 04 Sep | 240.3 | 201.6   | XF   | N    | UNIT 1 WAS SHUTDOWN PER EMERGENCY PLAN REQUIREMENTS FOR HURRICANE FRANCES ON 09/04/04 AT 1032 HRS AND REMAINED DOWN UNTIL RESTART/BREAKER CLOSE ON 09/14/04 AT 1052 HRS. |
| 25 Sep | 184.5 | 154.8   | XF   | N    | SHUTDOWN PER EMERGENCY PLAN REQUIREMENTS FOR HURRICANE JEANNE ON 09/25/04 AT 1130 HRS AND REMAINED SHUTDOWN FOR REMAINDER OF THE REPORTING PERIOD.                       |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1976 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          | 0  | 408       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 25        |          |
| C. Inspection, maintenance or repair combined with refuelling  | 839             |           |          | 1108                                     |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 91                                       | 7         |          |
| E. Testing of plant systems or components  |                 |           |          | 4  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 7  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 0  | 9         | 14       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 424      |  |           |          |
| Subtotal   | 839             | 0         | 424      | 1210                                     | 449       | 14       |
| Total  |                 | 1263      |          |  | 1673      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1976 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 32                                       |
| 12. Reactor I&C Systems                        |                 | 9  |
| 13. Reactor Auxiliary Systems                  |                 | 16                                       |
| 14. Safety Systems                             |                 | 6  |
| 15. Reactor Cooling Systems                    |                 | 120                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 10                                       |
| 32. Feedwater and Main Steam System            |                 | 15                                       |
| 33. Circulating Water System                   |                 | 3  |
| 41. Main Generator Systems                     |                 | 15                                       |
| 42. Electrical Power Supply Systems            |                 | 25                                       |
| XX. Miscellaneous Systems                      |                 | 12                                       |
| Total  | 0               | 265                                      |

# US-389 ST. LUCIE-2

**Operator:** FPL (FLORIDA POWER & LIGHT CO.)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 839.0 MW(e)  
**Design Net RUP:** 830.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6781.4 GW(e).h  
**Energy Availability Factor:** 91.8%  
**Load Factor:** 92.0%  
**Operating Factor:** 91.7%  
**Energy Unavailability Factor:** 8.2%  
**Total Off-line Time:** 725 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 633.1 | 582.7 | 634.6 | 612.5 | 630.5 | 608.7 | 627.9 | 625.2 | 191.9 | 540.4 | 606.9 | 487.2 | 6781.4 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 33.3  | 89.0  | 100.0 | 78.3  | 91.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 78.3  | 98.2   |
| <b>LF (%)</b>   | 101.4 | 99.8  | 101.7 | 101.5 | 101.0 | 100.8 | 100.6 | 100.2 | 31.8  | 86.5  | 100.5 | 78.0  | 92.0   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 35.0  | 87.2  | 100.0 | 78.2  | 91.7   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 66.7  | 11.0  | 0.0   | 21.7  | 8.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 21.7  | 1.8    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 66.7  | 11.0  | 0.0   | 0.0   | 6.4    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1976  
**Date of First Criticality:** 02 Jun 1983  
**Date of Grid Connection:** 13 Jun 1983  
**Date of Commercial Operation:** 08 Aug 1983

**Lifetime Generation:** 134071.5 GW(e).h  
**Cumulative Energy Availability Factor:** 86.4%  
**Cumulative Load Factor:** 85.5%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 13.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2575.8         | 808.0          | 0.0  | 0.0    | 87.9                              | 100.0  | 38.4               | 0.0    | 3598               | 43.3   |
| 1984 | 5564.8         | 786.0          | 82.8   | 82.8   | 79.5                              | 79.5   | 80.6               | 80.6   | 7067               | 80.5   |
| 1985 | 6108.6         | 824.0          | 83.9   | 83.4   | 83.9                              | 81.7   | 84.6               | 82.7   | 7368               | 84.1   |
| 1986 | 6151.2         | 837.0          | 82.8   | 83.2   | 82.8                              | 82.1   | 83.9               | 83.1   | 7253               | 82.8   |
| 1987 | 5950.2         | 839.0          | 82.3   | 83.0   | 82.3                              | 82.1   | 81.0               | 82.5   | 7206               | 82.3   |
| 1988 | 7407.1         | 839.0          | 100.0  | 86.4   | 100.0                             | 85.8   | 100.5              | 86.2   | 8784               | 100.0  |
| 1989 | 5443.4         | 839.0          | 74.6   | 84.4   | 74.6                              | 83.9   | 74.1               | 84.2   | 6531               | 74.6   |
| 1990 | 5341.5         | 839.0          | 74.1   | 82.9   | 74.1                              | 82.5   | 72.7               | 82.5   | 6487               | 74.1   |
| 1991 | 7428.7         | 839.0          | 100.0  | 85.1   | 100.0                             | 84.7   | 101.1              | 84.8   | 8760               | 100.0  |
| 1992 | 5431.2         | 839.0          | 75.2   | 84.0   | 75.1                              | 83.6   | 73.7               | 83.6   | 6598               | 75.1   |
| 1993 | 4719.9         | 839.0          | 76.4   | 83.2   | 76.4                              | 82.9   | 64.2               | 81.6   | 6687               | 76.3   |
| 1994 | 5607.4         | 839.0          | 79.6   | 82.9   | 79.6                              | 82.6   | 76.3               | 81.1   | 6971               | 79.6   |
| 1995 | 5295.9         | 839.0          | 75.0   | 82.2   | 75.0                              | 82.0   | 72.1               | 80.4   | 6570               | 75.0   |
| 1996 | 6984.8         | 839.0          | 96.2   | 83.3   | 96.2                              | 83.1   | 94.8               | 81.5   | 8444               | 96.1   |
| 1997 | 6498.9         | 839.0          | 88.5   | 83.7   | 88.6                              | 83.5   | 88.4               | 82.0   | 7756               | 88.5   |
| 1998 | 6739.5         | 839.0          | 91.5   | 84.2   | 91.4                              | 84.0   | 91.7               | 82.6   | 8009               | 91.4   |
| 1999 | 7213.0         | 839.0          | 98.0   | 85.1   | 98.0                              | 84.9   | 98.1               | 83.6   | 8583               | 98.0   |
| 2000 | 6804.3         | 839.0          | 91.6   | 85.5   | 91.6                              | 85.3   | 92.3               | 84.1   | 8041               | 91.5   |
| 2001 | 6707.5         | 839.0          | 91.1   | 85.8   | 91.1                              | 85.6   | 91.3               | 84.5   | 7979               | 91.1   |
| 2002 | 7425.0         | 839.0          | 99.8   | 86.5   | 99.8                              | 86.3   | 101.0              | 85.4   | 8742               | 99.8   |
| 2003 | 5891.3         | 839.0          | 81.3   | 86.3   | 81.3                              | 86.1   | 80.2               | 85.1   | 7120               | 81.3   |
| 2004 | 6781.4         | 839.0          | 98.2   | 86.8   | 91.8                              | 86.4   | 92.0               | 85.5   | 8059               | 91.7   |



## US-389 ST. LUCIE-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 04 Sep | 336.0 | 281.9   | XF   | N    | SHUTDOWN PER EMERGENCY PLAN REQUIREMENTS FOR HURRICANE FRANCES AND REMAINED SHUTDOWN UNTIL RESTART/BREAKER CLOSE ON 09/18/02 AT 0155 HRS.                                      |
| 25 Sep | 226.5 | 190.0   | XF   | N    | SHUTDOWN PER EMERGENCY PLAN REQUIREMENTS FOR HURRICANE JEANNE AND REMAINED SHUTDOWN UNTIL REMAINDER OF THE REPORTING PERIOD.   |
| 25 Dec | 161.2 | 135.2   | UF5  | A32  | MANUAL REACTOR TRIP ON 12/25/04, AT 0651 HOURS DUE TO LOW 2B SG LEVEL FOLLOWING THE LOSS OF THE 2B CONDENSATE PUMP. THE UNIT REMAINED OFF-LINE FOR THE REMAINDER OF THE MONTH. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 161       |          |  | 301       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 3         |          |
| C. Inspection, maintenance or repair combined with refuelling  |                 |           |          | 744                                      |           |          |
| D. Inspection, maintenance or repair without refuelling  |                 |           |          | 35                                       | 19        |          |
| E. Testing of plant systems or components  |                 |           |          | 2  | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          | 0  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          | 0  | 27        | 11       |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 562      |  |           |          |
| Subtotal   | 0               | 161       | 562      | 781                                      | 350       | 12       |
| Total  |                 | 723       |          |  | 1143      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 34                                       |
| 14. Safety Systems                             |                 | 16                                       |
| 15. Reactor Cooling Systems                    |                 | 134                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 4  |
| 31. Turbine and auxiliaries                    |                 | 46                                       |
| 32. Feedwater and Main Steam System            | 161             | 43                                       |
| 33. Circulating Water System                   |                 | 0  |
| 41. Main Generator Systems                     |                 | 19                                       |
| 42. Electrical Power Supply Systems            |                 | 2  |
| Total  | 161             | 298                                      |

# US-280 SURRY-1

**Operator:** DOMIN (DOMINION VIRGINIA POWER)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 810.0 MW(e)  
**Design Net RUP:** 788.0 MW(e)  
**Design Discharge Burnup:** 31500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6457.1 GW(e).h  
**Energy Availability Factor:** 90.5%  
**Load Factor:** 90.8%  
**Operating Factor:** 90.4%  
**Energy Unavailability Factor:** 9.5%  
**Total Off-line Time:** 841 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 613.6 | 574.8 | 595.4 | 593.4 | 567.0 | 589.4 | 606.0 | 607.9 | 590.2 | 589.5 | 0.0   | 529.9 | 6457.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 96.2  | 100.0 | 100.0 | 100.0 | 100.0 | 96.8  | 0.0   | 91.1  | 90.5   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 96.2  | 100.0 | 100.0 | 100.0 | 100.0 | 96.8  | 0.0   | 91.1  | 90.5   |
| <b>LF (%)</b>   | 101.8 | 102.0 | 98.8  | 101.9 | 94.1  | 101.1 | 100.6 | 100.9 | 101.2 | 97.7  | 0.0   | 87.9  | 90.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 96.1  | 100.0 | 100.0 | 100.0 | 100.0 | 96.6  | 0.0   | 91.0  | 90.4   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 3.8   | 0.0   | 0.0   | 0.0   | 0.0   | 3.2   | 100.0 | 8.9   | 9.5    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.2   | 100.0 | 8.9   | 9.2    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 3.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1968      **Lifetime Generation:** 155832.3 GW(e).h  
**Date of First Criticality:** 01 Jul 1972      **Cumulative Energy Availability Factor:** 72.2%  
**Date of Grid Connection:** 04 Jul 1972      **Cumulative Load Factor:** 70.4%  
**Date of Commercial Operation:** 22 Dec 1972      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 27.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 3517.1         | 775.0          | 56.4   | 58.2   | 56.3                              | 57.9   | 51.8               | 54.4   | 5010               | 57.2   |
| 1984 | 3334.1         | 775.0          | 58.1   | 58.2   | 58.1                              | 57.9   | 49.0               | 53.9   | 5138               | 58.5   |
| 1985 | 5618.3         | 779.0          | 89.3   | 60.6   | 89.3                              | 60.3   | 82.3               | 56.1   | 7827               | 89.3   |
| 1986 | 4488.6         | 781.0          | 68.1   | 61.1   | 68.1                              | 60.9   | 65.6               | 56.8   | 6013               | 68.6   |
| 1987 | 4633.4         | 781.0          | 70.1   | 61.7   | 70.1                              | 61.5   | 67.7               | 57.5   | 6113               | 69.8   |
| 1988 | 2685.0         | 781.0          | 18.7   | 59.0   | 18.7                              | 58.8   | 39.1               | 56.4   | 3632               | 41.3   |
| 1989 | 3170.5         | 781.0          | 46.8   | 58.3   | 46.8                              | 58.1   | 46.3               | 55.8   | 4217               | 48.1   |
| 1990 | 4772.2         | 781.0          | 74.9   | 59.2   | 74.9                              | 59.0   | 69.8               | 56.6   | 6655               | 76.0   |
| 1991 | 6590.9         | 781.0          | 100.0  | 61.4   | 96.3                              | 61.2   | 96.3               | 58.7   | 8760               | 100.0  |
| 1992 | 5223.8         | 781.0          | 79.6   | 62.3   | 79.6                              | 62.1   | 76.1               | 59.5   | 7033               | 80.1   |
| 1993 | 6229.2         | 781.0          | 95.9   | 63.9   | 95.9                              | 63.7   | 91.1               | 61.0   | 8402               | 95.9   |
| 1994 | 4881.9         | 781.0          | 74.3   | 64.3   | 74.3                              | 64.2   | 71.4               | 61.5   | 6560               | 74.9   |
| 1995 | 5747.0         | 784.0          | 85.4   | 65.3   | 85.4                              | 65.1   | 83.7               | 62.5   | 7505               | 85.7   |
| 1996 | 7137.8         | 801.0          | 100.0  | 66.8   | 100.0                             | 66.6   | 101.4              | 64.1   | 8784               | 100.0  |
| 1997 | 5640.5         | 801.0          | 80.7   | 67.3   | 80.7                              | 67.2   | 80.4               | 64.8   | 7067               | 80.7   |
| 1998 | 5752.4         | 801.0          | 81.9   | 67.9   | 81.9                              | 67.8   | 82.0               | 65.5   | 7170               | 81.8   |
| 1999 | 7116.2         | 801.0          | 100.0  | 69.1   | 100.0                             | 69.0   | 101.4              | 66.8   | 8760               | 100.0  |
| 2000 | 6548.4         | 801.0          | 93.2   | 70.0   | 93.2                              | 69.9   | 93.1               | 67.8   | 8188               | 93.2   |
| 2001 | 5941.6         | 810.0          | 84.3   | 70.5   | 84.3                              | 70.4   | 83.7               | 68.4   | 7380               | 84.2   |
| 2002 | 7149.5         | 810.0          | 100.0  | 71.5   | 100.0                             | 71.4   | 100.8              | 69.5   | 8760               | 100.0  |
| 2003 | 5419.8         | 810.0          | 77.0   | 71.7   | 77.0                              | 71.6   | 76.4               | 69.7   | 6741               | 77.0   |
| 2004 | 6457.1         | 810.0          | 90.5   | 72.3   | 90.5                              | 72.2   | 90.8               | 70.4   | 7943               | 90.4   |

**US-280 SURRY-1****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 15 May | 28.6  | 23.1    | UF2  | A42  | UNIT 1 TAKEN OFF-LINE FOR A MAIN TRANSFORMER REPAIRS. |
| 31 Oct | 811.0 | 656.9   | PF   | C21  | REFUELLING OUTAGE.                                    |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 28        |          |   | 623       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 21        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 810             |           |          | 879   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 466   | 1         |          |
| E. Testing of plant systems or components  |                 |           |          | 1   | 0         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 0   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 64        | 164      |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 1   | 137       | 0        |
| Subtotal   | 810             | 28        | 0        | 1347  | 846       | 164      |
| Total  |                 | 838       |          |   | 2357      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System   | 2004<br>Hours Lost | 1972 to 2004<br>Average Hours Lost Per Year |
|--|--------------------|---|
| 11. Reactor and Accessories                    |                    | 0   |
| 12. Reactor I&C Systems                        |                    | 32  |
| 13. Reactor Auxiliary Systems                  |                    | 7   |
| 14. Safety Systems                             |                    | 6   |
| 15. Reactor Cooling Systems                    |                    | 217   |
| 16. Steam generation systems                   |                    | 65  |
| 17. Safety I&C Systems (excluding reactor I&C) |                    | 2   |
| 31. Turbine and auxiliaries                    |                    | 23  |
| 32. Feedwater and Main Steam System            |                    | 101   |
| 41. Main Generator Systems                     |                    | 8   |
| 42. Electrical Power Supply Systems            | 28                 | 98  |
| XX. Miscellaneous Systems                      |                    | 6   |
| Total  | 28                 | 565   |

# US-281 SURRY-2

**Operator:** DOMIN (DOMINION VIRGINIA POWER)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 815.0 MW(e)  
**Design Net RUP:** 788.0 MW(e)  
**Design Discharge Burnup:** 31500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7051.7 GW(e).h  
**Energy Availability Factor:** 98.0%  
**Load Factor:** 98.5%  
**Operating Factor:** 98.0%  
**Energy Unavailability Factor:** 2.0%  
**Total Off-line Time:** 178 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 610.5 | 572.6 | 612.6 | 593.4 | 453.5 | 589.2 | 605.8 | 608.4 | 589.6 | 611.1 | 596.0 | 609.1 | 7051.7 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 76.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 76.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.0   |
| <b>LF (%)</b>   | 100.7 | 100.9 | 101.0 | 101.3 | 74.8  | 100.4 | 99.9  | 100.3 | 100.5 | 100.7 | 101.6 | 100.5 | 98.5   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 76.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 23.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 23.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 2.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jun 1968  
**Date of First Criticality:** 07 Mar 1973  
**Date of Grid Connection:** 10 Mar 1973  
**Date of Commercial Operation:** 01 May 1973

**Lifetime Generation:** 155485.3 GW(e).h  
**Cumulative Energy Availability Factor:** 73.0%  
**Cumulative Load Factor:** 71.1%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 27.0%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4086.1         | 775.0          | 65.0   | 59.1   | 65.0                              | 58.8   | 60.2               | 56.3   | 5729               | 65.4   |
| 1984 | 5209.4         | 775.0          | 83.3   | 61.3   | 83.3                              | 61.0   | 76.5               | 58.2   | 7327               | 83.4   |
| 1985 | 4072.4         | 775.0          | 65.8   | 61.7   | 65.8                              | 61.4   | 60.0               | 58.3   | 5857               | 66.9   |
| 1986 | 4498.9         | 780.0          | 68.7   | 62.2   | 68.7                              | 62.0   | 65.8               | 58.9   | 6072               | 69.3   |
| 1987 | 4791.0         | 781.0          | 73.6   | 63.0   | 73.6                              | 62.8   | 70.0               | 59.7   | 6456               | 73.7   |
| 1988 | 3570.9         | 781.0          | 56.5   | 62.6   | 56.6                              | 62.4   | 52.1               | 59.2   | 4993               | 56.8   |
| 1989 | 893.6          | 781.0          | 13.3   | 59.5   | 13.3                              | 59.3   | 13.1               | 56.3   | 1355               | 15.5   |
| 1990 | 5837.8         | 781.0          | 84.8   | 61.0   | 84.8                              | 60.8   | 85.3               | 58.0   | 7919               | 90.4   |
| 1991 | 3985.2         | 781.0          | 66.5   | 61.3   | 66.6                              | 61.2   | 58.3               | 58.0   | 5886               | 67.2   |
| 1992 | 6426.5         | 781.0          | 96.3   | 63.2   | 96.3                              | 63.0   | 93.7               | 59.9   | 8470               | 96.4   |
| 1993 | 4541.7         | 781.0          | 71.0   | 63.5   | 71.0                              | 63.4   | 66.4               | 60.2   | 6283               | 71.7   |
| 1994 | 6261.0         | 781.0          | 94.0   | 65.0   | 94.1                              | 64.9   | 91.5               | 61.7   | 8251               | 94.2   |
| 1995 | 5517.4         | 787.0          | 80.7   | 65.7   | 80.6                              | 65.6   | 80.0               | 62.6   | 7087               | 80.9   |
| 1996 | 6081.5         | 801.0          | 85.9   | 66.6   | 85.9                              | 66.5   | 86.4               | 63.6   | 7539               | 85.8   |
| 1997 | 6451.3         | 801.0          | 91.8   | 67.7   | 91.7                              | 67.6   | 91.9               | 64.8   | 8034               | 91.7   |
| 1998 | 7178.9         | 801.0          | 100.0  | 69.0   | 100.0                             | 68.9   | 102.3              | 66.4   | 8760               | 100.0  |
| 1999 | 5874.8         | 801.0          | 85.6   | 69.7   | 85.6                              | 69.6   | 83.7               | 67.1   | 7493               | 85.5   |
| 2000 | 6539.4         | 801.0          | 91.3   | 70.5   | 91.3                              | 70.4   | 92.9               | 68.0   | 8022               | 91.3   |
| 2001 | 6720.7         | 815.0          | 93.7   | 71.3   | 93.7                              | 71.3   | 94.1               | 69.0   | 8203               | 93.6   |
| 2002 | 6523.7         | 815.0          | 91.0   | 72.0   | 91.0                              | 72.0   | 91.4               | 69.8   | 7966               | 90.9   |
| 2003 | 5612.1         | 815.0          | 78.3   | 72.3   | 78.3                              | 72.2   | 78.6               | 70.1   | 6861               | 78.3   |
| 2004 | 7051.7         | 815.0          | 98.0   | 73.1   | 98.0                              | 73.0   | 98.5               | 71.1   | 8606               | 98.0   |

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### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 21 May | 177.3 | 144.5   | UF4  | A42  | UNIT 2 REACTOR TRIP DUE TO A FAILED MAIN TRANSFORMER PHASE COUPLING CAPACITOR. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1973 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 177       |          |   | 608       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 21        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1341  | 0         |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 266   |           |          |
| E. Testing of plant systems or components  |                 |           |          | 0   |           |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 1   |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   | 20        | 7        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 6   | 0         |          |
| Subtotal   | 0               | 177       | 0        | 1614  | 649       | 7        |
| Total  |                 | 177       |          |   | 2270      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1973 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|-----------------|---|
| 12. Reactor I&C Systems             |                 | 28  |
| 13. Reactor Auxiliary Systems       |                 | 4   |
| 14. Safety Systems                  |                 | 78  |
| 15. Reactor Cooling Systems         |                 | 16  |
| 16. Steam generation systems        |                 | 154   |
| 31. Turbine and auxiliaries         |                 | 129   |
| 32. Feedwater and Main Steam System |                 | 138   |
| 35. All other I&C Systems           |                 | 2   |
| 41. Main Generator Systems          |                 | 6   |
| 42. Electrical Power Supply Systems | 177             | 23  |
| XX. Miscellaneous Systems           |                 | 4   |
| Total                               | 177             | 582   |

# US-387 SUSQUEHANNA-1

**Operator:** PP&L (PENNSYLVANIA POWER & LIGHT CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1105.0 MW(e)  
**Design Net RUP:** 1065.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8027.0 GW(e).h  
**Energy Availability Factor:** 84.1%  
**Load Factor:** 81.2%  
**Operating Factor:** 83.8%  
**Energy Unavailability Factor:** 15.9%  
**Total Off-line Time:** 1425 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 779.9 | 595.7 | 0.0   | 164.8 | 849.4 | 813.1 | 842.6 | 826.9 | 807.9 | 862.6 | 618.8 | 865.4 | 8027.0 |
| <b>EAF (%)</b>  | 100.0 | 93.1  | 0.0   | 25.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.4  | 100.0 | 84.1   |
| <b>UCF (%)</b>  | 100.0 | 93.1  | 0.0   | 25.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 87.4  | 100.0 | 84.1   |
| <b>LF (%)</b>   | 94.9  | 77.5  | 0.0   | 20.7  | 100.6 | 99.5  | 99.8  | 97.9  | 98.9  | 102.0 | 75.7  | 102.5 | 81.2   |
| <b>OF (%)</b>   | 100.0 | 93.1  | 0.0   | 25.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.9  | 100.0 | 83.8   |
| <b>EUF (%)</b>  | 0.0   | 6.9   | 100.0 | 74.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.6  | 0.0   | 15.9   |
| <b>PUF (%)</b>  | 0.0   | 6.9   | 100.0 | 74.8  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 12.6  | 0.0   | 15.9   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1973  
**Date of First Criticality:** 10 Sep 1982  
**Date of Grid Connection:** 16 Nov 1982  
**Date of Commercial Operation:** 08 Jun 1983

**Lifetime Generation:** 162094.9 GW(e).h  
**Cumulative Energy Availability Factor:** 82.2%  
**Cumulative Load Factor:** 80.4%  
**Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 17.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4472.8         | 1034.0         | 0.0  | 0.0    | 56.4                              | 100.0  | 49.4               | 0.0    | 4891               | 55.8   |
| 1984 | 6088.1         | 1032.0         | 74.5   | 74.5   | 72.0                              | 72.0   | 67.2               | 67.2   | 6377               | 72.6   |
| 1985 | 5286.4         | 1032.0         | 60.4   | 67.4   | 60.4                              | 66.2   | 58.5               | 62.8   | 5469               | 62.4   |
| 1986 | 5839.2         | 1032.0         | 66.8   | 67.2   | 66.8                              | 66.4   | 64.6               | 63.4   | 5992               | 68.4   |
| 1987 | 6132.9         | 1032.0         | 70.7   | 68.1   | 70.7                              | 67.5   | 67.8               | 64.5   | 6331               | 72.3   |
| 1988 | 8410.1         | 1032.0         | 93.1   | 73.1   | 93.1                              | 72.6   | 92.8               | 70.2   | 8206               | 93.4   |
| 1989 | 6483.9         | 1032.0         | 72.2   | 72.9   | 72.1                              | 72.5   | 71.7               | 70.4   | 6447               | 73.6   |
| 1990 | 6446.7         | 1033.0         | 73.1   | 73.0   | 73.1                              | 72.6   | 71.2               | 70.6   | 6528               | 74.5   |
| 1991 | 8821.6         | 1035.0         | 98.0   | 76.1   | 98.0                              | 75.8   | 97.3               | 73.9   | 8596               | 98.1   |
| 1992 | 6400.3         | 1040.0         | 73.6   | 75.8   | 73.6                              | 75.6   | 70.1               | 73.5   | 6568               | 74.8   |
| 1993 | 5232.4         | 1040.0         | 57.5   | 74.0   | 57.5                              | 73.7   | 57.4               | 71.9   | 5205               | 59.4   |
| 1994 | 8414.5         | 1040.0         | 94.2   | 75.8   | 94.2                              | 75.6   | 92.4               | 73.7   | 8249               | 94.2   |
| 1995 | 7432.3         | 1073.0         | 81.1   | 76.3   | 81.1                              | 76.1   | 79.1               | 74.2   | 7126               | 81.3   |
| 1996 | 7752.9         | 1090.0         | 84.7   | 77.0   | 84.7                              | 76.8   | 81.0               | 74.7   | 7434               | 84.6   |
| 1997 | 9085.3         | 1090.0         | 94.5   | 78.3   | 94.5                              | 78.1   | 95.2               | 76.3   | 8274               | 94.5   |
| 1998 | 7652.8         | 1090.0         | 81.5   | 78.5   | 81.5                              | 78.3   | 80.1               | 76.5   | 7015               | 80.1   |
| 1999 | 8814.5         | 1090.0         | 94.0   | 79.5   | 94.0                              | 79.3   | 92.3               | 77.5   | 8234               | 94.0   |
| 2000 | 8180.6         | 1090.0         | 86.5   | 79.9   | 86.5                              | 79.8   | 85.4               | 78.0   | 7598               | 86.5   |
| 2001 | 9413.0         | 1090.0         | 99.5   | 81.0   | 99.5                              | 80.9   | 98.6               | 79.2   | 8718               | 99.5   |
| 2002 | 8026.6         | 1098.0         | 85.7   | 81.3   | 85.7                              | 81.2   | 83.4               | 79.4   | 7493               | 85.5   |
| 2003 | 9359.9         | 1105.0         | 98.0   | 82.2   | 98.0                              | 82.0   | 96.7               | 80.3   | 8585               | 98.0   |
| 2004 | 8027.0         | 1125.0         | 84.1   | 82.3   | 84.1                              | 82.2   | 81.2               | 80.4   | 7359               | 83.8   |

# US-387 SUSQUEHANNA-1

## 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description  |
|--------|--------|---------|------|------|--|
| 28 Feb | 1330.6 | 1470.3  | PF   | C21  | PLANNED REFUELLING OUTGAGE.  |
| 20 Nov | 93.4   | 103.2   | PF   | D41  | GENERATOR TAKEN OFF-LINE TO REPAIR A LEAKING GENERATOR BUSHING. REACTOR REMAINED CRITICAL. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |   | 289       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 29        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1330            |           |          | 902   |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 93              |           |          | 70  | 20        |          |
| E. Testing of plant systems or components  |                 |           |          | 72  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |   |           | 33       |
| J. Grid failure or grid unavailability   |                 |           |          |   |           | 9        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 88  | 46        |          |
| Subtotal   | 1423            | 0         | 0        | 1132  | 384       | 42       |
| Total  |                 | 1423      |          |   | 1558      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1983 to 2004<br>Average Hours Lost Per Year |
|--|-----------------|---|
| 12. Reactor I&C Systems                        |                 | 12  |
| 13. Reactor Auxiliary Systems                  |                 | 1   |
| 14. Safety Systems                             |                 | 21  |
| 15. Reactor Cooling Systems                    |                 | 44  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 11  |
| 31. Turbine and auxiliaries                    |                 | 95  |
| 32. Feedwater and Main Steam System            |                 | 18  |
| 33. Circulating Water System                   |                 | 0   |
| 35. All other I&C Systems                      |                 | 4   |
| 41. Main Generator Systems                     |                 | 14  |
| 42. Electrical Power Supply Systems            |                 | 24  |
| XX. Miscellaneous Systems                      |                 | 32  |
| Total  | 0               | 276   |

# US-388 SUSQUEHANNA-2

**Operator:** PP&L (PENNSYLVANIA POWER & LIGHT CO.)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 1140.0 MW(e)  
**Design Net RUP:** 1065.0 MW(e)  
**Design Discharge Burnup:** 30000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10057.1 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 100.4%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 875.2 | 812.5 | 871.3 | 834.9 | 823.9 | 808.3 | 841.4 | 843.4 | 814.9 | 836.8 | 836.0 | 858.6 | 10057.1 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>LF (%)</b>   | 103.2 | 102.4 | 102.7 | 101.9 | 97.1  | 98.5  | 99.2  | 99.4  | 99.3  | 98.5  | 101.9 | 101.2 | 100.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Nov 1973  
**Date of First Criticality:** 08 May 1984  
**Date of Grid Connection:** 03 Jul 1984  
**Date of Commercial Operation:** 12 Feb 1985

**Lifetime Generation:** 160200.4 GW(e).h  
**Cumulative Energy Availability Factor:** 86.2%  
**Cumulative Load Factor:** 84.9%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 13.8%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1984 | 932.0          | 1079.0         | 0.0  | 0.0    | 71.3                              | 100.0  | 9.9                | 0.0    | 1767               | 20.3   |
| 1985 | 7323.3         | 1032.0         | 0.0  | 0.0    | 91.0                              | 100.0  | 81.0               | 0.0    | 7463               | 85.2   |
| 1986 | 5458.4         | 1032.0         | 63.5   | 63.5   | 63.5                              | 63.5   | 60.4               | 60.4   | 5730               | 65.4   |
| 1987 | 8598.4         | 1032.0         | 96.0   | 79.8   | 96.0                              | 79.8   | 95.1               | 77.7   | 8431               | 96.2   |
| 1988 | 5915.2         | 1034.0         | 66.3   | 75.3   | 66.3                              | 75.3   | 65.1               | 73.5   | 5985               | 68.1   |
| 1989 | 6777.0         | 1038.0         | 76.9   | 75.7   | 76.9                              | 75.7   | 74.5               | 73.8   | 6745               | 77.0   |
| 1990 | 8290.7         | 1038.0         | 94.4   | 79.4   | 94.4                              | 79.4   | 91.2               | 77.3   | 8143               | 93.0   |
| 1991 | 7041.4         | 1041.0         | 78.4   | 79.3   | 78.4                              | 79.3   | 77.2               | 77.3   | 6955               | 79.4   |
| 1992 | 7186.2         | 1044.0         | 80.2   | 79.4   | 80.2                              | 79.4   | 78.4               | 77.4   | 7119               | 81.0   |
| 1993 | 8337.9         | 1044.0         | 92.3   | 81.0   | 92.3                              | 81.0   | 91.2               | 79.1   | 8094               | 92.4   |
| 1994 | 6909.8         | 1073.0         | 74.7   | 80.3   | 74.7                              | 80.3   | 73.5               | 78.5   | 6577               | 75.1   |
| 1995 | 8192.7         | 1094.0         | 87.8   | 81.1   | 87.8                              | 81.1   | 85.5               | 79.2   | 7691               | 87.8   |
| 1996 | 9127.2         | 1094.0         | 95.0   | 82.4   | 95.0                              | 82.4   | 95.0               | 80.7   | 8346               | 95.0   |
| 1997 | 7732.6         | 1094.0         | 82.4   | 82.4   | 82.4                              | 82.4   | 80.7               | 80.7   | 7211               | 82.3   |
| 1998 | 8820.8         | 1094.0         | 93.3   | 83.3   | 93.3                              | 83.3   | 92.0               | 81.6   | 8172               | 93.3   |
| 1999 | 7794.7         | 1094.0         | 83.0   | 83.2   | 83.0                              | 83.2   | 81.3               | 81.6   | 7268               | 83.0   |
| 2000 | 9347.2         | 1094.0         | 97.8   | 84.2   | 97.8                              | 84.2   | 97.3               | 82.7   | 8587               | 97.8   |
| 2001 | 8397.1         | 1102.0         | 87.9   | 84.5   | 87.9                              | 84.5   | 87.0               | 83.0   | 7693               | 87.8   |
| 2002 | 9306.2         | 1111.0         | 96.3   | 85.2   | 96.4                              | 85.2   | 95.6               | 83.7   | 8439               | 96.3   |
| 2003 | 8654.7         | 1132.0         | 88.2   | 85.4   | 88.1                              | 85.4   | 87.3               | 83.9   | 7701               | 87.9   |
| 2004 | 10057.1        | 1140.0         | 100.0  | 86.2   | 100.0                             | 86.2   | 100.4              | 84.9   | 8784               | 100.0  |



## US-388 SUSQUEHANNA-2

### 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1984 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 286       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 6         |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 810                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 26                                       | 1         |          |
| E. Testing of plant systems or components  |                 |           |          | 91                                       |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 1        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 13        |          |
| Subtotal   | 0               | 0         | 0        | 927                                      | 306       | 1        |
| Total  | 0               |           |          | 1234                                     |           |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1984 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 22                                       |
| 12. Reactor I&C Systems             |                 | 9  |
| 13. Reactor Auxiliary Systems       |                 | 8  |
| 14. Safety Systems                  |                 | 6  |
| 15. Reactor Cooling Systems         |                 | 21                                       |
| 31. Turbine and auxiliaries         |                 | 25                                       |
| 32. Feedwater and Main Steam System |                 | 34                                       |
| 41. Main Generator Systems          |                 | 31                                       |
| 42. Electrical Power Supply Systems |                 | 57                                       |
| XX. Miscellaneous Systems           |                 | 44                                       |
| Total                               | 0               | 257                                      |

# US-289 THREE MILE ISLAND-1

**Operator:** EXELON (Exelon Nuclear Co.)  
**Contractor:** B&W (BABCOCK & WILCOX CO.)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 802.0 MW(e)  
**Design Net RUP:** 819.0 MW(e)  
**Design Discharge Burnup:** 14400 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 7273.3 GW(e).h  
**Energy Availability Factor:** 100.0%  
**Load Factor:** 103.2%  
**Operating Factor:** 100.0%  
**Energy Unavailability Factor:** 0.0%  
**Total Off-line Time:** 0 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 629.0 | 592.1 | 630.8 | 606.8 | 595.9 | 590.4 | 593.1 | 610.0 | 594.9 | 628.3 | 606.7 | 595.3 | 7273.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>LF (%)</b>   | 105.4 | 106.1 | 105.7 | 105.2 | 99.9  | 102.2 | 99.4  | 102.2 | 103.0 | 105.2 | 105.1 | 99.8  | 103.2  |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0  |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 May 1968  
**Date of First Criticality:** 05 Jun 1974  
**Date of Grid Connection:** 19 Jun 1974  
**Date of Commercial Operation:** 02 Sep 1974

**Lifetime Generation:** 144345.0 GW(e).h  
**Cumulative Energy Availability Factor:** 68.9%  
**Cumulative Load Factor:** 68.5%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 31.1%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 0.0            | 776.0          | 100.0  | 79.5   | 0.0                               | 35.4   | 0.0                | 35.5   | 0                  | 0.0    |
| 1984 | 0.0            | 776.0          | 100.0  | 81.5   | 0.0                               | 31.9   | 0.0                | 32.0   | 0                  | 0.0    |
| 1985 | 811.7          | 776.0          | 37.8   | 77.6   | 37.8                              | 32.4   | 11.9               | 30.2   | 1853               | 21.2   |
| 1986 | 4818.3         | 776.0          | 70.8   | 77.0   | 70.8                              | 35.6   | 70.9               | 33.5   | 6209               | 70.9   |
| 1987 | 5034.3         | 776.0          | 72.5   | 76.7   | 72.5                              | 38.4   | 74.1               | 36.6   | 6351               | 72.5   |
| 1988 | 5465.4         | 784.0          | 76.0   | 76.6   | 76.0                              | 41.1   | 79.4               | 39.7   | 6679               | 76.0   |
| 1989 | 7216.8         | 808.0          | 99.5   | 78.2   | 99.5                              | 45.1   | 102.0              | 44.0   | 8714               | 99.5   |
| 1990 | 5316.2         | 808.0          | 81.8   | 78.4   | 81.8                              | 47.5   | 75.1               | 46.0   | 7123               | 81.3   |
| 1991 | 5671.2         | 808.0          | 86.4   | 78.9   | 86.4                              | 49.9   | 80.1               | 48.1   | 7536               | 86.0   |
| 1992 | 6936.5         | 789.0          | 99.5   | 80.1   | 99.5                              | 52.6   | 100.1              | 51.0   | 8743               | 99.5   |
| 1993 | 5962.2         | 786.0          | 88.0   | 80.5   | 88.0                              | 54.5   | 86.6               | 52.8   | 7702               | 87.9   |
| 1994 | 6590.9         | 786.0          | 95.3   | 81.2   | 95.3                              | 56.5   | 95.7               | 55.0   | 8349               | 95.3   |
| 1995 | 6388.0         | 786.0          | 90.5   | 81.7   | 90.5                              | 58.2   | 92.8               | 56.8   | 7926               | 90.5   |
| 1996 | 7100.3         | 786.0          | 100.0  | 82.5   | 100.0                             | 60.1   | 102.8              | 58.9   | 8784               | 100.0  |
| 1997 | 5918.8         | 786.0          | 87.3   | 82.7   | 87.3                              | 61.2   | 86.0               | 60.1   | 7633               | 87.1   |
| 1998 | 7059.2         | 786.0          | 100.0  | 83.4   | 100.0                             | 62.9   | 102.5              | 61.8   | 8760               | 100.0  |
| 1999 | 6328.4         | 786.0          | 89.4   | 83.7   | 89.4                              | 63.9   | 91.9               | 63.0   | 7827               | 89.3   |
| 2000 | 7144.9         | 786.0          | 100.0  | 84.3   | 100.0                             | 65.3   | 103.5              | 64.6   | 8784               | 100.0  |
| 2001 | 5416.7         | 786.0          | 80.3   | 84.2   | 80.3                              | 65.9   | 78.7               | 65.1   | 7034               | 80.3   |
| 2002 | 7313.5         | 798.0          | 100.0  | 84.7   | 100.0                             | 67.1   | 104.6              | 66.5   | 8760               | 100.0  |
| 2003 | 6205.1         | 802.0          | 86.7   | 84.8   | 86.7                              | 67.8   | 88.3               | 67.3   | 7602               | 86.8   |
| 2004 | 7273.3         | 802.0          | 100.0  | 85.3   | 100.0                             | 68.9   | 103.2              | 68.5   | 8784               | 100.0  |

# US-289 THREE MILE ISLAND-1

## 6. 2004 Outages

| Date | Hours | GW(e).h | Type | Code | Description |
|------|-------|---------|------|------|-------------|
|      |       |         |      |      |             |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1974 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 136       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 10        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 627                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 74                                       | 1         |          |
| E. Testing of plant systems or components  |                 |           |          | 10                                       | 0         |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 217       | 1910     |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 1         |          |
| Subtotal   | 0               | 0         | 0        | 711                                      | 365       | 1910     |
| Total  | 0               |           |          | 2986                                     |           |          |

## 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1974 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 27                                       |
| 13. Reactor Auxiliary Systems       |                 | 11                                       |
| 15. Reactor Cooling Systems         |                 | 34                                       |
| 16. Steam generation systems        |                 | 7  |
| 31. Turbine and auxiliaries         |                 | 27                                       |
| 32. Feedwater and Main Steam System |                 | 6  |
| 35. All other I&C Systems           |                 | 0  |
| 41. Main Generator Systems          |                 | 8  |
| 42. Electrical Power Supply Systems |                 | 4  |
| XX. Miscellaneous Systems           |                 | 0  |
| Total                               | 0               | 124                                      |

# US-250 TURKEY POINT-3

**Operator:** FPL (FLORIDA POWER & LIGHT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 693.0 MW(e)  
**Design Net RUP:** 693.0 MW(e)  
**Design Discharge Burnup:** 24500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 4734.0 GW(e).h  
**Energy Availability Factor:** 79.0%  
**Load Factor:** 77.8%  
**Operating Factor:** 78.9%  
**Energy Unavailability Factor:** 21.0%  
**Total Off-line Time:** 1850 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 541.1 | 501.6 | 537.3 | 514.5 | 490.9 | 427.4 | 516.4 | 517.4 | 416.6 | 0.0   | 0.0   | 270.9 | 4734.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.9  | 100.0 | 100.0 | 83.3  | 0.0   | 0.0   | 74.4  | 79.0   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.9  | 100.0 | 100.0 | 83.3  | 0.0   | 0.0   | 74.4  | 79.0   |
| <b>LF (%)</b>   | 104.9 | 104.0 | 104.2 | 103.3 | 95.2  | 85.7  | 100.2 | 100.4 | 83.5  | 0.0   | 0.0   | 52.5  | 77.8   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.9  | 100.0 | 100.0 | 85.3  | 0.0   | 0.0   | 72.3  | 78.9   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.1  | 0.0   | 0.0   | 16.7  | 100.0 | 100.0 | 25.6  | 21.0   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 16.7  | 100.0 | 96.7  | 0.0   | 17.8   |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.1  | 0.0   | 0.0   | 0.0   | 0.0   | 3.3   | 25.6  | 3.3    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1967      **Lifetime Generation:** 135821.0 GW(e).h  
**Date of First Criticality:** 20 Oct 1972      **Cumulative Energy Availability Factor:** 71.4%  
**Date of Grid Connection:** 02 Nov 1972      **Cumulative Load Factor:** 70.2%  
**Date of Commercial Operation:** 14 Dec 1972      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 28.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4331.0         | 659.0          | 73.3   | 71.2   | 73.3                              | 58.3   | 75.0               | 58.8   | 6415               | 73.2   |
| 1984 | 4784.2         | 666.0          | 82.6   | 72.1   | 82.6                              | 60.3   | 81.8               | 60.7   | 7253               | 82.6   |
| 1985 | 3421.0         | 666.0          | 61.0   | 71.3   | 59.7                              | 60.3   | 58.6               | 60.6   | 5224               | 59.6   |
| 1986 | 4513.1         | 666.0          | 77.9   | 71.7   | 77.9                              | 61.6   | 77.4               | 61.8   | 6816               | 77.8   |
| 1987 | 885.3          | 666.0          | 17.9   | 68.1   | 17.9                              | 58.6   | 15.2               | 58.6   | 1566               | 17.9   |
| 1988 | 3468.0         | 666.0          | 60.6   | 67.7   | 60.6                              | 58.8   | 59.3               | 58.7   | 5320               | 60.6   |
| 1989 | 3605.1         | 666.0          | 65.1   | 67.5   | 65.1                              | 59.1   | 61.8               | 58.9   | 5696               | 65.0   |
| 1990 | 3388.4         | 666.0          | 59.4   | 67.0   | 59.4                              | 59.1   | 58.1               | 58.8   | 5200               | 59.4   |
| 1991 | 1332.0         | 666.0          | 50.0   | 66.1   | 50.0                              | 58.7   | 22.8               | 56.9   | 2155               | 24.6   |
| 1992 | 3428.2         | 666.0          | 67.2   | 66.2   | 67.2                              | 59.1   | 58.6               | 57.0   | 5896               | 67.1   |
| 1993 | 5657.3         | 666.0          | 96.1   | 67.6   | 96.1                              | 60.9   | 97.0               | 58.9   | 8421               | 96.1   |
| 1994 | 4924.9         | 666.0          | 85.8   | 68.5   | 85.8                              | 62.0   | 84.4               | 60.1   | 7513               | 85.8   |
| 1995 | 5219.0         | 666.0          | 89.6   | 69.4   | 89.6                              | 63.2   | 89.5               | 61.4   | 7846               | 89.6   |
| 1996 | 5750.8         | 673.0          | 96.7   | 70.5   | 96.7                              | 64.6   | 97.3               | 62.9   | 8490               | 96.7   |
| 1997 | 5252.4         | 693.0          | 87.0   | 71.2   | 87.0                              | 65.5   | 86.5               | 63.9   | 7570               | 86.4   |
| 1998 | 5408.3         | 693.0          | 89.8   | 72.0   | 89.0                              | 66.5   | 89.1               | 64.9   | 7757               | 88.6   |
| 1999 | 6112.3         | 693.0          | 99.1   | 73.0   | 99.1                              | 67.7   | 100.7              | 66.3   | 8684               | 99.1   |
| 2000 | 5684.4         | 693.0          | 92.5   | 73.7   | 92.5                              | 68.7   | 93.4               | 67.3   | 8122               | 92.5   |
| 2001 | 5526.0         | 693.0          | 90.5   | 74.3   | 90.5                              | 69.4   | 91.0               | 68.1   | 7923               | 90.4   |
| 2002 | 6215.4         | 693.0          | 100.0  | 75.2   | 100.0                             | 70.5   | 102.4              | 69.3   | 8760               | 100.0  |
| 2003 | 5445.6         | 693.0          | 90.6   | 75.7   | 90.6                              | 71.2   | 89.7               | 70.0   | 7930               | 90.5   |
| 2004 | 4734.0         | 693.0          | 79.0   | 75.8   | 79.0                              | 71.4   | 77.8               | 70.2   | 6934               | 78.9   |

## US-250 TURKEY POINT-3

### 6. 2004 Outages

| Date   | Hours  | GW(e).h | Type | Code | Description                                 |
|--------|--------|---------|------|------|---|
| 17 Jun | 20.7   | 14.3    | UF2  | A31  | TURBINE OIL LEAK REPAIRS REQUIRED.          |
| 26 Jun | 51.7   | 35.8    | UF2  | A31  | TURBINE CONTROL VALVE REPAIRS REQUIRED.     |
| 26 Sep | 1561.0 | 1081.8  | PF   | C21  | REFUELLING OUTAGE.                          |
| 30 Nov | 35.7   | 24.7    | UF3  | Z21  | REFUELING EXTENSION.                        |
| 14 Dec | 106.4  | 73.7    | UF2  | P31  | FIRE NEAR #2 BEARING HIGH PRESSURE TURBINE. |
| 28 Dec | 73.2   | 50.7    | UF2  | A41  | GENERATOR EXCITER COOLING WATER LEAK.       |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 145       |          | 0  | 480       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 5         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 1561            |           |          | 866                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 353                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 10                                       | 2         |          |
| F. Major back-fitting, refurbishment or upgrading activities with refuelling         |                 |           |          | 3  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 313                                      | 19        | 6        |
| P. Fire  |                 | 106       |          |  |           |          |
| Z. Others  |                 | 35        |          |  |           |          |
| Subtotal   | 1561            | 286       | 0        | 1545                                     | 506       | 6        |
| Total  |                 | 1847      |          |  | 2057      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1972 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 43                                       |
| 13. Reactor Auxiliary Systems                  |                 | 62                                       |
| 14. Safety Systems                             |                 | 23                                       |
| 15. Reactor Cooling Systems                    |                 | 91                                       |
| 16. Steam generation systems                   |                 | 25                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 1  |
| 31. Turbine and auxiliaries                    | 72              | 41                                       |
| 32. Feedwater and Main Steam System            |                 | 31                                       |
| 33. Circulating Water System                   |                 | 2  |
| 35. All other I&C Systems                      |                 | 2  |
| 41. Main Generator Systems                     | 73              | 77                                       |
| 42. Electrical Power Supply Systems            |                 | 11                                       |
| XX. Miscellaneous Systems                      |                 | 51                                       |
| Total  | 145             | 460                                      |

# US-251 TURKEY POINT-4

**Operator:** FPL (FLORIDA POWER & LIGHT CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 693.0 MW(e)  
**Design Net RUP:** 693.0 MW(e)  
**Design Discharge Burnup:** 24500 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 6079.2 GW(e).h  
**Energy Availability Factor:** 98.6%  
**Load Factor:** 99.9%  
**Operating Factor:** 98.6%  
**Energy Unavailability Factor:** 1.4%  
**Total Off-line Time:** 122 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 541.3 | 502.9 | 536.3 | 514.7 | 406.8 | 500.5 | 512.2 | 504.8 | 504.3 | 529.0 | 516.8 | 509.6 | 6079.2 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 87.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.4  | 98.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 100.0 | 87.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.4  | 98.6   |
| <b>LF (%)</b>   | 105.0 | 104.3 | 104.0 | 103.3 | 78.9  | 100.3 | 99.3  | 97.9  | 101.1 | 102.5 | 103.6 | 98.8  | 99.9   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 100.0 | 87.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 96.4  | 98.6   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 12.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.6   | 1.4    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 12.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.6   | 1.4    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Apr 1967      **Lifetime Generation:** 134858.1 GW(e).h  
**Date of First Criticality:** 11 Jun 1973      **Cumulative Energy Availability Factor:** 74.6%  
**Date of Grid Connection:** 21 Jun 1973      **Cumulative Load Factor:** 73.1%  
**Date of Commercial Operation:** 07 Sep 1973      **Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 25.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2978.9         | 659.0          | 52.4   | 69.5   | 52.4                              | 66.3   | 51.6               | 66.4   | 4568               | 52.1   |
| 1984 | 3084.1         | 666.0          | 54.4   | 68.1   | 54.4                              | 65.2   | 52.7               | 65.1   | 4774               | 54.3   |
| 1985 | 5177.9         | 666.0          | 89.8   | 69.9   | 89.7                              | 67.2   | 88.8               | 67.1   | 7852               | 89.6   |
| 1986 | 1744.0         | 666.0          | 31.9   | 67.0   | 31.9                              | 64.5   | 29.9               | 64.2   | 2790               | 31.8   |
| 1987 | 2657.5         | 666.0          | 49.3   | 65.7   | 49.3                              | 63.4   | 45.6               | 62.9   | 4314               | 49.2   |
| 1988 | 3267.7         | 666.0          | 56.8   | 65.1   | 56.8                              | 63.0   | 55.9               | 62.4   | 4986               | 56.8   |
| 1989 | 2107.6         | 666.0          | 42.0   | 63.7   | 42.0                              | 61.7   | 36.1               | 60.8   | 3676               | 42.0   |
| 1990 | 4384.9         | 666.0          | 76.4   | 64.4   | 76.4                              | 62.5   | 75.2               | 61.6   | 6692               | 76.4   |
| 1991 | 808.0          | 666.0          | 48.2   | 63.5   | 48.2                              | 61.8   | 13.9               | 59.0   | 1335               | 15.2   |
| 1992 | 4642.3         | 666.0          | 81.3   | 64.5   | 81.3                              | 62.8   | 79.4               | 60.1   | 7139               | 81.3   |
| 1993 | 4746.3         | 666.0          | 83.1   | 65.4   | 83.1                              | 63.8   | 81.4               | 61.1   | 7277               | 83.1   |
| 1994 | 4844.4         | 666.0          | 85.0   | 66.3   | 85.0                              | 64.8   | 83.0               | 62.2   | 7437               | 84.9   |
| 1995 | 5780.1         | 666.0          | 98.5   | 67.8   | 98.5                              | 66.3   | 99.1               | 63.8   | 8629               | 98.5   |
| 1996 | 5165.4         | 673.0          | 88.6   | 68.7   | 88.6                              | 67.3   | 87.4               | 64.9   | 7771               | 88.5   |
| 1997 | 5442.6         | 693.0          | 89.6   | 69.6   | 89.6                              | 68.3   | 89.7               | 65.9   | 7809               | 89.1   |
| 1998 | 6181.5         | 693.0          | 100.0  | 70.9   | 100.0                             | 69.6   | 101.8              | 67.4   | 8760               | 100.0  |
| 1999 | 5735.3         | 693.0          | 93.5   | 71.8   | 93.4                              | 70.5   | 94.5               | 68.5   | 8185               | 93.4   |
| 2000 | 5591.4         | 693.0          | 91.4   | 72.5   | 91.4                              | 71.3   | 91.9               | 69.4   | 8028               | 91.4   |
| 2001 | 6105.3         | 693.0          | 98.4   | 73.5   | 98.4                              | 72.3   | 100.6              | 70.6   | 8623               | 98.4   |
| 2002 | 5854.1         | 693.0          | 95.5   | 74.3   | 95.6                              | 73.2   | 96.4               | 71.5   | 8369               | 95.5   |
| 2003 | 5562.5         | 693.0          | 91.7   | 74.9   | 91.7                              | 73.8   | 91.6               | 72.2   | 8033               | 91.7   |
| 2004 | 6079.2         | 693.0          | 98.6   | 75.7   | 98.6                              | 74.6   | 99.9               | 73.1   | 8662               | 98.6   |

## US-251 TURKEY POINT-4

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 14 May | 94.5  | 65.5    | UF4  | A35  | AUTOMATIC REACTOR TRIP OCCURRED FROM 100% POWER AFTER 4A S/G FLOW CONTROL VALVE CLOSED ON 5/14/04. UNIT RETURNED TO POWER 5/18/04. |
| 25 Dec | 26.6  | 18.4    | UF5  | A31  | MANUAL REACTOR TRIP ON CONDENSER LOW VACUUM.   |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1975 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 121       |          |  | 405       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 14        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1319                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 138                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 8  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 193                                      |           |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 169       | 0        |
| Subtotal   | 0               | 121       | 0        | 1658                                     | 588       | 0        |
| Total  |                 | 121       |          |  | 2246      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1975 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 11. Reactor and Accessories         |                 | 8  |
| 12. Reactor I&C Systems             |                 | 24                                       |
| 13. Reactor Auxiliary Systems       |                 | 4  |
| 14. Safety Systems                  |                 | 5  |
| 15. Reactor Cooling Systems         |                 | 116                                      |
| 16. Steam generation systems        |                 | 119                                      |
| 31. Turbine and auxiliaries         | 26              | 57                                       |
| 32. Feedwater and Main Steam System |                 | 19                                       |
| 33. Circulating Water System        |                 | 4  |
| 35. All other I&C Systems           | 94              | 0  |
| 41. Main Generator Systems          |                 | 1  |
| 42. Electrical Power Supply Systems |                 | 41                                       |
| Total                               | 120             | 398                                      |

# US-271 VERMONT YANKEE

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** GE (GENERAL ELECTRIC COMPANY (US))

## 1. Station Details

**Type:** BWR  
**Net Reference Unit Power at the beginning of 2004:** 510.0 MW(e)  
**Design Net RUP:** 514.0 MW(e)  
**Design Discharge Burnup:** 19000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 3858.0 GW(e).h  
**Energy Availability Factor:** 86.6%  
**Load Factor:** 86.1%  
**Operating Factor:** 86.5%  
**Energy Unavailability Factor:** 13.4%  
**Total Off-line Time:** 1185 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr  | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 392.7 | 366.8 | 391.1 | 36.0 | 319.9 | 209.3 | 287.8 | 367.7 | 360.9 | 376.5 | 368.7 | 380.6 | 3858.0 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 100.0 | 10.7 | 88.3  | 57.0  | 81.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.6   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 100.0 | 10.7 | 88.3  | 57.0  | 81.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.6   |
| <b>LF (%)</b>   | 103.5 | 103.3 | 103.1 | 9.8  | 84.3  | 57.0  | 75.8  | 96.9  | 98.3  | 99.1  | 100.4 | 100.3 | 86.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 100.0 | 9.9  | 88.2  | 57.5  | 80.8  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 86.5   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 0.0   | 89.3 | 11.7  | 43.0  | 18.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 13.4   |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 89.3 | 11.7  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.3    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 43.0  | 18.1  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1967  
**Date of First Criticality:** 24 Mar 1972  
**Date of Grid Connection:** 20 Sep 1972  
**Date of Commercial Operation:** 30 Nov 1972

**Lifetime Generation:** 114524.9 GW(e).h  
**Cumulative Energy Availability Factor:** 82.5%  
**Cumulative Load Factor:** 80.5%  
**Cumulative Unit Capability Factor:** 77.4%  
**Cumulative Energy Unavailability Factor:** 17.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 2874.5         | 504.0          | 69.8   | 75.9   | 69.8                              | 75.6   | 65.1               | 72.3   | 6072               | 69.3   |
| 1984 | 3335.8         | 504.0          | 79.0   | 76.2   | 79.0                              | 75.9   | 75.3               | 72.5   | 6933               | 78.9   |
| 1985 | 2999.4         | 504.0          | 71.8   | 75.8   | 71.8                              | 75.6   | 67.9               | 72.2   | 6287               | 71.8   |
| 1986 | 2058.4         | 504.0          | 48.9   | 73.9   | 48.9                              | 73.6   | 46.6               | 70.3   | 4280               | 48.9   |
| 1987 | 3536.4         | 504.0          | 83.2   | 74.5   | 83.2                              | 74.3   | 80.1               | 71.0   | 7288               | 83.2   |
| 1988 | 4113.8         | 504.0          | 94.9   | 75.8   | 94.9                              | 75.6   | 92.9               | 72.4   | 8333               | 94.9   |
| 1989 | 3606.8         | 504.0          | 84.4   | 76.3   | 84.4                              | 76.1   | 81.7               | 72.9   | 7372               | 84.2   |
| 1990 | 3616.3         | 504.0          | 84.7   | 76.8   | 84.7                              | 76.6   | 81.9               | 73.4   | 7392               | 84.4   |
| 1991 | 4108.3         | 504.0          | 95.1   | 77.7   | 93.7                              | 77.5   | 93.1               | 74.4   | 8200               | 93.6   |
| 1992 | 3734.6         | 504.0          | 87.6   | 78.2   | 87.6                              | 78.0   | 84.4               | 74.9   | 7680               | 87.4   |
| 1993 | 3372.1         | 504.0          | 78.6   | 78.3   | 78.6                              | 78.0   | 76.4               | 75.0   | 6860               | 78.3   |
| 1994 | 4315.6         | 504.0          | 98.2   | 79.2   | 98.2                              | 78.9   | 97.7               | 76.0   | 8600               | 98.2   |
| 1995 | 3858.5         | 507.0          | 86.6   | 79.5   | 86.6                              | 79.3   | 86.9               | 76.5   | 7554               | 86.2   |
| 1996 | 3798.8         | 510.0          | 84.9   | 79.7   | 84.9                              | 79.5   | 84.8               | 76.9   | 7422               | 84.5   |
| 1997 | 4266.9         | 510.0          | 95.6   | 80.4   | 95.6                              | 80.2   | 95.5               | 77.6   | 8358               | 95.4   |
| 1998 | 3358.7         | 510.0          | 76.6   | 80.2   | 76.6                              | 80.0   | 75.2               | 77.5   | 6690               | 76.4   |
| 1999 | 4059.1         | 510.0          | 90.5   | 80.6   | 90.5                              | 80.4   | 90.9               | 78.0   | 7936               | 90.6   |
| 2000 | 4548.1         | 510.0          | 99.5   | 81.3   | 99.5                              | 81.1   | 101.5              | 78.9   | 8738               | 99.5   |
| 2001 | 4171.1         | 510.0          | 93.1   | 81.7   | 93.1                              | 81.5   | 93.4               | 79.4   | 8145               | 93.0   |
| 2002 | 3962.6         | 510.0          | 91.0   | 82.0   | 91.0                              | 81.8   | 88.7               | 79.7   | 7966               | 90.9   |
| 2003 | 4444.2         | 510.0          | 98.3   | 82.5   | 98.3                              | 82.4   | 99.5               | 80.3   | 8612               | 98.3   |
| 2004 | 3858.0         | 510.0          | 86.6   | 82.7   | 86.6                              | 82.5   | 86.1               | 80.5   | 7599               | 86.5   |



**US-271 VERMONT YANKEE****6. 2004 Outages**

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 04 Apr | 647.2 | 327.5   | PF   | C21  | REFUELLING OUTAGE.   |
| 04 May | 87.4  | 44.2    | PF   | C12  | REFUELLING OUTAGE.   |
| 18 Jun | 448.0 | 226.7   | UF2  | A42  | GENERATOR LOAD REJECT DUE TO ELECTRICAL FAULT ON MAIN TRANSFORMER. |

**7. Full Outages, Analysis by Cause**

| Outage Cause   | 2004 Hours Lost |           |          | 1972 to 2004<br>Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|---|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                     | Unplanned | External |
| A. Plant equipment failure   |                 | 448       |          |   | 255       |          |
| B. Refuelling without a maintenance  |                 |           |          |   | 8         |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 734             |           |          | 936   |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 128   | 0         |          |
| E. Testing of plant systems or components  |                 |           |          | 7   | 12        |          |
| H. Nuclear regulatory requirements   |                 |           |          |   |           | 6        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          | 24  |           | 6        |
| Subtotal   | 734             | 448       | 0        | 1095  | 275       | 12       |
| Total  |                 | 1182      |          |   | 1382      |          |

**8. Equipment Related Full Outages, Analysis by System**

| System                              | 2004<br>Hours Lost | 1972 to 2004<br>Average Hours Lost Per Year |
|-------------------------------------|--------------------|---|
| 11. Reactor and Accessories         |                    | 9   |
| 12. Reactor I&C Systems             |                    | 7   |
| 13. Reactor Auxiliary Systems       |                    | 19  |
| 14. Safety Systems                  |                    | 52  |
| 15. Reactor Cooling Systems         |                    | 45  |
| 31. Turbine and auxiliaries         |                    | 44  |
| 32. Feedwater and Main Steam System |                    | 21  |
| 42. Electrical Power Supply Systems | 448                | 52  |
| XX. Miscellaneous Systems           |                    | 2   |
| Total                               | 448                | 251   |

# US-395 VIRGIL C. SUMMER-1

**Operator:** SCEG (SOUTH CAROLINA ELECTRIC & GAS CO.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 966.0 MW(e)  
**Design Net RUP:** 900.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 8243.3 GW(e).h  
**Energy Availability Factor:** 95.8%  
**Load Factor:** 97.1%  
**Operating Factor:** 95.8%  
**Energy Unavailability Factor:** 4.2%  
**Total Off-line Time:** 371 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 733.4 | 685.9 | 700.9 | 440.7 | 732.3 | 704.8 | 724.9 | 725.0 | 704.9 | 733.5 | 710.2 | 646.7 | 8243.3 |
| <b>EAF (%)</b>  | 100.0 | 100.0 | 93.5  | 66.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.7  | 95.8   |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 93.6  | 66.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.7  | 95.8   |
| <b>LF (%)</b>   | 102.0 | 102.0 | 97.5  | 63.5  | 101.9 | 101.3 | 100.9 | 100.9 | 101.4 | 101.9 | 102.1 | 90.0  | 97.1   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 95.6  | 63.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 89.7  | 95.8   |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 6.5   | 33.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3  | 4.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 6.5   | 33.9  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 10.3  | 4.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Mar 1973      **Lifetime Generation:** 139957.1 GW(e).h  
**Date of First Criticality:** 22 Oct 1982      **Cumulative Energy Availability Factor:** 83.5%  
**Date of Grid Connection:** 16 Nov 1982      **Cumulative Load Factor:** 80.3%  
**Date of Commercial Operation:** 01 Jan 1984      **Cumulative Unit Capability Factor:** 78.1%  
**Cumulative Energy Unavailability Factor:** 16.5%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1983 | 4327.5         | 900.0          | 0.0  | 0.0    | 74.4                              | 100.0  | 54.9               | 0.0    | 6238               | 71.2   |
| 1984 | 4208.6         | 900.0          | 61.3   | 61.3   | 61.3                              | 61.3   | 53.2               | 53.2   | 5362               | 61.0   |
| 1985 | 5235.1         | 885.0          | 71.6   | 66.4   | 71.6                              | 66.4   | 67.5               | 60.3   | 6272               | 71.6   |
| 1986 | 7160.6         | 885.0          | 95.3   | 76.0   | 95.3                              | 76.0   | 92.4               | 70.9   | 8346               | 95.3   |
| 1987 | 5168.1         | 885.0          | 70.1   | 74.5   | 70.1                              | 74.5   | 66.7               | 69.9   | 6135               | 70.0   |
| 1988 | 5068.2         | 885.0          | 67.8   | 73.2   | 67.8                              | 73.2   | 65.2               | 68.9   | 5952               | 67.8   |
| 1989 | 5412.8         | 885.0          | 80.8   | 74.4   | 80.8                              | 74.4   | 69.8               | 69.1   | 7073               | 80.7   |
| 1990 | 6117.3         | 885.0          | 82.9   | 75.6   | 82.9                              | 75.6   | 78.9               | 70.5   | 7261               | 82.9   |
| 1991 | 5346.1         | 885.0          | 80.7   | 76.3   | 80.7                              | 76.3   | 69.0               | 70.3   | 7065               | 80.7   |
| 1992 | 7515.2         | 885.0          | 97.1   | 78.6   | 97.1                              | 78.6   | 96.7               | 73.2   | 8532               | 97.1   |
| 1993 | 6109.5         | 885.0          | 82.9   | 79.0   | 82.9                              | 79.0   | 78.8               | 73.8   | 7258               | 82.9   |
| 1994 | 4456.0         | 885.0          | 68.8   | 78.1   | 68.8                              | 78.1   | 57.5               | 72.3   | 6022               | 68.7   |
| 1995 | 7561.4         | 885.0          | 96.8   | 79.6   | 96.8                              | 79.6   | 97.5               | 74.4   | 8478               | 96.8   |
| 1996 | 7155.1         | 923.0          | 89.6   | 80.4   | 89.6                              | 80.4   | 88.3               | 75.5   | 7829               | 89.1   |
| 1997 | 7267.9         | 948.0          | 89.9   | 81.2   | 89.9                              | 81.1   | 87.5               | 76.4   | 7805               | 89.1   |
| 1998 | 8188.9         | 953.0          | 98.7   | 82.4   | 98.7                              | 82.4   | 98.1               | 77.9   | 8638               | 98.6   |
| 1999 | 7376.3         | 954.0          | 88.8   | 82.8   | 88.8                              | 82.8   | 88.3               | 78.6   | 7779               | 88.8   |
| 2000 | 6358.8         | 965.0          | 76.2   | 82.4   | 76.2                              | 82.4   | 75.0               | 78.4   | 6688               | 76.1   |
| 2001 | 6757.5         | 966.0          | 81.0   | 82.3   | 81.0                              | 82.3   | 79.9               | 78.5   | 7095               | 81.0   |
| 2002 | 7379.5         | 966.0          | 87.3   | 82.6   | 87.3                              | 82.6   | 87.2               | 79.0   | 7645               | 87.3   |
| 2003 | 7352.1         | 966.0          | 86.4   | 82.8   | 86.4                              | 82.8   | 86.9               | 79.4   | 7564               | 86.3   |
| 2004 | 8243.3         | 966.0          | 95.8   | 83.5   | 95.8                              | 83.5   | 97.1               | 80.3   | 8413               | 95.8   |

## US-395 VIRGIL C. SUMMER-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 30 Mar | 292.7 | 282.7   | UF2  | A15  | REPAIR C REACTOR COOLANT PUMP SEAL INJECTION LINE.   |
| 06 Dec | 76.9  | 74.3    | UF2  | A31  | REACTOR POWER WAS REDUCED TO 2% WITH THE MAIN TURBINE OFFLINE TO REPAIR A STEAM LEAK IN THE EXTRACTION STEAM PIPING. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1983 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 369       |          | 11                                       | 149       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 13        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 1068                                     |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 194                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  | 0         |          |
| J. Grid failure or grid unavailability   |                 |           |          |  |           | 0        |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 44        | 1        |
| Subtotal   | 0               | 369       | 0        | 1276                                     | 206       | 1        |
| Total  |                 | 369       |          |  | 1483      |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1983 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 17                                       |
| 14. Safety Systems                  |                 | 6  |
| 15. Reactor Cooling Systems         | 292             | 44                                       |
| 16. Steam generation systems        |                 | 15                                       |
| 31. Turbine and auxiliaries         | 76              | 11                                       |
| 32. Feedwater and Main Steam System |                 | 14                                       |
| 35. All other I&C Systems           |                 | 1  |
| 41. Main Generator Systems          |                 | 20                                       |
| 42. Electrical Power Supply Systems |                 | 14                                       |
| Total                               | 368             | 142                                      |

# US-424 VOGTLE-1

**Operator:** SOUTH (Southern Nuclear Operating Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1152.0 MW(e)  
**Design Net RUP:** 1122.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10162.3 GW(e).h  
**Energy Availability Factor:** 99.0%  
**Load Factor:** 100.4%  
**Operating Factor:** 99.0%  
**Energy Unavailability Factor:** 1.0%  
**Total Off-line Time:** 90 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 884.9 | 827.6 | 749.8 | 843.6 | 864.9 | 833.6 | 858.9 | 862.7 | 837.2 | 871.6 | 847.6 | 879.9 | 10162.3 |
| <b>EAFF (%)</b> | 100.0 | 100.0 | 88.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.0    |
| <b>UCF (%)</b>  | 100.0 | 100.0 | 88.0  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.0    |
| <b>LF (%)</b>   | 103.2 | 103.2 | 87.5  | 101.9 | 100.9 | 100.5 | 100.2 | 100.7 | 100.9 | 101.6 | 102.2 | 102.7 | 100.4   |
| <b>OF (%)</b>   | 100.0 | 100.0 | 87.9  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.0    |
| <b>EUF (%)</b>  | 0.0   | 0.0   | 12.0  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.0     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 2.2   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.2     |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 9.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.8     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1976  
**Date of First Criticality:** 09 Mar 1987  
**Date of Grid Connection:** 27 Mar 1987  
**Date of Commercial Operation:** 01 Jun 1987

**Lifetime Generation:** 150765.5 GW(e).h  
**Cumulative Energy Availability Factor:** 89.4%  
**Cumulative Load Factor:** 89.1%  
**Cumulative Unit Capability Factor:** 78.6%  
**Cumulative Energy Unavailability Factor:** 10.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1988 | 6799.7         | 1079.0         | 74.3   | 74.3   | 74.2                              | 74.2   | 71.7               | 71.7   | 6569               | 74.8   |
| 1989 | 8709.4         | 1083.0         | 94.2   | 84.2   | 94.2                              | 84.2   | 91.8               | 81.8   | 8275               | 94.5   |
| 1990 | 7353.1         | 1079.0         | 78.4   | 82.3   | 78.4                              | 82.3   | 77.8               | 80.5   | 6980               | 79.7   |
| 1991 | 7501.7         | 1100.0         | 79.0   | 81.4   | 78.9                              | 81.4   | 77.9               | 79.8   | 7016               | 80.1   |
| 1992 | 9383.5         | 1105.0         | 96.9   | 84.6   | 96.9                              | 84.6   | 96.7               | 83.2   | 8523               | 97.0   |
| 1993 | 8600.7         | 1145.0         | 86.3   | 84.9   | 86.3                              | 84.9   | 85.7               | 83.7   | 7577               | 86.5   |
| 1994 | 8817.2         | 1168.0         | 89.6   | 85.6   | 89.6                              | 85.6   | 86.2               | 84.0   | 7847               | 89.6   |
| 1995 | 9984.0         | 1162.0         | 99.2   | 87.4   | 98.4                              | 87.3   | 98.1               | 85.9   | 8621               | 98.4   |
| 1996 | 8149.8         | 1162.0         | 81.5   | 86.7   | 81.5                              | 86.6   | 79.8               | 85.2   | 7162               | 81.5   |
| 1997 | 8270.1         | 1162.0         | 81.8   | 86.2   | 81.9                              | 86.1   | 81.2               | 84.8   | 7167               | 81.8   |
| 1998 | 10216.9        | 1162.0         | 99.8   | 87.5   | 99.8                              | 87.4   | 100.4              | 86.2   | 8738               | 99.7   |
| 1999 | 9425.9         | 1152.0         | 92.6   | 87.9   | 92.6                              | 87.8   | 93.4               | 86.8   | 8108               | 92.6   |
| 2000 | 9196.6         | 1148.0         | 90.7   | 88.1   | 90.7                              | 88.1   | 91.2               | 87.2   | 7963               | 90.7   |
| 2001 | 10144.4        | 1148.0         | 98.9   | 88.9   | 98.9                              | 88.8   | 100.9              | 88.2   | 8665               | 98.9   |
| 2002 | 8638.8         | 1148.0         | 85.3   | 88.7   | 85.3                              | 88.6   | 85.9               | 88.0   | 7469               | 85.3   |
| 2003 | 9411.5         | 1152.0         | 92.5   | 88.9   | 92.5                              | 88.8   | 93.3               | 88.3   | 8097               | 92.4   |
| 2004 | 10162.3        | 1152.0         | 99.0   | 89.5   | 99.0                              | 89.4   | 100.4              | 89.1   | 8694               | 99.0   |

# US-424 VOGTLE-1

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 27 Mar | 73.1  | 84.2    | UF5  | A32  | MANUAL REACTOR TRIP DUE TO LOSS OF FEEDWATER PUMP SPEED CONTROL.                               |
| 27 Mar | 16.3  | 18.8    | PF   | D41  | SCHEDULED MAINTENANCE WITH GENERATOR OFF-LINE, TO RELACE A POWER SUPPLY IN THE GENERREX PANEL. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1988 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 73        |          |  | 151       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 17        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 681                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 16              |           |          | 33                                       |           |          |
| E. Testing of plant systems or components  |                 |           |          | 3  |           |          |
| H. Nuclear regulatory requirements   |                 |           |          |  | 11        |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 2         | 3        |
| Z. Others  |                 |           |          | 2  |           |          |
| Subtotal   | 16              | 73        | 0        | 719                                      | 181       | 3        |
| Total  |                 | 89        |          |  | 903       |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1988 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 5  |
| 14. Safety Systems                             |                 | 33                                       |
| 15. Reactor Cooling Systems                    |                 | 44                                       |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 2  |
| 32. Feedwater and Main Steam System            | 73              | 11                                       |
| 35. All other I&C Systems                      |                 | 3  |
| 41. Main Generator Systems                     |                 | 26                                       |
| 42. Electrical Power Supply Systems            |                 | 15                                       |
| Total  | 73              | 141                                      |

# US-425 VOGTLE-2

**Operator:** SOUTH (Southern Nuclear Operating Co.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1149.0 MW(e)  
**Design Net RUP:** 1101.0 MW(e)  
**Design Discharge Burnup:** 33000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9168.7 GW(e).h  
**Energy Availability Factor:** 90.8%  
**Load Factor:** 90.8%  
**Operating Factor:** 90.7%  
**Energy Unavailability Factor:** 9.2%  
**Total Off-line Time:** 814 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 873.7 | 778.4 | 878.7 | 471.2 | 359.2 | 836.0 | 858.1 | 783.8 | 837.3 | 872.6 | 741.2 | 878.4 | 9168.7 |
| <b>EAF (%)</b>  | 96.8  | 98.3  | 100.0 | 56.6  | 47.2  | 100.0 | 100.0 | 97.2  | 100.0 | 100.0 | 93.3  | 100.0 | 90.8   |
| <b>UCF (%)</b>  | 96.8  | 98.3  | 100.0 | 56.6  | 47.2  | 100.0 | 100.0 | 97.2  | 100.0 | 100.0 | 93.3  | 100.0 | 90.8   |
| <b>LF (%)</b>   | 102.2 | 97.3  | 102.8 | 57.0  | 42.0  | 101.1 | 100.4 | 91.7  | 101.2 | 101.9 | 89.6  | 102.8 | 90.8   |
| <b>OF (%)</b>   | 99.3  | 95.4  | 100.0 | 56.7  | 46.8  | 100.0 | 100.0 | 97.2  | 100.0 | 100.0 | 93.2  | 100.0 | 90.7   |
| <b>EUF (%)</b>  | 3.2   | 1.7   | 0.0   | 43.4  | 52.8  | 0.0   | 0.0   | 2.8   | 0.0   | 0.0   | 6.7   | 0.0   | 9.2    |
| <b>PUF (%)</b>  | 3.2   | 1.7   | 0.0   | 43.4  | 52.8  | 0.0   | 0.0   | 2.8   | 0.0   | 0.0   | 0.0   | 0.0   | 8.7    |
| <b>UCLF (%)</b> | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 6.7   | 0.0   | 0.6    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Aug 1976  
**Date of First Criticality:** 28 Mar 1989  
**Date of Grid Connection:** 10 Apr 1989  
**Date of Commercial Operation:** 20 May 1989

**Lifetime Generation:** 140148.8 GW(e).h  
**Cumulative Energy Availability Factor:** 90.3%  
**Cumulative Load Factor:** 89.4%  
**Cumulative Unit Capability Factor:** 79.2%  
**Cumulative Energy Unavailability Factor:** 9.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1989 | 5547.2         | 1110.0         | 0.0  | 0.0    | 96.0                              | 100.0  | 60.2               | 0.0    | 5104               | 61.5   |
| 1990 | 6868.0         | 1110.0         | 81.1   | 81.1   | 81.1                              | 81.1   | 70.6               | 70.6   | 7125               | 81.3   |
| 1991 | 8897.4         | 1097.0         | 95.4   | 88.2   | 95.4                              | 88.2   | 92.6               | 81.5   | 8375               | 95.6   |
| 1992 | 7779.6         | 1109.0         | 80.8   | 85.7   | 80.8                              | 85.7   | 79.9               | 81.0   | 7175               | 81.7   |
| 1993 | 8680.9         | 1140.0         | 88.1   | 86.3   | 88.1                              | 86.3   | 86.9               | 82.5   | 7737               | 88.3   |
| 1994 | 9331.6         | 1168.0         | 92.1   | 87.5   | 92.1                              | 87.5   | 91.2               | 84.3   | 8062               | 92.0   |
| 1995 | 9165.6         | 1162.0         | 90.8   | 88.1   | 90.3                              | 88.0   | 90.0               | 85.3   | 7908               | 90.3   |
| 1996 | 9037.6         | 1162.0         | 89.9   | 88.4   | 89.9                              | 88.3   | 88.5               | 85.8   | 7899               | 89.9   |
| 1997 | 10310.8        | 1162.0         | 100.0  | 89.8   | 100.0                             | 89.8   | 101.3              | 87.7   | 8760               | 100.0  |
| 1998 | 8388.6         | 1162.0         | 83.9   | 89.2   | 83.9                              | 89.1   | 82.4               | 87.1   | 7347               | 83.9   |
| 1999 | 9022.6         | 1156.0         | 89.5   | 89.2   | 89.5                              | 89.1   | 89.1               | 87.3   | 7833               | 89.4   |
| 2000 | 10337.8        | 1149.0         | 100.0  | 90.2   | 100.0                             | 90.1   | 102.4              | 88.7   | 8784               | 100.0  |
| 2001 | 9456.7         | 1149.0         | 92.6   | 90.4   | 92.6                              | 90.3   | 94.0               | 89.2   | 8112               | 92.6   |
| 2002 | 8418.9         | 1149.0         | 83.7   | 89.9   | 83.7                              | 89.8   | 83.6               | 88.7   | 7328               | 83.7   |
| 2003 | 9736.6         | 1149.0         | 95.9   | 90.3   | 95.9                              | 90.3   | 96.7               | 89.3   | 8401               | 95.9   |
| 2004 | 9168.7         | 1149.0         | 90.8   | 90.3   | 90.8                              | 90.3   | 90.8               | 89.4   | 7970               | 90.7   |

## US-425 VOGTLE-2

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 31 Jan | 36.2  | 41.6    | PF   | D41  | PLANNED MAINTENANCE TO REPAIR GENERATOR HYDROGEN LEAK.   |
| 18 Apr | 703.8 | 808.7   | PF   | C21  | REFUELLING OUTAGE.   |
| 17 May | 1.8   | 2.0     | PF   | E31  | TURBINE OVERSPEED TRIP SURVEILLANCE TEST.  |
| 07 Aug | 21.0  | 24.1    | PF   | Z    | SHUTDOWN TO INVESTIGATE A REACTIVITY ANOMOLY.  |
| 20 Nov | 48.3  | 55.5    | UF2  | L    | COMPLETE MISCELLANEOUS OUTAGE RELATED ACTIVITIES AND PERFORM REQUIRED MODE CHANGE PREREQUISITES. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1989 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 |           |          |  | 64        |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 35        |          |
| C. Inspection, maintenance or repair combined with refuelling                        | 703             |           |          | 559                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              | 36              |           |          | 74                                       |           |          |
| E. Testing of plant systems or components  | 1               |           |          | 0  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 16        | 2        |
| L. Human factor related  |                 | 48        |          |  |           |          |
| Z. Others  | 20              |           |          | 3  |           |          |
| Subtotal   | 760             | 48        | 0        | 636                                      | 115       | 2        |
| Total  |                 | 808       |          |  | 753       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1989 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             |                 | 7  |
| 13. Reactor Auxiliary Systems       |                 | 1  |
| 14. Safety Systems                  |                 | 18                                       |
| 15. Reactor Cooling Systems         |                 | 7  |
| 16. Steam generation systems        |                 | 2  |
| 31. Turbine and auxiliaries         |                 | 1  |
| 32. Feedwater and Main Steam System |                 | 7  |
| 35. All other I&C Systems           |                 | 10                                       |
| 41. Main Generator Systems          |                 | 0  |
| 42. Electrical Power Supply Systems |                 | 4  |
| Total                               | 0               | 57                                       |

**US-382 WATERFORD-3**

**Operator:** ENTERGY (ENTERGY NUCLEAR)  
**Contractor:** CE (COMBUSTION ENGINEERING CO.)

**1. Station Details**

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1075.0 MW(e)  
**Design Net RUP:** 1104.0 MW(e)  
**Design Discharge Burnup:** 34384 MW.d/t

**2. Production Summary 2004**

**Energy Production:** 9654.4 GW(e).h  
**Energy Availability Factor:** 99.9%  
**Load Factor:** 102.2%  
**Operating Factor:** 99.9%  
**Energy Unavailability Factor:** 0.1%  
**Total Off-line Time:** 13 hours

**3. 2004 Monthly Performance Data**

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 824.2 | 751.8 | 820.1 | 797.1 | 821.2 | 791.3 | 812.7 | 810.5 | 785.7 | 820.6 | 795.5 | 823.7 | 9654.4 |
| <b>EAF (%)</b>  | 100.0 | 98.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9   |
| <b>UCF (%)</b>  | 100.0 | 98.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9   |
| <b>LF (%)</b>   | 103.1 | 100.5 | 102.5 | 103.1 | 102.7 | 102.2 | 101.6 | 101.3 | 101.5 | 102.5 | 102.8 | 103.0 | 102.2  |
| <b>OF (%)</b>   | 100.0 | 98.1  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9   |
| <b>EUF (%)</b>  | 0.0   | 1.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 0.0   | 1.8   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.1    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

**4. 2004 Summary of Operation****5. Historical Summary**

**Date of Construction Start:** 01 Nov 1974  
**Date of First Criticality:** 04 Mar 1985  
**Date of Grid Connection:** 18 Mar 1985  
**Date of Commercial Operation:** 24 Sep 1985

**Lifetime Generation:** 156740.8 GW(e).h  
**Cumulative Energy Availability Factor:** 86.3%  
**Cumulative Load Factor:** 85.9%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 13.7%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 2773.1         | 1099.0         | 0.0  | 0.0    | 93.1                              | 100.0  | 30.7               | 0.0    | 3372               | 41.1   |
| 1986 | 7308.4         | 1096.0         | 79.5   | 79.5   | 79.5                              | 79.5   | 76.1               | 76.1   | 6921               | 79.0   |
| 1987 | 7434.1         | 1075.0         | 80.9   | 80.2   | 80.9                              | 80.2   | 78.9               | 77.5   | 7085               | 80.9   |
| 1988 | 6548.4         | 1075.0         | 73.7   | 78.0   | 73.7                              | 78.0   | 69.3               | 74.8   | 6468               | 73.6   |
| 1989 | 7609.4         | 1075.0         | 81.5   | 78.9   | 81.5                              | 78.9   | 80.8               | 76.3   | 7136               | 81.5   |
| 1990 | 8604.2         | 1075.0         | 92.3   | 81.6   | 92.2                              | 81.6   | 91.4               | 79.3   | 8079               | 92.2   |
| 1991 | 7274.9         | 1075.0         | 78.9   | 81.1   | 78.5                              | 81.0   | 77.3               | 79.0   | 6869               | 78.4   |
| 1992 | 7622.2         | 1075.0         | 82.1   | 81.3   | 82.1                              | 81.2   | 80.7               | 79.2   | 7213               | 82.1   |
| 1993 | 9138.8         | 1075.0         | 99.2   | 83.5   | 99.2                              | 83.4   | 97.0               | 81.4   | 8691               | 99.2   |
| 1994 | 7931.9         | 1075.0         | 86.3   | 83.8   | 86.3                              | 83.8   | 84.2               | 81.7   | 7555               | 86.2   |
| 1995 | 7763.4         | 1075.0         | 82.7   | 83.7   | 82.7                              | 83.7   | 82.4               | 81.8   | 7241               | 82.7   |
| 1996 | 8926.8         | 1075.0         | 93.8   | 84.6   | 93.8                              | 84.6   | 94.5               | 83.0   | 8237               | 93.8   |
| 1997 | 6720.7         | 1075.0         | 70.3   | 83.4   | 70.4                              | 83.4   | 71.4               | 82.0   | 6161               | 70.3   |
| 1998 | 8620.8         | 1075.0         | 91.0   | 84.0   | 91.0                              | 84.0   | 91.5               | 82.7   | 7966               | 90.9   |
| 1999 | 7441.7         | 1075.0         | 78.9   | 83.6   | 78.9                              | 83.6   | 79.0               | 82.5   | 6905               | 78.8   |
| 2000 | 8477.4         | 1075.0         | 88.2   | 83.9   | 88.2                              | 83.9   | 89.8               | 83.0   | 7743               | 88.1   |
| 2001 | 9539.1         | 1075.0         | 99.5   | 84.9   | 99.5                              | 84.9   | 101.3              | 84.1   | 8718               | 99.5   |
| 2002 | 8847.9         | 1075.0         | 92.8   | 85.4   | 92.8                              | 85.4   | 94.0               | 84.7   | 8136               | 92.9   |
| 2003 | 8503.1         | 1075.0         | 89.7   | 85.6   | 89.7                              | 85.6   | 90.3               | 85.0   | 7865               | 89.8   |
| 2004 | 9654.4         | 1075.0         | 99.9   | 86.4   | 99.9                              | 86.3   | 102.2              | 85.9   | 8771               | 99.9   |



# US-382 WATERFORD-3

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description  |
|--------|-------|---------|------|------|--|
| 20 Feb | 12.4  | 13.5    | UF2  | A31  | REACTOR POWER REDUCTION TO TAKE TURBINE GENERATOR OFF-LINE DUE TO ELECTRO-HYDRUALIC SYSTEM FLUID LEAK. |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1985 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 12        |          |  | 242       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 16        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 782                                      |           |          |
| D. Inspection, maintenance or repair without refuelling                              |                 |           |          | 112                                      |           |          |
| E. Testing of plant systems or components  |                 |           |          | 1  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 8         | 1        |
| Subtotal   | 0               | 12        | 0        | 895                                      | 266       | 1        |
| Total  |                 | 12        |          |  | 1162      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1985 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 12. Reactor I&C Systems                        |                 | 10                                       |
| 13. Reactor Auxiliary Systems                  |                 | 5  |
| 14. Safety Systems                             |                 | 3  |
| 15. Reactor Cooling Systems                    |                 | 108                                      |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 39                                       |
| 31. Turbine and auxiliaries                    | 12              | 9  |
| 32. Feedwater and Main Steam System            |                 | 28                                       |
| 35. All other I&C Systems                      |                 | 23                                       |
| 41. Main Generator Systems                     |                 | 2  |
| 42. Electrical Power Supply Systems            |                 | 3  |
| Total  | 12              | 230                                      |

# US-390 WATTS BAR-1

**Operator:** TVA (TENNESSEE VALLEY AUTHORITY)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1121.0 MW(e)  
**Design Net RUP:** 1218.0 MW(e)  
**Design Discharge Burnup:** 36000 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 9856.9 GW(e).h  
**Energy Availability Factor:** 98.8%  
**Load Factor:** 100.1%  
**Operating Factor:** 98.8%  
**Energy Unavailability Factor:** 1.2%  
**Total Off-line Time:** 104 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>GW(e).h</b>  | 790.8 | 812.9 | 861.0 | 829.4 | 845.0 | 809.2 | 831.3 | 830.9 | 708.3 | 846.2 | 828.9 | 862.9 | 9856.9 |
| <b>EAF (%)</b>  | 94.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.4  | 100.0 | 100.0 | 100.0 | 98.8   |
| <b>UCF (%)</b>  | 94.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.4  | 100.0 | 100.0 | 100.0 | 98.8   |
| <b>LF (%)</b>   | 94.8  | 104.2 | 103.2 | 102.9 | 101.3 | 100.3 | 99.7  | 99.6  | 87.8  | 101.3 | 102.7 | 103.5 | 100.1  |
| <b>OF (%)</b>   | 94.4  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 91.4  | 100.0 | 100.0 | 100.0 | 98.8   |
| <b>EUF (%)</b>  | 5.6   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.6   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |
| <b>UCLF (%)</b> | 5.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 8.6   | 0.0   | 0.0   | 0.0   | 1.2    |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Dec 1972  
**Date of First Criticality:** 01 Jan 1996  
**Date of Grid Connection:** 06 Feb 1996  
**Date of Commercial Operation:** 05 May 1996

**Lifetime Generation:** 77281.6 GW(e).h  
**Cumulative Energy Availability Factor:** 91.6%  
**Cumulative Load Factor:** 91.3%  
**Cumulative Unit Capability Factor:** 82.2%  
**Cumulative Energy Unavailability Factor:** 8.4%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1996 | 5544.2         | 1109.0         | 0.0  | 0.0    | 65.5                              | 100.0  | 61.3               | 0.0    | 5491               | 67.3   |
| 1997 | 7600.1         | 1117.0         | 82.3   | 82.3   | 82.3                              | 82.3   | 77.7               | 77.7   | 7269               | 83.0   |
| 1998 | 9681.0         | 1117.0         | 99.0   | 90.6   | 99.0                              | 90.6   | 98.9               | 88.3   | 8672               | 99.0   |
| 1999 | 8267.4         | 1118.0         | 86.8   | 89.3   | 86.8                              | 89.4   | 84.4               | 87.0   | 7606               | 86.8   |
| 2000 | 9076.4         | 1118.0         | 92.5   | 90.1   | 92.5                              | 90.1   | 92.4               | 88.4   | 8124               | 92.5   |
| 2001 | 9626.6         | 1126.0         | 96.1   | 91.3   | 96.1                              | 91.3   | 97.6               | 90.2   | 8419               | 96.1   |
| 2002 | 9079.4         | 1125.0         | 91.3   | 91.3   | 91.3                              | 91.3   | 92.1               | 90.5   | 7998               | 91.3   |
| 2003 | 8549.6         | 1123.0         | 86.2   | 90.6   | 86.2                              | 90.6   | 86.9               | 90.0   | 7551               | 86.2   |
| 2004 | 9856.9         | 1121.0         | 98.8   | 91.6   | 98.8                              | 91.6   | 100.1              | 91.3   | 8680               | 98.8   |

## US-390 WATTS BAR-1

### 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 16 Jan | 42.0  | 47.1    | UF4  | E    | AUTOMATIC TRIP RESULTED WHEN INDIVIDUALS WHO WERE PERFORMING TESTING IN THE REACTOR TRIP SYSTEM INDUCED AN INVALID TURBINE TRIP SIGNAL.   |
| 19 Sep | 62.0  | 69.5    | UF5  | A12  | THE REACTOR WAS MANUALLY TRIPPED AFTER THE INADVERTENT FULL INSERTION (DROP) OF FOUR RODS IN CONTROL BANK B GROUP 2 FROM 100% POWER. THE CAUSE WAS A FAILURE OF A ROD CONTROL SYSTEM POWER CABINET PHASE CONTROL BOARD. |

### 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1996 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 62        |          |  | 210       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 11        |          |
| C. Inspection, maintenance or repair combined with refuelling                        |                 |           |          | 478                                      |           |          |
| E. Testing of plant systems or components  |                 | 42        |          | 78                                       |           |          |
| H. Nuclear regulatory requirements   |                 |           |          | 127                                      |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand) |                 |           |          |  | 22        |          |
| Subtotal   | 0               | 104       | 0        | 683                                      | 243       | 0        |
| Total  |                 | 104       |          |  | 926       |          |

### 8. Equipment Related Full Outages, Analysis by System

| System                              | 2004 Hours Lost | 1996 to 2004 Average Hours Lost Per Year |
|-------------------------------------|-----------------|--|
| 12. Reactor I&C Systems             | 62              |  |
| 14. Safety Systems                  |                 | 21                                       |
| 15. Reactor Cooling Systems         |                 | 24                                       |
| 31. Turbine and auxiliaries         |                 | 26                                       |
| 32. Feedwater and Main Steam System |                 | 80                                       |
| 33. Circulating Water System        |                 | 29                                       |
| 35. All other I&C Systems           |                 | 4  |
| 42. Electrical Power Supply Systems |                 | 23                                       |
| Total                               | 62              | 207                                      |

# US-482 WOLF CREEK

**Operator:** WOLF (WOLF CREEK NUCLEAR OPERATION CORP.)  
**Contractor:** WEST (WESTINGHOUSE ELECTRIC CORPORATION)

## 1. Station Details

**Type:** PWR  
**Net Reference Unit Power at the beginning of 2004:** 1166.0 MW(e)  
**Design Net RUP:** 1170.0 MW(e)  
**Design Discharge Burnup:** 32700 MW.d/t

## 2. Production Summary 2004

**Energy Production:** 10132.7 GW(e).h  
**Energy Availability Factor:** 98.5%  
**Load Factor:** 98.9%  
**Operating Factor:** 98.5%  
**Energy Unavailability Factor:** 1.5%  
**Total Off-line Time:** 134 hours

## 3. 2004 Monthly Performance Data

|                 | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual  |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| <b>GW(e).h</b>  | 883.9 | 721.3 | 882.0 | 853.9 | 880.0 | 846.9 | 837.0 | 810.1 | 842.7 | 833.1 | 856.7 | 885.3 | 10132.7 |
| <b>EAF (%)</b>  | 100.0 | 90.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.1  | 100.0 | 96.1  | 100.0 | 100.0 | 98.5    |
| <b>UCF (%)</b>  | 100.0 | 90.3  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.1  | 100.0 | 100.0 | 100.0 | 100.0 | 98.8    |
| <b>LF (%)</b>   | 101.9 | 88.9  | 101.7 | 101.9 | 101.4 | 100.9 | 96.5  | 93.4  | 100.4 | 95.9  | 102.0 | 102.1 | 98.9    |
| <b>OF (%)</b>   | 100.0 | 90.2  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 95.0  | 100.0 | 96.1  | 100.0 | 100.0 | 98.5    |
| <b>EUF (%)</b>  | 0.0   | 9.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 4.9   | 0.0   | 3.9   | 0.0   | 0.0   | 1.5     |
| <b>PUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0     |
| <b>UCLF (%)</b> | 0.0   | 9.7   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 5.0   | 0.0   | 0.0   | 0.0   | 0.0   | 1.2     |
| <b>XUF (%)</b>  | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 3.9   | 0.0   | 0.0   | 0.3     |

UCLF replaces previously used UUF.

## 4. 2004 Summary of Operation

## 5. Historical Summary

**Date of Construction Start:** 01 Jan 1977  
**Date of First Criticality:** 22 May 1985  
**Date of Grid Connection:** 12 Jun 1985  
**Date of Commercial Operation:** 03 Sep 1985

**Lifetime Generation:** 166191.3 GW(e).h  
**Cumulative Energy Availability Factor:** 85.4%  
**Cumulative Load Factor:** 84.7%  
**Cumulative Unit Capability Factor:** 78.2%  
**Cumulative Energy Unavailability Factor:** 14.6%

| Year | Energy GW(e).h | Capacity MW(e) | Performance for Full Years of Commercial Operation |        |                                   |        |                    |        |                    |        |
|------|----------------|----------------|--|--------|-----------------------------------|--------|--------------------|--------|--------------------|--------|
|      |                |                | Unit Capability Factor (in %)                      |        | Energy Availability Factor (in %) |        | Load Factor (in %) |        | Annual Time Online |        |
|      |                |                | Annual   | Cumul. | Annual                            | Cumul. | Annual             | Cumul. | Hours              | OF (%) |
| 1985 | 3814.0         | 1144.0         | 0.0  | 0.0    | 39.5                              | 100.0  | 39.5               | 0.0    | 4350               | 51.5   |
| 1986 | 6966.1         | 1128.0         | 73.0   | 73.0   | 73.0                              | 73.0   | 70.5               | 70.5   | 6416               | 73.2   |
| 1987 | 6504.1         | 1128.0         | 68.6   | 70.8   | 68.6                              | 70.8   | 65.8               | 68.2   | 6009               | 68.6   |
| 1988 | 6676.4         | 1128.0         | 66.8   | 69.5   | 66.8                              | 69.5   | 67.4               | 67.9   | 5963               | 67.9   |
| 1989 | 9709.3         | 1135.0         | 98.3   | 76.7   | 98.4                              | 76.7   | 97.7               | 75.4   | 8618               | 98.4   |
| 1990 | 7889.1         | 1135.0         | 79.8   | 77.3   | 79.8                              | 77.3   | 79.3               | 76.2   | 7036               | 80.3   |
| 1991 | 5891.4         | 1135.0         | 71.0   | 76.3   | 71.0                              | 76.3   | 59.3               | 73.3   | 6288               | 71.8   |
| 1992 | 8490.7         | 1131.0         | 85.4   | 77.6   | 85.4                              | 77.6   | 85.5               | 75.1   | 7538               | 85.8   |
| 1993 | 7908.6         | 1132.0         | 79.3   | 77.8   | 79.3                              | 77.8   | 79.8               | 75.7   | 7000               | 79.9   |
| 1994 | 8546.0         | 1149.0         | 85.4   | 78.7   | 85.4                              | 78.6   | 84.9               | 76.7   | 7500               | 85.6   |
| 1995 | 10062.2        | 1163.0         | 98.5   | 80.7   | 98.5                              | 80.7   | 98.8               | 79.0   | 8625               | 98.5   |
| 1996 | 8233.7         | 1165.0         | 81.8   | 80.8   | 80.6                              | 80.7   | 80.5               | 79.1   | 7078               | 80.6   |
| 1997 | 8447.5         | 1163.0         | 82.8   | 81.0   | 82.8                              | 80.8   | 82.9               | 79.4   | 7255               | 82.8   |
| 1998 | 10400.7        | 1163.0         | 100.0  | 82.4   | 100.0                             | 82.3   | 102.1              | 81.2   | 8760               | 100.0  |
| 1999 | 9156.6         | 1163.0         | 89.6   | 83.0   | 89.6                              | 82.9   | 89.9               | 81.8   | 7847               | 89.6   |
| 2000 | 9071.4         | 1169.0         | 88.8   | 83.4   | 88.8                              | 83.3   | 88.3               | 82.3   | 7795               | 88.7   |
| 2001 | 10346.7        | 1170.0         | 99.7   | 84.4   | 99.7                              | 84.3   | 101.0              | 83.5   | 8731               | 99.7   |
| 2002 | 9041.7         | 1167.0         | 87.8   | 84.6   | 87.8                              | 84.5   | 88.4               | 83.8   | 7695               | 87.8   |
| 2003 | 8902.5         | 1166.0         | 86.7   | 84.7   | 86.7                              | 84.6   | 87.2               | 83.9   | 7594               | 86.7   |
| 2004 | 10132.7        | 1166.0         | 98.8   | 85.5   | 98.5                              | 85.4   | 98.9               | 84.7   | 8650               | 98.5   |

# US-482 WOLF CREEK

## 6. 2004 Outages

| Date   | Hours | GW(e).h | Type | Code | Description   |
|--------|-------|---------|------|------|---|
| 13 Feb | 67.5  | 78.6    | UF4  | A35  | REACTOR TRIP DUE TO FEEDWATER VALVE MALFUNCTION. VALVE INTERNALS WERE REPLACED AND THE SYSTEM RESTORED TO OPERATIONAL STATUS. |
| 22 Aug | 36.8  | 42.9    | UF4  | E    | REACTOR TRIP OCCURRED DURING RESTORATION FROM RPS SURVEILLANCE TESTING.   |
| 07 Oct | 29.0  | 33.8    | XF4  | N    | REACTOR TRIP ON TURBINE HIGH VIBRATIONS RESULTING FROM LIGHTNING STRIKE IN THE SWITCHYARD.                                    |

## 7. Full Outages, Analysis by Cause

| Outage Cause   | 2004 Hours Lost |           |          | 1986 to 2004 Average Hours Lost Per Year |           |          |
|--|-----------------|-----------|----------|--|-----------|----------|
|  | Planned         | Unplanned | External | Planned                                  | Unplanned | External |
| A. Plant equipment failure   |                 | 67        |          |  | 149       |          |
| B. Refuelling without a maintenance  |                 |           |          |  | 145       |          |
| C. Inspection, maintenance or repair combined with refuelling  | 922             |           |          |  |           |          |
| D. Inspection, maintenance or repair without refuelling  | 11              |           |          |  | 17        |          |
| E. Testing of plant systems or components  |                 | 36        |          | 0  |           |          |
| K. Load-following (frequency control, reserve shutdown due to reduced energy demand)   |                 |           |          |  | 11        | 5        |
| N. Environmental conditions (flood, storm, lightning, lack of cooling water due to dry weather, cooling water temperature limits etc.) |                 |           | 29       |  |           |          |
| Subtotal   | 0               | 103       | 29       | 933                                      | 322       | 5        |
| Total  |                 | 132       |          |  | 1260      |          |

## 8. Equipment Related Full Outages, Analysis by System

| System   | 2004 Hours Lost | 1986 to 2004 Average Hours Lost Per Year |
|--|-----------------|--|
| 11. Reactor and Accessories                    |                 | 32                                       |
| 12. Reactor I&C Systems                        |                 | 15                                       |
| 15. Reactor Cooling Systems                    |                 | 2  |
| 16. Steam generation systems                   |                 | 8  |
| 17. Safety I&C Systems (excluding reactor I&C) |                 | 2  |
| 31. Turbine and auxiliaries                    |                 | 6  |
| 32. Feedwater and Main Steam System            |                 | 23                                       |
| 35. All other I&C Systems                      | 67              | 3  |
| 42. Electrical Power Supply Systems            |                 | 5  |
| Total  | 67              | 96                                       |

## **7. NON-ELECTRICAL APPLICATION OF NUCLEAR ENERGY IN MEMBER STATES**



**Table 1: District heating and process heat in 2004**

| Country        | Reactor         | District heating [Gcal] | Process heat [Gcal] | Total heat [Gcal] |
|----------------|-----------------|-------------------------|---------------------|-------------------|
| Czech Republic | Temelin-1       | 41123                   | N/A                 | 41123             |
|                | Temelin-2       | 7757                    | N/A                 | 7757              |
| Hungary        | PAKS-2          | 0                       | N/A                 | 0                 |
|                | PAKS-3          | 63834                   | N/A                 | 63834             |
|                | PAKS-4          | 208556                  | N/A                 | 208556            |
| India          | Rajasthan-1     | N/A                     | 12597               | 12597             |
|                | Rajasthan-2     | N/A                     | 125008              | 125008            |
| Russia         | Balakovo-1      | 53996                   | 0                   | 53996             |
|                | Balakovo-2      | 0                       | 0                   | 0                 |
|                | Balakovo-3      | 7658                    | 0                   | 7658              |
|                | Balakovo-4      | 0                       | 0                   | 0                 |
|                | Beloyarsky-3    | 292906                  | 0                   | 292906            |
|                | Bilibino-1      | 55212                   | 0                   | 55212             |
|                | Bilibino-2      | 31580                   | 0                   | 31580             |
|                | Bilibino-3      | 59497                   | 0                   | 59497             |
|                | Bilibino-4      | 59521                   | 0                   | 59521             |
|                | Kalinin-1       | 392028                  | 14996               | 407024            |
|                | Kalinin-2       | 315634                  | 13366               | 329000            |
|                | Kola-1          | 16019                   | 398                 | 16417             |
|                | Kola-2          | 10756                   | 355                 | 11111             |
|                | Kola-3          | 29467                   | 441                 | 29908             |
|                | Kola-4          | 14215                   | 455                 | 14670             |
|                | Kursk-1         | 130954                  | 148877              | 279831            |
|                | Kursk-2         | 30467                   | 34557               | 65024             |
|                | Kursk-3         | 176458                  | 159147              | 335605            |
|                | Kursk-4         | 181017                  | 177859              | 358876            |
|                | Leningrad-1     | 36992                   | 0                   | 36992             |
|                | Leningrad-2     | 173813                  | 0                   | 173813            |
|                | Leningrad-3     | 286387                  | 0                   | 286387            |
|                | Leningrad-4     | 281305                  | 0                   | 381305            |
|                | Novovoronezh-3  |                         |                     |                   |
|                | Novovoronezh-4  | 105898                  | 2375                | 108273            |
|                | Novovoronezh-5  | 0                       | 86                  | 86                |
| Smolensk-1     | 60636           | 486                     | 61122               |                   |
| Smolensk-2     | 79102           | 13197                   | 922999              |                   |
| Smolensk-3     | 162190          | 14229                   | 176419              |                   |
| Slovakia       | Bohunice-3      | 203022                  | 0                   | 203               |
|                | Bohunice-4      | 169579                  | 0                   | 170               |
| Switzerland    | Beznau-1        | 132                     | N/A                 | 132               |
|                | Beznau-2        | 8                       | N/A                 | 8                 |
|                | Goesgen         | N/A                     | 53905               | 53905             |
| Ukraine        | Khemnitski-1    | 223678                  | N/A                 | 223678            |
|                | Rovno-1         | 87186                   | N/A                 | 87186             |
|                | Rovno-2         | 98279                   | N/A                 | 98279             |
|                | Rovno-3         | 247282                  | N/A                 | 247282            |
|                | South Ukraine-1 | 90987                   | N/A                 | 90987             |
|                | South Ukraine-2 | 96446                   | N/A                 | 96446             |
|                | South Ukraine-3 | 170805                  | N/A                 | 170805            |
|                | Zaporozhe-1     | 101772                  | N/A                 | 101772            |
|                | Zaporozhe-2     | 73567                   | N/A                 | 73567             |
|                | Zaporozhe-3     | 77931                   | N/A                 | 77931             |
|                | Zaporozhe-4     | 56683                   | N/A                 | 56683             |
|                | Zaporozhe-5     | 119278                  | N/A                 | 119278            |
|                | Zaporozhe-6     | 113007                  | N/A                 | 113007            |



**Table 2: Water desalination in 2004**

| Country  | Reactor   | Thermal energy [Gcal]         | Electrical energy for reverse osmosis [MWh] | Water produced [m3]                |
|----------|---|-------------------------------|---|------------------------------------|
| India    | Madras-1<br>Madras-2  |                               |   |                                    |
| Japan    | Genkai-3<br>Genkai-4<br>Ikata-1<br>Ikata-2<br>Ikata-3<br>Ohi-1<br>Ohi-2<br>Takahama-3<br>Takahama-4 | 26959<br><br>23350<br><br>N/A | <br><br><br><br>2812                        | 421782<br><br>248020<br><br>639650 |
| Pakistan | KANUPP  |                               |   |                                    |



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