IAEA International Atomic Energy Agency

Nuclear Power Newsletter

A newsletter of the Division of Nuclear Power
Vol. 3, No. 1, April 2006

http://www.iaea.org/OurWork/ST/NE/NENP/index.html

Contents

Division of Nuclear Power
Department of Nuclear Energy
IAEA
P.O. Box 100
Wagramer Strasse 5,
A-1400 Vienna, Austria
Tel : +43 1 2600 22751
Fax: +43 1 2600 29598

Nuclear Power Technology and Operations Databases

The Division of Nuclear Power (NENP) has been collecting and publishing information about the world's nuclear power plants since 1970. Comprehensive and reliable databases are essential elements for improving plant operational performance. Additionally, the NENP has been compiling and publishing reliable information about the latest advances in nuclear power plant technology for current and future plant designs. This article provides an insight into some of these databases.

Country Nuclear Power Profiles (CNPPs)

The CNPPs consolidate information on the nuclear power infrastructures in various countries, and present factors related to the effective planning, decision making and implementation of nuclear power programmes that together lead to safe and economic operations. Altogether 30 IAEA Member States with operating nuclear power plants, as well as Bangladesh, Egypt, Islamic Republic of Iran, Italy, Kazakhstan, Poland, Turkey and Vietnam have contributed information. Bangladesh, Egypt and Poland are the newly participating Countries.

Visit CNPP on the web:
http://www.iaea.org/OurWork/ST/NE/NENP/NPES/Downloads/CNPP2004_CD/pages/index.htm .

Power Reactor Information System (PRIS)

PRIS is a comprehensive data source on nuclear power reactors in the World. It includes specification and performance history data of operating reactors as well as reactors under construction or reactors being decommissioned.

The reactor specification data consist of basic information (location, operator, owner, suppliers, milestone dates) and design characteristics. These data provide detailed general and technical information about individual plants.

The performance data include production and energy loss data as well as outage and operational event information. The monthly power production and power losses data have been recorded in PRIS since the 1970s. Recently the electricity production data were complemented also by information on energy provided by nuclear power plants to non-electrical applications like district heating, process heat supply or desalination.

Due to detailed classification of energy losses and the comprehensive outage coding system, a set of internationally accepted performance indicators are calculated from the PRIS performance data. The indicators can be used for benchmarking, international comparison or analyses of nuclear power availability and reliability from reactor specific, national or worldwide perspectives. These analyses can be suitably utilized in evaluation of nuclear power competitive advantages compared with other power sources.

PRIS outputs are available on the public PRIS Web Site, in annual publications and to registered users through on-line applications.

Visit PRIS on the web: http://www.iaea.org/programmes/a2/index.html.

Electronic Nuclear Training Catalogue (ENTRAC)

ENTRAC provides nuclear industry specialists with information that will help them and their organizations to continually improve and learn from others.

ENTRAC contains information collected by both the IAEA and nuclear industry organizations in the areas of training, human performance, management systems, and engineering/technology. In general, this information both complements and supplements that provided in IAEA technical documents. In many cases, in the preparation of such documents, more information was collected than could be included in the document. ENTRAC provides a repository for this information. Additionally, ENTRAC includes presentations and other materials assembled for IAEA meetings, workshops and training courses conducted recently in the areas of training, human performance, management systems, and engineering/technology.

Visit ENTRAC on the web: http://entrac.iaea.org.

Accelerator Driven Systems Research and Development Database (ADSDB)

The database contains information on existing and planned experimental facilities that can be used for accelerator driven systems, related R&D, as well as the R&D programmes themselves, and the methodologies used (codes and data).

Visit ADSDB on the web: http://www-adsdb.iaea.org.

Fast Reactor Database (FRDB)

The database contains plant design and structural data and plant parameters (reactor physics, thermohydraulics, etc.) of about 30 liquid metal fast reactors (LMFRs). The focus is on practical issues that are useful to engineers, scientists, managers and university students and professors with information on the following topics: general information; core and blanket: layout, geometry and characteristics; fuel design and performance; control rods and control drive mechanisms; main and auxiliary heat transport systems and components; shielding, containment and safety features; control systems; fuel handling systems including refuelling operations and in-service inspection provisions.

Visit FRDB on the web: http://frdb.iaea.org.

Nuclear Economic Performance Information System (NEPIS)

NEPIS includes detailed annual operation, maintenance and capital cost data. The database, developed on functional basis, comprises four parts, containing information on stations and plants, and detailed information on functional cost accounts for non-outages and for outages. The detailed functional cost accounts are divided into operations, maintenance, support services, plant administration, total direct costs, total indirect costs and capital costs. Each cost account is further broken down into resource categories that include labour, materials and outside services.

Visit NEPIS on the web: http://entrac.iaea.org/nepis.

Thermo-physical Properties Database of LWRs and HWRs (THERPRO)

THERPRO is a web based on-line database on materials for light and heavy water reactors, providing material properties data to the registered/authorized users in IAEA Member States (instructions for registering are given on the home page). THERPRO is owned by the IAEA and managed by the IAEA's Designated Centre for Nuclear Materials Properties Database Management located at Hanyang University, Seoul, Republic of Korea. It contains over 13,000 data files for 250 reactor materials, descriptions of experiments, and bibliographic information. Latest data published in the relevant technical journals are now being collected and included. The database has a hierarchical structure consisting of several levels: home page, entry, element, compound, property, author, report, and bibliography level. All of the data sets in each level are interconnected using a network structure and thus any data can be easily retrieved including the bibliographical information by an appropriate query action. The THERPRO home page provides the access to the main body of the database for the registered/authorized users. Once the access is

approved, the registered user will be led to the entry level consisting of periodic table for easy access to target data set and supplementary features for convenient data retrieval.

One immediate use of the THERPRO database has been in University level nuclear engineering design classes.

Visit THERPRO on the web:
http://www.iaea.org/THERPRO.

Other Databases:

- International Database on Piping of Nuclear Power Plants (IDPNPP)
- International Database on Reactor Pressure Vessel Materials (IDRPVM)
- International Database on Steam Generators (IDSG)
- Operator Support Systems in Nuclear Power Plants (OSSDB)

Knowledge collected by NENP during over last 30 years is available to Member States for their improvement in safe and reliable operation of Nuclear Power Plants and sustainable development of Nuclear Energy.

Visit Division of Nuclear Power on the web:
http://www.iaea.org/OurWork/ST/NE/NENP/index.html.

Contact: A.Pryakhin@iaea.org

Message from the Director

Welcome to the first Nuclear Power Newsletter for 2006. The Department of Nuclear Energy stated in its Nuclear Technology Review 2006 that "while the outlook for nuclear power still remains mixed, 2005 has been a year of rising expectations". One such example was the Paris Ministerial Conference held in March 2005 on "Nuclear Energy in the 21st Century". A vast majority of participants affirmed that nuclear power can make a major contribution to meeting energy needs in the 21st century. The fact that well-known environmentalists such as James Lovelock and Patrick Moore are talking favorably about the nuclear option is also evidence of some change.

If we characterize 2005 as the year of rising expectations, what about the year of 2006?

Recent announcements center around the international or multi-lateral framework on the assurance of supply of fuel cycle services and around advanced fuel cycle technology such as Russian President's Statement on January 25th and US announcement of GNEP on February 6th; and these announcements suggest that this year could be a very exciting and vibrant year for nuclear energy.

In the beginning of 2006, NENP welcomed Atam Rao as the new Section Head of the Technology Development Section. I am confident of his contribution to Member States and success of his service in his tenure at the IAEA. Also, since the end of last year, we have been formulating a vision for the two biennia cycle 2008-2011, thinking what will be our priorities in this 4 year period.

E-mail: A.Omoto@iaea.org

Mr. Atam Rao, the New Head of Nuclear Power Technology Development Section

Mr. Atam Rao has recently joined the Division of Nuclear Power and taken up duties as Section Head of the Nuclear Power Technology Development Section.

Mr. Rao has over 30 years experience on the design, development and technology of boiling water reactors. He worked for over 30 years at the General Electric Company in San Jose, California, USA. Most recently, he led the GE effort on the design, development and licensing of the ESBWR - a passive simplified boiling water reactor.

He has extensive experience working with companies, universities and national research laboratories in Europe, Asia and the Americas on collaborative research programmes. He is also very active in the activities of Technical Societies, like the American Nuclear Society, where he has been the main organizer of international conferences like ICAPP and ICONE over the last 20 years.

Mr. Rao believes that the "future of nuclear power lies in innovative designs that are simpler and with less components. These designs will be developed for application all over the world – advanced and developing

countries. The technology that goes into these designs will be developed as a result of cooperative programmes involving designers, universities, laboratories and the ultimate owners of the plants". International cooperative programmes like INPRO and others form the bedrock for such future activity. The activities of the IAEA in the Division of Nuclear Power are expected to benefit from successful international cooperative programmes with considerable benefits for all Member States.

He also brings a unique personal background – he got his basic engineering education in India and his post-graduate education and major work experience in California. This will enable him to better define and develop cooperative programmes that meet the needs of all Member States.

Mr. Rao can be contacted on telephone +43 1 2600 22808, email a.rao@iaea.org.

Nuclear Power Plant Operating Performance and Life Cycle Management

Continuous Process Optimization and Management

Two I&C-related Consultancy Meetings are scheduled for March 2006 to initiate two new technical documents (IAEA-TECDOCs) titled **Integration of analog and digital I&C systems in hybrid main control rooms** and **Avoiding common-cause failures in digital I&C systems of NPPs**, respectively. The first IAEA-TECDOC will discuss both the instrumentation and the human factor engineering aspects of designing, implementing, licensing, and operating hybrid main control rooms. The second IAEA-TECDOC will describe techniques and tools used for preventing common cause failures in digital I&C systems. Both documents are intended to provide guidelines to utilities, regulators, technical support organizations, and software designers/developers. Contact: O.Glockler@iaea.org

The training course on **Advanced Technology for Modernization of Instrumentation and Control Systems in Nuclear Power Plant**, was held at Tong Yeoung, Republic of Korea from 30 October to 4 November 2005. For the training course, experts from Hungary, United States of America and Republic of Korea were invited to give lectures on real experiences of instrumentation and control (I&C) system modernization of nuclear power plants. This training course was designed for staff of utilities, regulatory authorities and NPP's headquarters organizations from countries participating in Regional Asia TC projects RAS/4/021, namely China, Islamic Republic of Iran, Republic of Korea and Pakistan. Contact : K.S.Kang@iaea.org

IAEA and an European Industrial Expert Group, **ENIQ (European Network for Inspection and Qualification)**, have been actively working to promote understanding and technology transfer and harmonize the industrial practices among the nuclear power countries. On 13-14 December 2005, the ENIQ Steering Committee meeting was held at Petten, Netherlands. During the meeting, it was agreed that the IAEA would co-operate with ENIQ on the three activities in 2006-2008.

- To develop an IAEA-TECDOC on **the best practices of RI-ISI and its adaptation for its use** in the developing countries;
- To implement an IAEA-CRP on **RI-ISI** which will study specifically PSA requirements for risk informed decision making of ISI scope selection;
- Pilot study on **RI-ISI for WWER NPPs** under regional TC project RER/4/027.

Contact: H.Cheng@iaea.org

Integrated NPP Life Cycle Management

The first Research Co-ordination Meeting (RCM) of the Coordinated Research Project (CRP) on **Review and Benchmark of Calculation Methods for Structural Integrity Assessment of Reactor Pressure Vessels (RPV) during Pressurized Thermal Shock (PTS)** was held at the VIC from 29 November to 2 December 2005. The purpose of the RCM was as follows:

- To discuss the work scopes and responsibilities of each participant;
- To decide the reference plant for benchmark calculation;
- To collect the input data for calculation of PTS of WWER-440/213 and PWR- 900; and
- To consider further actions with regard to implementation of Co-ordinated Research Project (CRP) schedule.

11 experts from 9 Member States and one international organization presented their national research programme

and provided the input for benchmark calculation in the first RCM. During the meeting discussion was divided into three parts according to the planned phases of the CRP as follows:

- Phase 1: IAEA-TECDOC on basic benchmark calculations;
- Phase 2: IAEA-TECDOC on Good practice Handbook for RPV deterministic integrity evaluation during PTS;
- Phase 3: IAEA TRS on Pressurized Thermal Shock:
- After RCM, all participants celebrated the70th of birthday of Milan Brumovsky from the Czech Republic.

Contact : K.S.Kang@iaea.org

A consultancy to finalize a TECODC on **Guidelines on Plant Life Management Processes and Practices for Heavy Water Reactors** was held from 23-25 November 2005 at Mississauga (Toronto), Canada. The Canadian Nuclear Safety Commission (CNSC) provided their position to plant life extension for CANDU reactors. The new TEODOC will be published in mid of 2006. This IAEA-TECDOC will help with the implementation and integration of the full range of information required by all categories of plant staff, and more comprehensive, cost effective project management for ageing management and plant life management for HWR NPPs.

A technical meeting on **Ageing Management for Tube Type Reactor of Nuclear Power Plants (NPP)** was held at Kaunas, Lithuania from 6-8 December 2005. The purpose of the technical meeting was to transfer experience on the practical application of ageing management of fuel channel, feeder pipe, pressure tube, residual life assessment in operating tube type reactor nuclear power plants (Candu and RBMK). The technical meeting focused on more specific components of tube type reactors and provided participants with a lot of operating experience, and information on degradation mechanisms, material performance, service life prediction, inspection and non-destructive evaluation methods.

A workshop on **Effects of Electronic Components Ageing or Radiation on Instrumentation and Control System Reliability**, which was held at Haiyan, China from 10-13 October 2005 under an extra budgetary programme. For the workshop, experts from Hungary, Japan, Republic of Korea and Switzerland were invited to give lectures on real situations and experiences of nuclear power plants. The purpose of the workshop was to transfer experiences on ageing management and I&C modernization regarding with following topics;

- Ageing and obsolescence processes,
- Relationship between ageing, life cycle management and maintenance,
- Digital I&C modernization in Hungary NPP and Japan NPPs,
- Calculation of remaining life time of instruments.

A workshop on **the Ageing Management and License Renewal/Life Extension of Nuclear Power Plants** was convened at Heviz, Hungary from 6-10 February 2006. To achieve better efficiency and to provide more information to participants, the workshop was combined with the international conference on **Ageing Material European Strategy (AMES) for Reactor Pressure Vessel Prediction** organized by the European Commission (EC)/Joint Research Centre. For special lectures, Dr. L. Debarberi from JRC-IE presented “The PLiM activities of European Union” and Dr. Mark Erickson Kirk from NRC, USA presented “The technical basis for revision of the pressurized thermal shock rules” and Dr. Kim Wallin from VTT Finland presented “Master Curve interpretation of the thermal shock experience data”.

Contact : K.S.Kang@iaea.org

Databases to Support NPP Performance

The Training Course on the Power Reactor Information System (PRIS) was held from 19-22 December 2005, in Wuhan, China.

The objective of the Training Course was to familiarize the participants with PRIS and to provide training how to report data to PRIS and how to use PRIS outputs for evaluation of nuclear power plant operation. The training course was attended by 20 participants representing all operating nuclear power plants in China, CNNC (China National Nuclear Corporation) and hosting organization RINPO (Research Institute of Nuclear Power Operation).

Lectures were given on PRIS data structure, data definitions, requirements for data reporting, frequent reporting problems, PRIS performance indicator definitions, PRIS outputs and their practical use in nuclear power analyses. On-line access to the PRIS database during the working group sessions provided a possibility to practice the lessons learned. Meeting participants were actively involved in discussions based upon training lessons.

Participants indicated that continuing operating experience exchange and international benchmarking are very important for improvement of nuclear power performance. They evaluated PRIS as a very efficient tool in this process.

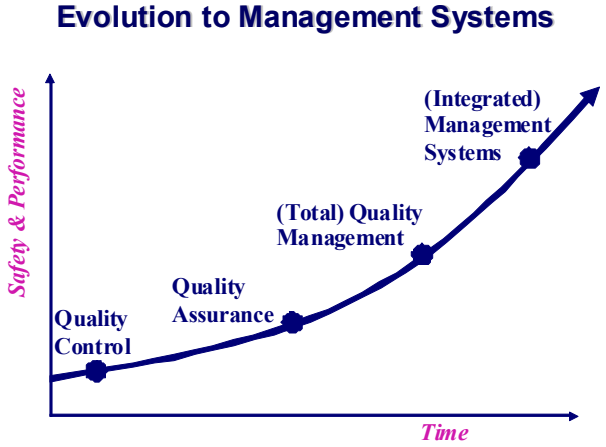
Contact: J.Mandula@iaea.org

The new version of **Country Nuclear Power Profiles** was published. Altogether 30 IAEA Member States having operating nuclear power plants, as well as Bangladesh, Egypt, Islamic Republic of Iran, Italy, Kazakhstan, Poland, Turkey and Vietnam have contributed information to the publication's major sections. Bangladesh, Egypt and Poland are the newly participating Countries. The new version is on the IAEA website clicking the address http://www.iaea.org/OurWork/ST/NE/NENP/NPES/Downloads/CNPP2004_CD/pages/index.htm and also in CD on your request to IAEA printing shop.

Contact: s.k.cho@iaea.org

Management System, Regional Infrastructure and Training

Strengthening and Harmonizing Quality Management System



As a result of close cooperation between the Department of the Nuclear Energy and the Department of Nuclear Safety the IAEA has finalized the efforts in development of the new **Safety Standard on management systems**: Safety Requirement on Management System for Facilities and Activities GS-R-3. The final step was to obtain the approval from the Board of Governors to send to the GC(50), which took place in March 2006. GS-R-3 will replace the current IAEA documents on Quality Assurance on the subject, issued as Safety Series No. 50/C/SG-Q (1966), which includes a Code and 14 Safety Guides. GS-R-3 on "Management System for Facilities and Activities' will be issued in late 2006.

The development of this standard is a very good example of the cooperation and 'one-house approach' between the IAEA departments, and will serve as an example for future activities.

http://www-ns.iaea.org/standards/documentpages/management-systems.htm

Contact: p.vincze@iaea.org

Strengthening National and Regional Nuclear Power Infrastructures

A Technical Meeting to Develop Guidance on **Infrastructure Needed for Nuclear Power Implementation** was held in Vienna from 5-9 December 2005.It was attended by 34 participants from 20 Member States. During the meeting sessions, three draft documents directed to provide guidance on infrastructure areas needed for nuclear power implementation were reviewed and detailed recommendations for finalizing the documents provided. The participants also identified areas where further IAEA assistance is desirable. The main areas were related to national and governmental infrastructure, NPP owner/operating organizations, localization and industrial/technical support for NPP operations, and relations with the local/national government and community.

Contacts: T.Mazour@iaea.org; N.Pieroni@iaea.org

A document directed to managers and executives of electrical utilities who are tasked with decision-making related to **Early Closure or Continued Operation of a Nuclear Power Plant** was finalized for publication. The information provided is based on the experiences of a number of countries in addressing a spectrum of issues broader than the simple economics of the operation the NPP itself. The local population, the customers for the electricity generated and those responsible for regional energy policy and the broader economic management of the region have different perceptions of the value of the NPP. The document which was finalized provides information on several issues important to key stakeholders. The target users are the executives, managers and owners of NPPs ant their consultants and advisors.

There are several stages in the process of introducing nuclear power in a country. These include development of nuclear policies and regulations, feasibility studies; public consultations; technology evaluation; request for proposals and proposal evaluation; project and contracts development and financing; supply, construction, and

commissioning; and finally operation. A document that addresses the **Minimum Infrastructure for a Nuclear Power Project**, including the minimum needs which are adequate until the issue of the construction licence, was recently finalized for publication. The target users are decision makers, advisers and senior managers in the governmental organizations, utilities, industrial organizations and regulatory bodies in the countries adopting nuclear power programmes or exporting supplies for these programmes. The governmental organizations that may find this publication useful include: Ministries of Economy, Energy, Foreign Affairs, Finance, Mining, Internal Affairs, Academic Institutions, Nuclear Energy Agencies and Environmental Agencies.

The introduction or expansion of a nuclear power programme in a country and its successful execution is largely dependent on the network of national infrastructure, covering a wide range of activities and capabilities. The wide extent of infrastructure needs require an investment that can be too large or onerous for the national economy. The burden of infrastructure can be reduced significantly if a country forms a sharing partnership with other countries. The sharing can include physical facilities, common programmes and knowledge, which will reflect in economic benefits. A document that provides **criteria and guidance for analysing and identifying the Potential for Sharing Nuclear Power Infrastructure during the stages of nuclear power project life cycle** was recently finalized for publication. The target users are decision makers, advisers and senior managers in utilities, industrial organizations, regulatory bodies and governmental organizations in countries adopting or extending nuclear power programmes. Contacts: N.Pieroni@iaea.org; R.I.Facer@iaea.org

For Member States considering starting a nuclear programme, the IAEA needs to provide comprehensive assistance in building infrastructure consistent with the Member State's selected nuclear strategy. The need for the IAEA to expand support for infrastructure development was explicitly reinforced in the infrastructure resolution passed at the 49th General Conference (GC/(49)RES/12(G)). Further, IAEA activities in this area include the development of a road map to nuclear power for countries preparing to introduce nuclear power. This document builds upon the documents described above and will establish milestones for the developing country to achieve. These milestones will identify the necessary level required to achieve the milestone level for many issues including, but not limited to: the development of legal and regulatory frameworks, human resources, and necessary industrial and physical support facilities. Contact: R.I.Facer@iaea.org

Effective Training to Achieve Excellence in Human Performance

Recently an upgrade of the Electronic Nuclear Training Catalogue ENTRAC http://entrac.iaea.org was completed to improve its ease of use. Additionally, quite a lot of content has been added. To register send an e-mail. Member States requested that the IAEA implement ENTRAC as a tool to exchange experiences through placing information from operating and training organizations on ENTRAC. All interested parties who have valuable experience and achievements or outstanding needs to share with others are welcome to contribute. Contact: T.Mazour@iaea.org and A.Kazennov@iaea.org

A new activity to develop the IAEA Guidelines on **Increasing the Effectiveness of NPP Personnel Training** is being initiated. The main focus will be on improving organizational and human performance. All interested parties (organizations and specialists) are welcome to contribute. Contact: A.Kazennov@iaea.org

Technology Developments and Applications for Advanced Reactors

International Project on Innovative Nuclear Reactors and Fuel Cycles

The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) is proceeding with the development of a Manual on **INPRO methodology for assessment of innovative nuclear energy systems (INSs).** An action plan for Phase 2 of INPRO is also being elaborated.

A meeting to discuss intermediate results of a **joint assessment study of systems with closed nuclear fuel cycle and fast reactors** was convened in Kalpakkam (India) from 27 February to 3 March 2006, with participation of experts from the Russian Federation, India, China, France, the Republic of Korea and Japan (as an observer).

A meeting of the **ad hoc group of representatives of INPRO members** to identify frameworks, options and guidelines for implementation of collaborative projects

under INPRO Phase 2 will be convened in Vienna on 10-12 April 2006. The Terms of Reference for this meeting are being elaborated currently.

The 9th meeting of the **INPRO Steering Committee** is tentatively scheduled for July 2006; the dates set at the moment are 9-10 July 2006.

With the support from an interregional Technical Cooperation project INT/4/141, a Workshop on **application of the INPRO methodology to INS assessment** will be conducted in Vienna on 26-30 June 2006. The information letter, the prospectus and the nomination forms have been sent out to Member States. The deadline for submitting nominations is 15 April 2006. The Workshop will include lectures from the developers of the INPRO methodology, presentations from its users, discussions and training sessions. All INPRO subject areas will be addressed including an aggregated method of judgment and nuclear power development modelling.

Contact: F.Depisch@iaea.org, v.v.kuznetsov@iaea.org

Common Technologies and Issues for SMRs

An IAEA-TECDOC on **Advanced Nuclear Plant Design Options to Cope with External Events** was published. This report addresses the issues of plant design, siting, component qualification and testing, and risk-informed safety assessment regarding extreme external events, and provides guidance to the designers of advanced NPPs on a consistent strategy of plant protection from possible external event impacts.

Another IAEA-TECDOC on **Status of Small and Medium Sized Reactor Designs 2005: Reactors with Conventional Refuelling Schemes** has received a number and will be soon released from print as IAEA-TECDOC-1485. This report presents structured design descriptions of 26 innovative SMRs of different types, provided by Member States, and summary and crosscutting chapters intended for a wider audience, including the regulators and decision makers.

The CRP on **identification of competitive technological options for SMRs**, which is already in the IAEA's Blue Book, still needs the definition of a detailed research programme. To accomplish this, a consultancy meeting to start-up preparation of a report on review of options to break the economy of scale for SMRs and to define the programme of this CRP will be convened in Vienna on 27-29 March 2006. The project could then be started late in 2006 or early in 2007. Contact: v.v.kuznetsov@iaea.org

Technology Advances in Water Cooled Reactors for Improvement in Economics and Safety

Meetings of the IAEA Nuclear Energy Department's TWG-LWR and TWG-HWR

The twelfth Meeting of the **TWG-LWR** and the eighth meeting of the **TWG-HWR** were held at IAEA Headquarters, 7-9 December, 2005. Sessions on topics of common interest to the two working groups were held jointly.

The TWGs provide a global forum for exchanging information on national programmes, provide advice to the IAEA on its activities in technology development for water-cooled reactors, marshal support in the home countries for conduct of the agreed activities, and are a means for the IAEA to provide balanced and objective information to all Member States on water-cooled reactor technology status and advancements.

The TWG-HWR was represented by 9 participants from 6 Member States (Argentina, Canada, India, Republic of Korea, Romania, and the Russia Federation).

The TWG-LWR was represented by 15 participants from 13 Member States (Argentina, China, Czech Republic, France, India, Italy, Japan, Republic of Korea, the Russian Federation, Spain, Sweden, Switzerland, and the USA).

The TWG-HWR Chairman is Mr. D. Torgerson, Senior Vice President and Chief Technology Officer of AECL, Canada. The TWG-LWR Chairman is Mr. K. Foskolos Deputy Head of the Nuclear Energy and Safety Research Department of the Paul Scherrer Institute, Switzerland.

The objectives of the meetings were to summarize and discuss recent developments in water-cooled reactor technology, to review the progress of collaborative efforts within the framework of the TWGs, and to identify areas of common interest for future collaboration.

With regard to suggestions for future activities, The IAEA's Standing Advisory Group on Nuclear Energy (SAGNE), which advises the Director General, has recommended that activities of the TWGs cover:

- Application of newly acquired knowledge and technologies;
- New technological approaches or strategic trends in advanced technologies for LWRs and HWRs;
- Knowledge preservation;
- Resolution of cross-technology issues (relating to safety, licensing, performance, ...).

Further, there are rising expectations for nuclear power in the future. In that context, TWG participants were asked to consider what collaborative activities could be

conducted within the framework of the TWGs to support these rising expectations.

Activities conducted within the framework of the TWG-LWR and TWG-HWR address a broad range of proven means and new approaches for improving economics of advanced LWRs and HWRs. Current activities include:

- A CRP on Natural Circulation Phenomena, Modelling and Reliability of Passive Systems that Utilize Natural Circulation
- A Collaborative Assessment of Advanced Applications of Water Cooled Reactors
- Preparation of a User's Requirements Document for Evolutionary HWRs
- Completion of a CRP on Inter-comparison of HWR Pressure Tube Inspection and Diagnostic Techniques; and
- Preparation of a new CRP on Heat Transfer Behaviour and Thermo-Hydraulics Code Testing for Supercritical Water Cooled Reactors, in coordination with the OECD-NEA

The following highlights one activity that has very recently been completed:

CRP on Establishment of a Thermo-physical Properties Database for LWRs and HWRs

One approach for improving economics involves improving the technology base for eliminating over design by helping to remove the need for large design margins to account for limitations of calculational methodologies and data uncertainties. In this context, a CRP on **Establishment of a Thermo-physical Properties Database for LWRs and HWRs** (the THERPRO database, see page 2) has recently been completed. Organizations participating in this CRP were; Atomic Energy of Canada Ltd (Canada), the Nuclear Power Institute of China (China), the University of West Bohemia (Czech Republic), the Institute of Physics and Power Engineering and the Institute of High Temperatures of the Russian Academy of Sciences (Russian Federation), Bhabha Atomic Research Centre (India), Commissariat a l'Energie Atomique, Cadarache (France) and Hanyang University and Seoul National University (Republic of Korea). Significant contributions have also been made by the Argonne National Laboratory (USA). The organizations shared existing data, and conducted experiments to obtain new data for selected properties. Organizations also collaborated to conduct data assessments and peer reviews to recommend the most appropriate relationships for selected properties.

An IAEA-TECDOC has been prepared within this CRP. The materials have been grouped within Nuclear Fuel Materials, Cladding and Pressure Tube Materials, Absorber Materials and their Oxides, Structural Materials and Coolants (light and heavy water). The thermo-physical properties in the database include Thermal Conductivity, Thermal Diffusivity, Thermal Expansion, Enthalpy and other properties. New measurements of thermo-physical properties of Zirconium liquid, Hafnium, Zr-2.5%Nb and UO_2-Gd_2O_3 were conducted and contributed through the CRP. Assessments of thermo-physical properties of materials including Zircaloy, Zr-2.5% Nb, Zr-1% Nb, Zr liquid, ThO_2 -UO_2, ThO_2, UO_2-Gd_2O_3, UO_2, Russian steels, Hafnium, Corium and Inconel were carried out and peer reviewed by the participating organizations.

Contact: J.Cleveland@iaea.org.

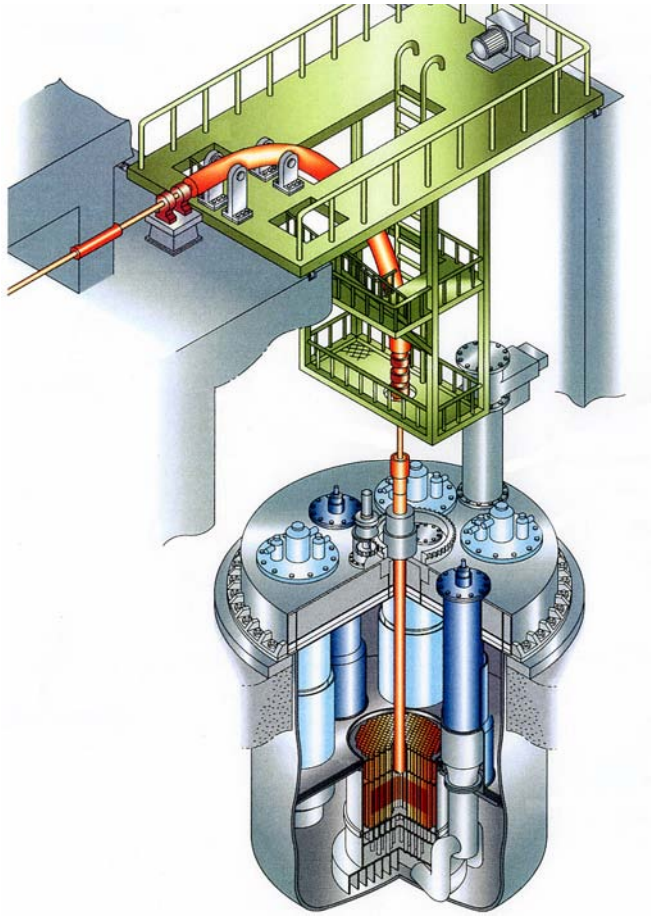
Technology Advances in Fast Reactors and Accelerator Driven Systems

Activities are conducted with the advice and support of the **Technical Working Group on Fast Reactors (TWGFR),** addressing all technical aspects of FR and ADS research and development, design, deployment, operation, and decommissioning. The following summarizes recent progress and plans:

The Project conducted a TC mission to Brazil (project BRA/0/018-14 **Technological Evaluation of Not Assembled Old Sodium Loops**) from 21 – 23 November 2005. The purpose of the mission was to advise the Brazilian partner Nuclear Engineering Institute (NEI) / National Nuclear Energy Commission (CNEN) with regard to the three sodium loops arrived at the Institute in 1984, to re-evaluate their possible uses in function of their technological obsolescence, and to recommend proper alternatives for the disposal of nine tons of metallic sodium in case the assemblage of the loops is not considered feasible. The mission was conducted with the help of a scientist from IPPE, Obninsk.

The Project convened the kick-off Research Coordination Meeting (RCM) of the IAEA Coordinated Research Project (CRP) on **Analytical and Experimental Benchmark Analyses of Accelerator Driven Systems (ADS)** at the Belarus National Academy of Sciences in Minsk from 5–9 December 2005. The CRP has received proposals for research agreements and contracts from scientists representing 25 institutions in 18 IAEA Member States and one International Organization. The overall objective of the CRP to contribute to the generic R&D efforts in various fields common to innovative fast neutron system development, i.e., heavy liquid metal thermal hydraulics, dedicated transmutation fuels and associated core designs, theoretical nuclear reaction models, measurement and evaluation of nuclear data for transmutation, and development and validation of calculational methods and codes. The specific objective

of the CRP is to improve the present understanding of the coupling of the ADS spallation source with the sub-critical core. The CRP will address all major physics phenomena of the spallation source and its coupling to the sub-critical core. The participants will perform computational and experimental benchmark analyses using integrated calculation schemes and simulation methods. Apart from analytical benchmark exercises, the CRP will integrate some of the planned experimental demonstration projects of the coupling at power between a sub-critical core and a spallation source (e.g., YALINA Booster in Belarus and SAD at JINR, Dubna). The RCM discussed 17 different benchmark exercise proposals that had been submitted by the participants. Out of these proposals, the RCM decided to retain (at least for a first stage of the CRP) 7 benchmark exercises, which, in some cases, are pooling together and/or consolidating proposals that were aimed at similar objectives.



Conceptual view of JAEA's 800 MW(th) lead-bismuth eutectic cooled ADS that will be one of the concepts considered in the CRP's benchmark exercises

In collaboration with INIS/NKM, work on the IAEA's **Initiative on Fast Reactor Data Retrieval and Knowledge Preservation** is ongoing. The ultimate objective of this initiative is to provide a Fast Reactor Knowledge Preservation (FRKP) System ("FRKP Portal") to be developed and maintained by the IAEA that would allow interested scientists access to the national guardians of assured quality information in the basic research, design, safety, fabrication, construction, operation, and in the decommissioning of fast reactors. To achieve this objective, a systematic method of capturing data and knowledge related to fast reactors is required. This system should have a standard structure, which will allow all members to contribute to and use the FRKP Portal. Based on proposals made by the IAEA and on discussions held with interested Member States over the course of last year, IPPE consultants have prepared a draft proposal for such a structure. At a consultants meeting in Vienna (13–17 February 2006), the draft was finalized, based on the peer review by two US scientists.

Visit: http://www.iaea.org/inis/aws/fnss/

Contact: A.Stanculescu@iaea.org.

Support for Demonstration of Nuclear Seawater Desalination

Summary reports from the CSIs in the framework of the CRP on **Economic research on, and assessment of, selected nuclear desalination projects and case studies** were received from the CSIs and were reviewed for inclusion in the proposed IAEA-TECDOC Annex. The CSIs used the DEEP 3.0 version for their studies resulting to its validation.

The second expert mission for the TC National Project INS/4/034 (2005-06 cycle) of Indonesia on Public Information on Nuclear Desalination was held at Pamekasan Madura, Indonesia on November 28-30, 2005. Workshop on **nuclear reactors and desalination systems** for the UAE project UAE/4/002 was postponed on the request of the counterparts. It is now planned for April 11-13, 2006.

The Technical Meeting on **Integrated Nuclear Desalination Systems** was held on December 5-8, 2005 at VIC, Vienna. It was attended by 11 participants and three observers. Issues related to the state-of-art of deployment of integrated nuclear desalination system including the techno-economic and socio-environmental aspects of nuclear desalination were discussed during the meeting.

The 8th **INDAG meeting** was held on February 6-8, 2006 at the VIC, Vienna. Fourteen members and two observers attended the meeting. INDAG reviewed the implementation of 2004-05 activities and approved the proposed activities of 2006-07 and made its recommendations.

A consultants meeting was held on February 9-10, 2006 to prepare a Status Report on **Nuclear Desalination Systems** including recent activities in the Member States and relevant activities of the IAEA.

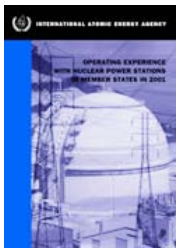
Expert mission for the Algerian TC project ALG/4/011 on **Techno-economic Feasibility of Seawater Desalination using Nuclear Energy** was held on February 19-21, 2006 at Algiers.

An invited presentation titled **Hybrid Desalination Systems and Economic Evaluation Using IAEA DEEP** was given at the IDA International Water Forum at Dubai on March 5-6, 2006.

The Training Course on **Desalination System Modelling-Technology and Economics** is planned for April 24-28, 2006 at ICTP, Trieste.

Contact: B.M.Misra@iaea.org.

Recent Publications



Operating Experience with Nuclear Power Stations in Member States in 2004

This report is the thirty-fifth in the IAEA's series of annual reports on operating experience with nuclear power stations in Member States. It is a direct output from the IAEA's Power Reactor Information System (PRIS) and contains data on electricity production, overall plant operating performance and plant outage during 2003 for individual plants. 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 figures illustrating worldwide performance and statistical data.

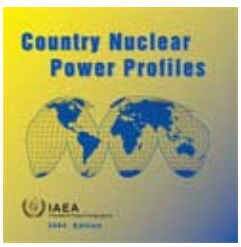
ISBN 92-0-114304-4

Advanced Nuclear Power Plant Design Options to Cope with External Events

IAEA TECDOC Series No. 1487

This report presents the state of the art in design approaches for the protection from external event impact for nuclear power plants (NPPs) with evolutionary and innovative reactors. It provides both the general and the technical information background to assist designers of advanced NPPs in the definition of consistent strategies in selected issues of the design and siting evaluation in relation to extreme external events.

ISBN 92-0-100506-7



Country Nuclear Power Profiles - 2004 Edition

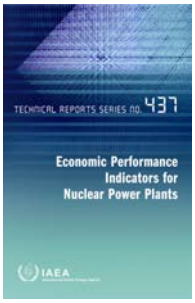
The new version is on the IAEA website addressing http://www.iaea.org/OurWork/ST/NE/NENP/NPES/Downloads/CNPP2004_CD/pages/index.htm and also available in CD.

ISBN 92-0-114505-5, CD-ROM

Nuclear Power for the 21st Century Proceedings of an International Ministerial Conference held in Paris, 21-22 March 2005

The International Ministerial Conference on Nuclear Energy in the 21st Century was organized by the IAEA, in cooperation with the Organisation for Economic Cooperation and Development (OECD) and the Nuclear Energy IAEA (OECD/NEA), and was hosted by the Government of France. The broad strategic objectives of the conference were to facilitate a discussion on the issue of nuclear energy and society, involving ministers, experts and decision makers, which would review the role of nuclear power and define the potential benefits (energy security, sustainability and improved environmental protection) that expanding nuclear power offers to meet the increasing energy needs of the world. This was encouraged by recent indications by a number of Member States regarding their future increased use of nuclear power.

ISBN 92-0-109505-8, CD-ROM



Economic Performance Indicators for Nuclear Power Plants

Technical Reports Series No. 437

From a global perspective, it is clear that there is no single group of key economic and financial measures that are applicable and useful for all countries and regions. The extent to which deregulation and privatization is occurring varies considerably throughout the world, with some countries continuing to foster regulated monopolies or government subsidies for power generation, while in others, retail and wholesale electricity is sold in truly open market, competitive situations. Consequently, the requirement for key measures of financial and economic success for the nuclear power industry will continue to vary from one region or country to another.

The primary purpose of this report is to identify and define a number of economic performance measures for use at nuclear power plants operating in deregulated, competitive electricity markets. The report outlines recent changes in the regulatory environments surrounding the financial operation of electric utilities, and in particular discusses the implications of deregulation and competition on gauging the economic performance and financial health of a nuclear power enterprise. It presents and discusses a general definition and classification of nuclear economic indicators, within the context of regulation, competition and the economic requirements of constructing, operating and decommissioning nuclear power plants. The economic indicators selected are a reflection of the diversity of requirements and are intended to have application in different regions throughout the world. In using the indicators, individual countries and Member States should select from the list those economic measures that are best suited to their specific applications and financial requirements.

ISBN 92-0-100905-4

Optimization of the Coupling of Nuclear Reactors and Desalination Systems

IAEA TECDOC Series No. 1444

In 1998, the IAEA initiated a Coordinated Research Programmed (CRP) on “Optimization of the Coupling of Nuclear Reactors and Desalination Systems” with participation of institutes from nine Member States in order to share relevant information, optimize resources and integrate related research and development in this area. All nuclear reactor types can provide the energy required by the various desalination processes. A total of nine nuclear reactors were examined for optimal coupling with desalination systems within this CRP. They are all of the water-cooled reactor type and are in various degrees of development. The commercial sea water desalination processes, which are proven and reliable for large scale production of desalted water are multi-stage flash (MSF) and multi-effect distillation (MED) for distillation processes and reverse osmosis (RO) for membrane processes and hybrid technologies such as MSF-RO and MED-RO. Different coupling options between the above nuclear and desalination technologies have been investigated within the CRP and were optimized with respect to safety, operational flexibility, reliability/availability and economics.

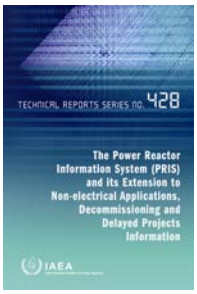
ISBN 92-0-102505-X

Management of Life Cycle and Ageing at Nuclear Power Plants: Improved I&C Maintenance

IAEA TECDOC Series No. 1402

The goal of this publication is to provide the latest information on ageing, obsolescence and performance monitoring of those items of Instrumentation and Control (I&C) equipment that are classified as safety equipment and/or safety related equipment, are operated in harsh environments in NPPs, and are important in plant life extension not only for normal operation but also, and more importantly, for post-accident service. In achieving this goal, this publication identifies the key I&C components of interest that are expected to function well throughout the life of a plant including the extended life.

ISBN 92-0-108804-3



The Power Reactor Information System (PRIS) and its Extension to Non-electrical Applications, Decommissioning and Delayed Projects Information

Technical Reports Series No. 428

The IAEA’s Power Reactor Information System (PRIS) contains detailed information on nuclear power plants worldwide since their start of commercial operation. It covers a broad range of information, including reactor design characteristics, plant general specifications, operating experience data and non-electrical applications of nuclear power plants such as steam production and desalination. This report describes all the elements of PRIS and explains the rules, coding, terminology and definitions used in the system.

ISBN 92-0-104704-5

Orders and requests for information may be addressed directly to:

Sales and Promotion Unit
International Atomic Energy Agency
Wagramerstrasse 5, P.O. Box 100,
A-1400 Vienna, Austria
Telephone: +43 1 2600 22529 (or 22530)
Facsimile: +43 1 2600 29302
E-mail: sales.publications@iaea.org
Web site: www.iaea/books

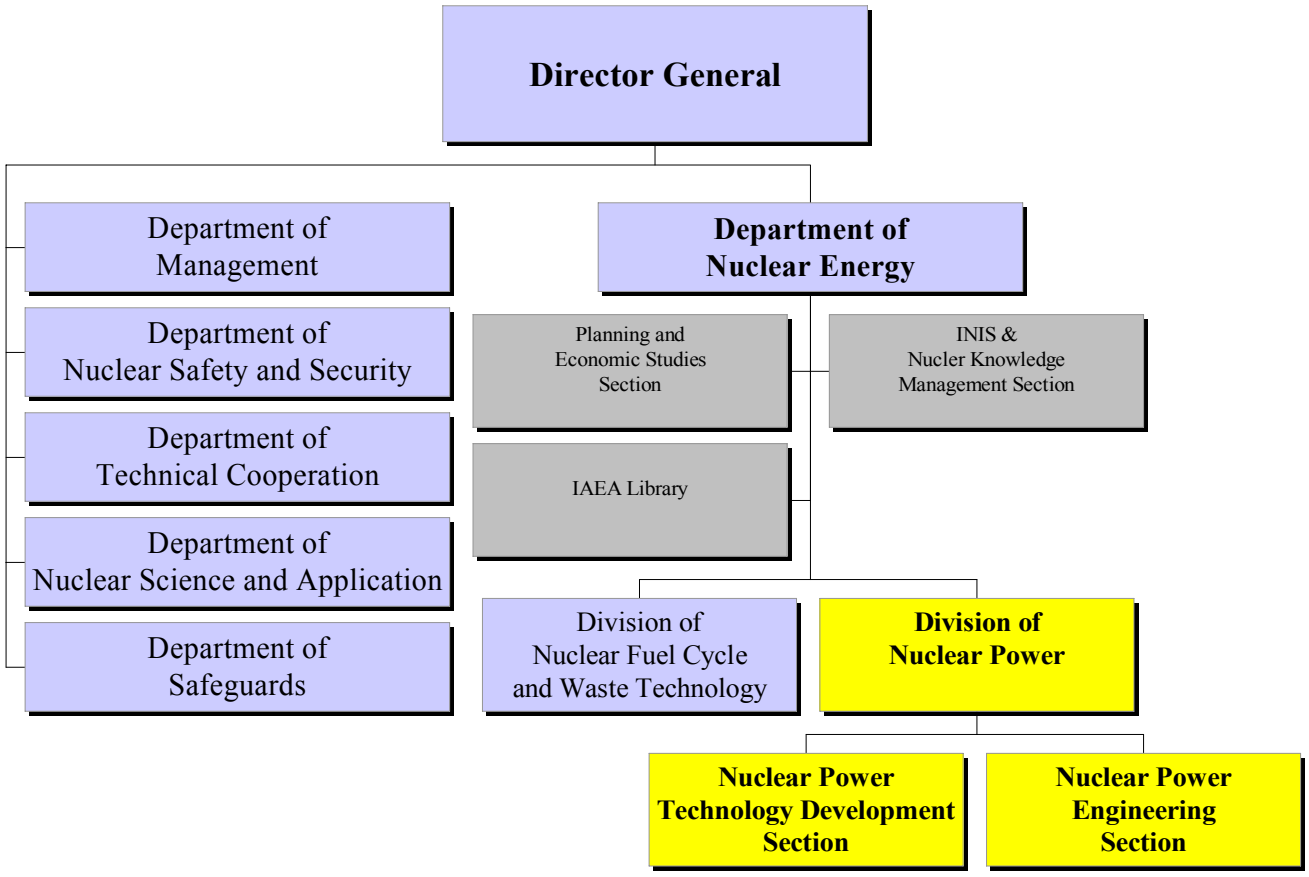
Planned Meetings in 2006

Start Date	End Date	Meeting Title	Location	Country	Scientific Secretary
06 Feb	08 Feb	International Desalination Advisory Group (INDAG)	VIC	Austria	Misra, Braj Mohan
01 Mar	03 Mar	TM on Fuel Failure and Failed Fuel Detection Systems for Fast Reactors	Kalpakkam	India	Stanculescu, Alexander
03 Apr	07 Apr	Updated codes and methods to reduce the calculational uncertainties of the LMFR reactivity effects	VIC	Austria	Stanculescu, Alexander
04 Apr	06 Apr	TM to Organize the 2nd International Conference on Nuclear Power Plant Life Management	ACV	Austria	Kang, Ki Sig
04 Apr	06 Apr	TM of the Technical Working Group on Training and Qualification of NPP Personnel	VIC	Austria	Mazour, Thomas
10 Apr	12 Apr	TM on Framework, Options and Guidelines for Implementation of R&D within INPRO	VIC	Austria	Omoto, Akira
24 Apr	28 Apr	Training Course on Desalination System Modelling: Technology and Economics	ICTP Trieste	Italy	Misra, Braj Mohan
15 May	19 May	Meeting of the Technical Working Group on Fast Reactors	Beijing	China	Stanculescu, Alexander
12 Jun	16 Jun	TM on the Status of Validation and Testing of Passive Safety Systems for SMRs	ACV	Austria	Kuznetsov, Vladimir
12 Jun	15 Jun	TM to Foster Information Exchange on Socio-economic and Environmental Aspects of Nuclear Desalination	VIC	Austria	Misra, Braj Mohan
19 Jun	22 Jun	TM on Quality Management of NPP Personnel Training	VIC	Austria	Kazennov, Alexey
9 Jul	10 Jul	9th Steering Committee Meeting on Innovative Nuclear Reactors and Fuel Cycles (INPRO)	VIC	Austria	Rao, Atambir Singh
11 Sep	15 Sep	RCM on Natural circulation phenomena, modelling and reliability of passive systems that utilize natural circulation	Cadarache	France	Cleveland, John
25 Sep	29 Sep	RCM on Evaluation of High Temperature Gas Cooled Reactor (HTGR) Performance	Pretoria	South Africa	Methnani, Mabrouk
09 Oct	12 Oct	RCM on Economic Research on, and Assessment of, Selected Nuclear Desalination Projects and Case Studies	VIC	Austria	Misra, Braj Mohan
09 Oct	12 Oct	TM on Maintaining and Operating the PRIS Database and its Products: Module 1, 2 and 3	VIC	Austria	Mandula, Jiri
09 Oct	12 Oct	TM to Disseminate Good Practices on the Training for the Commissioning of Nuclear Power Plants	VIC	Austria	Mazour, Thomas
16 Oct	20 Oct	TM to Review the Enabling Technologies for SMRs	VIC	Austria	Kuznetsov, Vladimir
17 Oct	20 Oct	TM on Cyber Security of Nuclear Power Plant Instrumentation, Control, and Information Systems	Idaho Falls, ID	United States of America	Glockler, Oszvald
31 Oct	03 Nov	TM on Lessons Learned from Large Modernization Projects in I&C Systems	Cape Town	South Africa	Glockler, Oszvald
06 Nov	08 Nov	RCM on Master Curve Approach to Monitor the Fracture Toughness of Reactor Pressure Vessel in Nuclear Power Plants	Dresden	Germany	Kang, Ki Sig
04 Dec	08 Dec	TM on Development of Benchmarking Processes for Economic PI and O&M Costs	VIC	Austria	TBD

Start Date	End Date	Meeting Title	Location	Country	Scientific Secretary
11 Dec	14 Dec	TM on Integrated Nuclear Desalination Systems	Cadrache	France	Misra, Braj Mohan
TBD	TBD	TM on Constructive Relationship Between All the NPP stakeholders: Regulatory, Utility and Supplier Organizations	VIC	Austria	Vincze, Pal
TBD	TBD	TM on Increasing Power Output and Performance of NPPs by Improved I&C Systems	TBD	TBD	Glockler, Oszvald
TBD	TBD	TM on Decommissioning Review Guidelines	VIC	Austria	Vincze, Pal
TBD	TBD	TM on Resolution of Comments of the Safety Standard Committee	VIC	Austria	Vincze, Pal
TBD	TBD	TM on Management Systems	TBD	TBD	Vincze, Pal
TBD	TBD	TM on the INPRO Methodology in the Area of Environment for the Assessment of Non-nuclear Energy Sources	VIC	Austria	Rao, Atambir Singh
TBD	TBD	TM on Further Development of Proliferation Resistance Assessment	VIC	Austria	Rao, Atambir Singh
TBD	TBD	TM on the Update of the User Manual for INPRO Methodology	VIC	Austria	Rao, Atambir Singh
TBD	TBD	TM on the Development of Recommendations for Infrastructure Changes to Support the Deployment of INS	VIC	Austria	Rao, Atambir Singh
TBD	TBD	TM on the Adaption of the Life Cycle Assessment (LCA) and Material Flow Assessment (MFA) Techniques to the Specific Requirements of INPRO	VIC	Austria	Rao, Atambir Singh
TBD	TBD	TM on the Preparation of Country Profiles on Innovative Technology Developments	VIC	Austria	Rao, Atambir Singh
TBD	TBD	10th INPRO Steering Committee Meeting	VIC	Austria	Rao, Atambir Singh
TBD	TBD	TM on Comparison of Simulation Results for Severe Transients in Heavy Water Reactors	TBD	TBD	Cleveland, John
TBD	TBD	TM on the Implementation of Fast Reactor Data Retrieval and Knowledge Preservation Activities	VIC	Austria	Stanculescu, Alexander
TBD	TBD	TM on the Review of the Status of Fast Reactor R&D and Technology	VIC	Austria	Stanculescu, Alexander
TBD	TBD	TM on the Review of the Status of Accelerator Driven Systems R&D and Technology	VIC	Austria	Stanculescu, Alexander
TBD	TBD	TM on the Comparative Assessment of the Dynamics and Safety Characteristics of Transmutation Systems	TBD	TBD	Stanculescu, Alexander
TBD	TBD	TM of the Group of Deep Users	VIC	Austria	Misra, Braj Mohan
TBD	TBD	TM to Organize an International Symposium on Non-electric Applications of Nuclear Power in 2007	TBD	TBD	Methnani, Mabrouk
TBD	TBD	TM to Prepare the International Symposium on Non-electric Applications of Nuclear Power in 2007	VIC	Austria	Methnani, Mabrouk
TBD	TBD	TM on Design and Safety Approaches for Coupling of Hydrogen Production Systems with Nuclear Reactors	VIC	Austria	Methnani, Mabrouk
TBD	TBD	Advisory Meeting with Nuclear Hydrogen Experts	VIC	Austria	Methnani, Mabrouk

Division of Nuclear Power Web Site Links

Division Introduction : NENP home: http://www.iaea.org/OurWork/ST/NE/NENP/index.html



Nuclear Power Engineering Section (NPES)

http://www.iaea.org/OurWork/ST/NE/NENP/NPES/index.html

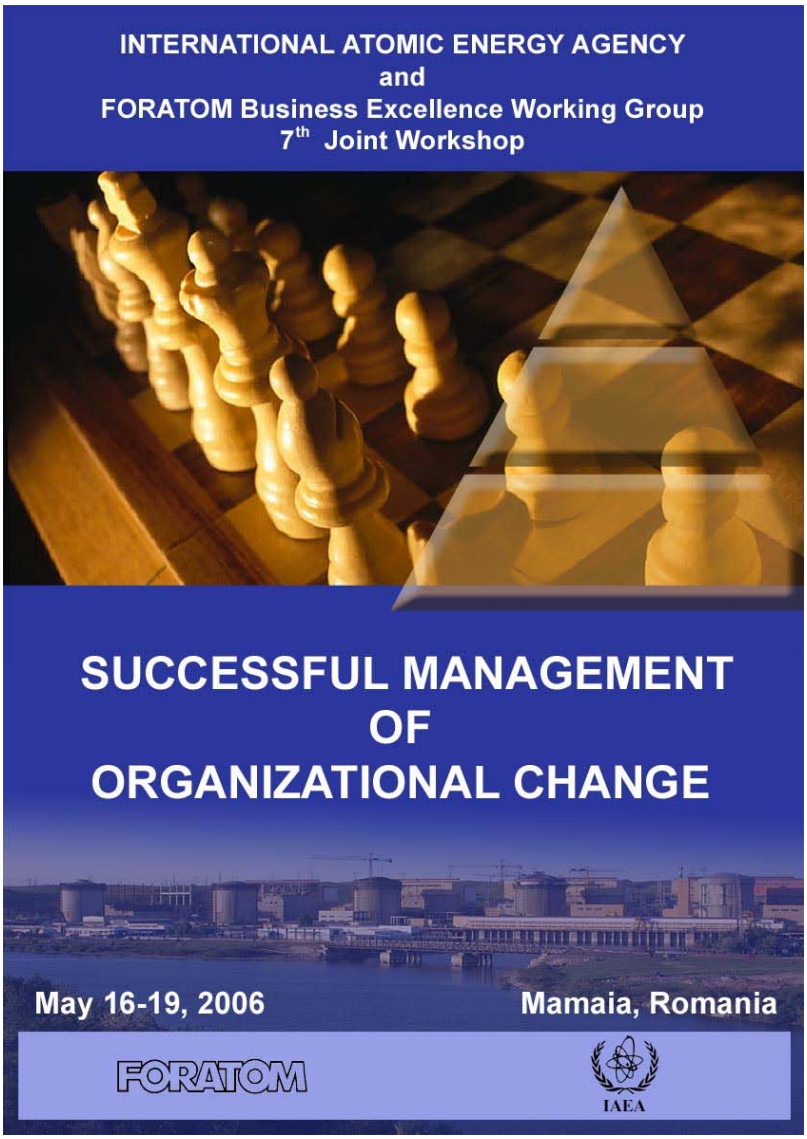
- Main activities and result
  http://www.iaea.org/OurWork/ST/NE/NENP/NPES/Activity/index.html
- Publications and documents
  http://www.iaea.org/OurWork/ST/NE/NENP/NPES/publications.html
- Contact persons
  http://www.iaea.org/OurWork/ST/NE/NENP/NPES/staff.html
- Databases (PRIS, CNPP, ENTRAC), software (SAT) and downloads
  http://www.iaea.org/OurWork/ST/NE/NENP/NPES/Downloads/index.html

Nuclear Power Technology Development Section (NPTDS)

http://www.iaea.org/OuWork/ST/NE/NENP/NPTDS/Projects/index.html

- Databases and software
  - ► Fast Reactors Database:
    http://www-frdb.iaea.org/index.html
  - ► ADS Database:
    http://www-adsdb.iaea.org/index.cfm
  - ► User friendly education with nuclear reactor simulators
    http://www.iaea.org/OurWork/ST/NE/NENP/NPTDS/Projects/edu.html
- Active Coordinated Research Projects (CRPs)
  http://www.iaea.org/OurWork/ST/NE/NENP/NPTDS/crps.html

The 7th IAEA - FORATOM Joint Workshop on Successful Management of Organizational Change



The 7th **IAEA - FORATOM Joint Workshop on Successful Management of Organizational Change** will be held on 16-19 May 2006, Mamaia, Romania.

The objective of the workshop is to provide a forum for exchanging experience and information regarding the successful management of organizational change. The focus of the workshop will be to identify common difficulties, possible solutions and good practices that will lead to an improvement in overall performance with due regard to safety.

The workshop is planned to enable the participants to discuss, in a series of parallel Working Groups Sessions, their experiences in managing organizational change and their impact on the organization. The sessions will be as follows:

Effective handling of organizational change

- Organizational culture/and safety culture
- Application of Management systems

For further information, please contact Mr. P. Vincze: p.vincze@iaea.org.

IAEA International Atomic Energy Agency

Nuclear Power Newsletter
Vol. 3, No. 1, April 2006

06-11841

Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria

The Nuclear Power Newsletter is prepared quarterly by the Division of Nuclear Power, Department of Nuclear Energy.

Printed by the IAEA in Austria, April 2006