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**Division of Nuclear Power
Department of Nuclear Energy
IAEA**

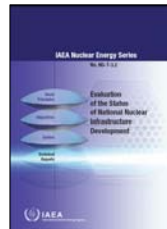
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New Publication on the Evaluation of National Nuclear Infrastructure Development Status



A new NE Series Technical Report on 'Evaluation of National Nuclear Infrastructure Development Status' is available at the Web link

http://www.pub.iaea.org/MTCD/publications/PDF/Pub1358_web.pdf.

This publication provides a holistic approach to evaluate progress in the development of the nuclear power infrastructure based on the IAEA guidance laid out in the publication NG-G-3.1 Milestones in the development of a National Infrastructure for Nuclear Power.

Read more on page 9

Second Common User Considerations Workshop

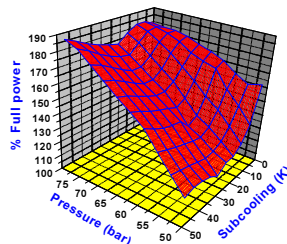


INPRO organized the second 'Common User Considerations' (CUC) workshop from 22-25 September 2008. The workshop concludes a two-year INPRO activity to identify common considerations related to safety regulation and

licensing, cost information, optimization of resources, 'proven-ness' of technology and standardization.

Read more on page 11

Development of Methodologies for the Assessment of Passive Safety System Performance in Advanced Reactors



A CRP entitled 'Development of Methodologies for the Assessment of Passive Safety System Performance in Advanced Reactors' (2008-2011), the detailed programme of which has been approved earlier this year, is finalizing the collection and evaluation of the applications for research agreements and research contracts. This project has the objective to determine a common analysis-and-test based method for reliability assessment of passive safety system performance. Such a method would facilitate application of risk-informed approaches in design optimization and safety qualification of the future advanced reactors, contributing to their enhanced safety levels and improved economics.

Read more on page 17

Message from the Director



Welcome to the December issue

Although the financial crisis and collapse of oil prices from their peak of \$147/barrel may have a potential to dampen growth of electricity demand and further the expectation for the role of nuclear power, more than 50 new

countries are considering embarking on nuclear power programmes and are asking the IAEA for assistance. As a consequence, in the next cycle beginning 2009, the number of the IAEA's Technical Cooperation projects for introduction of nuclear power shows a quadruple increase in the Division of Nuclear Power. Human resources development in a country considering nuclear power is recognized as a key issue for the successful development of that country's nuclear infrastructure. This demand for more human resources also arises from developed countries where baby boomers, supporting nuclear technology and working in the industry, are retiring over the next few years.

The IAEA continues to assist by providing guidance in education and training, facilitating support to regional networks by Member States such as ANENT (Asian Network for Education of Nuclear technology), organizing training courses, preparing training materials, and launching distance learning programmes. You can view examples of these activities at:

<http://www-ns.iaea.org/training/ni/materials.asp#trainthetrainers>

<http://entrac.iaea.org/ELibrary.aspx>

<http://www.iaea.org/inisnkm/nkm/activitiesInMs.html>

The IAEA is also considering a programme for a regional training centre for newcomers supported by Research Reactor coalitions and networks. Not all of them are implemented by the Division of Nuclear Power, but our work is an integral part of the IAEA's support for human resources development necessary for successful implementation of a nuclear power programme. In this issue of the newsletter, you will find an interesting article on Human Resources development in Russia and Eastern Europe as well as in the previous September issue. More information is available by accessing ENTRAC.

Auf Wiedersehen, Russ Clark

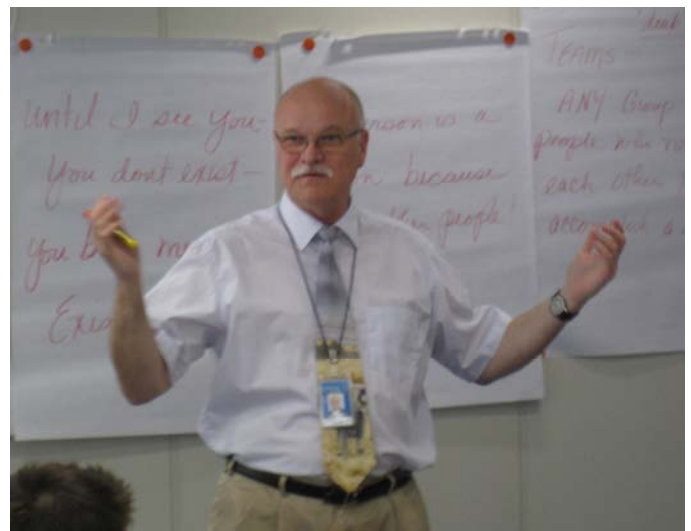
It is with great regret that I must announce that the Division of Nuclear power is losing one of our section heads, Mr. Russ Clark.

Many of you that are recipients of this newsletter have had the pleasure to work with the Nuclear Power Engineering Section (NPES) Head, Mr. CLARK, C. Russell (Russ). Thus, I wanted to inform you that Russ will be leaving the IAEA in January 2009 to take the position of Director of Education and Training for the United Arab Emirates (UAE) Federal Authority to support the launching of their nuclear power programme. We, the staff of the NPES, have benefited greatly from his exceptional leadership during his nearly 9 years in the IAEA, 7 years of which were as our Section Head, and we will miss him a lot. One of Russ' many strengths as a manager is in mentoring, encouraging and developing his staff for continuous improvement. Thus, even in his absence, we are hopeful that we will be able to maintain the high standards that he has established for our work.

Russ has previous experience as the training manager for a nuclear power plant. That, along with his mentoring skills, should make him an ideal person for this position with the UAE Federal Authority for Nuclear Regulation, as it is currently in the formative stages.

By taking this opportunity, I would like to thank Russ for his invaluable contribution to the Division. We wish Russ all the best — Goodbye and Auf Wiedersehen.

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Russ Clark at a section brainstorming meeting, 23 May 2008, Vienna Austria

NPP Instrumentation and Control Technologies

Workshop on Neutron Fluctuations, Reactor Noise

The workshop titled ‘Neutron Fluctuations, Reactor Noise, and Their Applications in Nuclear Reactors’ was held from 22 to 26 September 2008, at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. The workshop was intended for scientists, researchers, engineers, and university personnel interested in broadening their understanding of the subject. 30 participants and 5 invited lecturers from 20 countries attended the workshop. The purpose of the workshop was to provide the participants with the knowledge of fundamental theories, equations, relationships, and applications of stochastic processes taking place in nuclear reactors. Practical applications of signals noise analysis in nuclear power plants were discussed with an emphasis on instrumentation and control (I&C) systems for surveillance, diagnostics, and prognostics.



Workshop participants, 22-26 September 2008, ICTP, Trieste, Italy

The IAEA was represented at a combined symposium of three topical meetings related to nuclear energy (ISSNP/CSEPC/ISOFIG2008) which was held in Harbin, China on 8-10 September 2008. The event was hosted by the Harbin Engineering University (HEU). A presentation was made on a new IAEA coordinated research programme (CRP) titled ‘Advanced Surveillance, Diagnostics, and Prognostics Techniques Used for Health Monitoring of Systems, Structures, and Components in Nuclear Power Plants’. The CRP started this year and is expected to run for three years. Several participants of the symposium expressed their intention to join the CRP.

Workshop on the Applications of Field-Programmable Gate Arrays (FPGA) in Nuclear Power Plants

The First Workshop on the Applications of Field-Programmable Gate Arrays (FPGA) in Nuclear Power Plants was held on 8-10 October 2008 in Chatou, France. The workshop was hosted by the R&D Division of EdF, and was co-sponsored by the IAEA. 70 participants from 9 countries attended the workshop, and 28 presentations were made. The agenda of the workshop included

hardware demonstrations and discussions on the design, implementation, standards, and licensing of FPGA devices in safety related applications in NPPs and in other industries. Experience gained in actual modernization projects of I&C systems at NPPs using FPGA technology was also presented.

Consultants meeting on Interaction of Grid Characteristics with Design and Performance of Nuclear Power Plants

The consultants meeting on ‘Interaction of Grid Characteristics with Design and Performance of Nuclear Power Plants’ was held on 21–24 October 2008 in the Vienna International Centre. Five experts from France, Hungary, Japan, the Republic of Korea and the USA attended the meeting. The objective of the meeting was to initiate the updating process of an older document (Technical Report Series No. 224) with the above title, which was published in 1983. The meeting established the outline of the new updated document. It is anticipated that the final version of the document will be produced within two years in an additional consultants meeting. The meeting also produced a 30-page document that will serve as a starting point for drafting an Annex to the IAEA’s Nuclear Technology Review (NTR-2009) on the subject.

Technical Meeting on Impact of Digital I&C on the Operation and Licensing of Nuclear Power Plants

The IAEA Technical Meeting titled ‘Impact of Digital I&C on the Operation and Licensing of Nuclear Power Plants’ was hosted by the China Nuclear Power Engineering (CNPE) Company in Beijing on 3-6 November 2008. Sixty-three participants from 14 countries attended the meeting, and 29 presentations were delivered. The purpose of the meeting was to discuss the benefits and challenges of using digital technologies in the instrumentation, control, and information systems of nuclear power plants and to further develop a technical document on the topic. The meeting’s agenda included a full-day technical visit to the Tianwan NPP, where new digital I&C systems and human-system interfaces of the NPP’s control rooms were demonstrated.

For more information please visit

<http://www.iaea.org/NuclearPower/landC/>

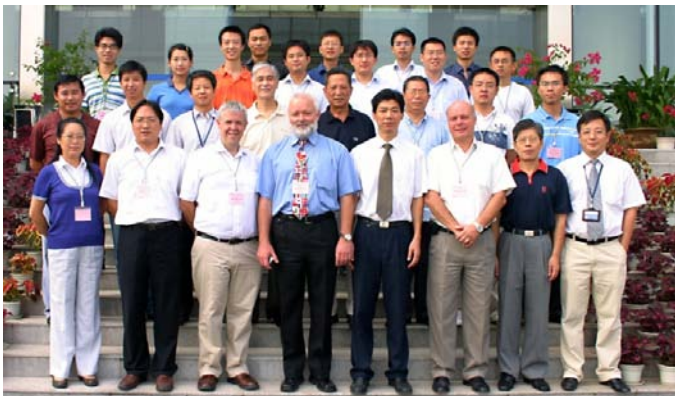
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Integrated NPP Life Cycle Management

Validation of the Technology of In-Service Inspection Non-Destructive Testing for Nuclear Power Plants

As part of the IAEA Technical Cooperation (TC) project CPR/4/028, titled ‘Validation of the Technology of In-

Service Inspection Non-Destructive Testing for Nuclear Power Plants', an expert mission was implemented in Wuhan, China. The mission was hosted by China Nuclear Power Operation Technology Corp., Ltd. (CNPO), previously known as Research Institute of Nuclear Power Operations (RINPO), from 15 to 24 September 2008. The objective of the project was (1) to complete the pilot study of inspection qualification tests, and (2) to set up a national system of in-service inspection (ISI) qualification in China. The mission built on the expert services of two external experts, Mr. Tommy Zetterwall of the Swedish Qualification Centre and Mr. Russell Booter of Serco Assurance in the UK. The title of the mission was 'Practical Trial of Inspection Qualification of Ultrasonic Test of Dissimilar Metallic Welds'. The actual work included (1) the detection and characterization of manufactured faults in a large test piece by various inspection teams, and (2) the demonstration how a Qualification Body (qualifying test methods, equipment, and competence of personnel) would review the test procedures and results. The performance of the second activity is aimed at supporting the establishment of the Chinese Qualification Body in the area of in-service inspection and non-destructive testing in nuclear power plants.



Experts and national participants, 15-24 September 2008, CNPO, Wuhan, China

Meeting on In-Service Inspection (ISI) Qualification of Nuclear Power Plants

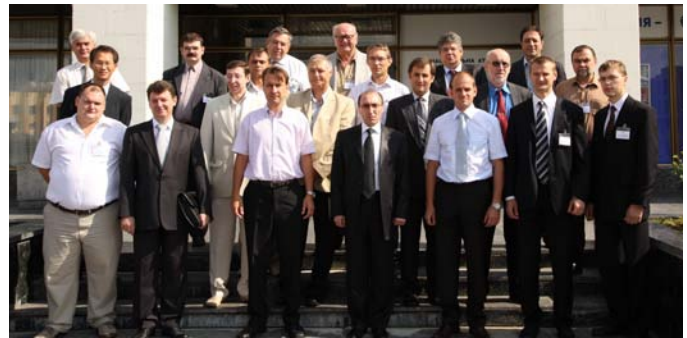
A two-day IAEA Technical Meeting titled 'In-Service Inspection (ISI) Qualification of Nuclear Power Plants; 3rd International Workshop of In-Service Inspection Qualification Bodies' was held on 15-16 October 2008 in the Vienna International Centre. The meeting was co-organized by the European Commission, Joint Research Centre, Institute for Energy. The objective of the Qualification Bodies' meeting was to revisit the field of inspection qualification, inspection validation, performance demonstration, and to exchange information on lessons learned in ISI applications and qualification in nuclear power plants. The main themes of the technical meeting were:

- Inspection qualification in relation to risk informed (based) inspection.
- Inspection qualification in relation to new NPP build (and replacement components).
- Inspection qualification in relation to plant life extension.
- Requirements for good inspection procedures.

37 participants from 17 Member States attended the meeting, and 15 presentations were delivered.

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Workshop on Improved Reactor Pressure Vessel Structural Integrity Assessment, 8–12 September 2008, Kuznetsovsk, Ukraine



Workshop participants, 8–12 September 2008, Kuznetsovsk, Ukraine

Reactor pressure vessels (RPVs) are the highest priority key components in nuclear power plants (NPPs). The RPV houses the reactor core and because of its function it has direct safety significance. Unexpected age related degradation of the mechanical properties of the RPV steel can lead to safety concerns related to the mechanisms involved in ageing, which include irradiation embrittlement, thermal ageing, temper embrittlement, fatigue, and corrosion. Structural integrity of RPVs should be assured for all normal operating, upset, faulted, and accident conditions, as well as non-design transients such as pressurized thermal shock (PTS) through the whole operating life. Neutron irradiation degrades the mechanical properties of RPV steels, and the extent of the degradation is determined by the type and structure of the steel and other factors such as neutron fluence, irradiation temperature, neutron flux, and chemical composition. The most sensitive location in the RPV is the region adjacent to the reactor core (termed the beltline region). Welds and their heat-affected-zones (HAZ) in this region are particularly important since these regions have a higher probability for flaws.

The workshop was jointly organised by the IAEA and EC-JRC, Institute of Energy. The IAEA invited three experts from Republic of Korea, Russian Federation and Germany. EC-JRC sponsored invitation of two experts — from Czech Republic and Hungary.

A total of 20 participants from 9 countries in the Eastern Europe region — Armenia, Bulgaria, Czech Republic, Hungary, Lithuania, Russian Federation, Romania, Slovakia and Ukraine — participated in the workshop. The workshop consisted of four technical sessions besides the opening and closing sessions:

- Session 1: Elements of Material Degradation.
- Session 2: Experience, Mechanisms and Mitigation.
- Session 3: Regulatory Aspects, Industry, Case Studies.
- Session 4: Monitoring RPV, Flow accelerated corrosion, Application of Leak-Before-Break concept.

In the workshop closing session, it has been stressed that it should be considered:

- The scope and intervals of RPV non-destructive examination — there are differences between approaches applied in VVER and PWR nuclear power plants worldwide,
- Harmonisation of various approaches in order to assess the RPV integrity and compare the situation in various countries (transition temperature calculations, use of reference bound curves, size and position of postulated defect, PTS calculations).

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Workshop on Plant Life Management and Long Term Operation Issues of WWER type of NPPs, 20–23 October Budapest, Hungary

A plant life management approach is a tool allowing an operating organization to follow ageing effects in systems, structures and components (SSCs) and to help in making decisions concerning when and how to repair, replace or modify them in an economically optimal way. Plant life management (PLiM) can be seen as a precursor to operation up to and even beyond the original design lifetime — the long term operation (LTO).



The workshop was hosted by the KFKI, Hungary. A total of 34 participants from 9 countries in the Eastern Europe region — Armenia, Bulgaria, Czech Republic, Hungary, Lithuania, Russian Federation, Romania, Slovakia, and Ukraine — participated in the workshop and 18 lectures were presented. The workshop consisted of four

technical sessions besides the opening and closing sessions:

- Session 1: Plant Life Management.
- Session 2: Ageing Management and Related Programmes.
- Session 3: Design Modifications, Refurbishment and Replacement of SSCs.
- Session 4: Current Research and Development Results.

In the workshop closing session, it has been emphasized that it should be considered:

- Harmonisation of various approaches in order to assess integrity and mutually compare actual condition of the major passive SSCs,
- Long term experience in some Member States with replacement of major passive SSCs (steam generators, reactor vessel heads),
- Outage optimizations with respect to the experience in pressurized water reactor operating countries (France, Republic of Korea, USA),
- Use and standardization of new techniques used for examination/investigation of SSCs ageing/degradation, particularly for detecting of stress corrosion cracking in critical hot spots in WWER NPPs.

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Excellence Programme on Nuclear Plant Life Prediction from 16-18 September at Madrid, Spain

The EC has launched the European Network of Excellence Programme on Nuclear Plant Life Prediction (NULIFE) programme focusing on integrating research on materials, structures/systems and producing an harmonised lifetime assessment approach through exploiting the results of this integration. The aim of NULIFE is to help operating nuclear power plants in EC with the following objectives:

- Provide a better common understanding of the factors affecting the lifetime prediction of nuclear power plants, together with associated management methods,
- Facilitate extensions to the safe and economic lifetime of existing nuclear power plants,
- Develop the design criteria for future generations of nuclear power plant.

While over half are from the research organizations, NULIFE also tried to invite many industrial organizations and the dedicated End User Group. Joint R&D activities were defined and prioritized. The first pilot projects are being implemented for 1) stress corrosion cracking (SCC), 2) thermal fatigue, 3) ageing of Instrumentation and Control (I&C) and 4) dissimilar

metal weld (DMW). These research results were reported during meeting.

The level of importance of plant life management for long term operation has increased considerably during the past several years in the EC. To minimize the duplication and coordinate PLiM for LTO activities with the EC, the IAEA get involved with the EC activities to maximize the synergistic effects and that a joint workshop focusing the harmonized approach for life extension be organized.

The Codes and Standards Working Group Meeting of Multinational Design Evaluation Programme

The codes and standards working group (CSWG) meeting of multinational design evaluation programme (MDEP) took place from 29th to 31st October 2008 at the Autorité de Sûreté Nucléaire (ASN) Office; in Dijon, France. The purpose of the meeting was to evaluate the differences between the design codes and standards of reactor pressure vessel based on inputs identified by the standard development organizations (SDOs), to improve the effectiveness and efficiency in design and construction of nuclear power plants.

Eight country representatives from Canada, China, Finland, France, Japan, the Republic of Korea, the Russian Federation and USA among the 10 member countries of the CSWG of MDEP are participated in this CSWG meeting. In addition, four representatives from the standard development organizations (SDOs) from France, Japan, the Republic of Korea and USA participated in the meeting too. The OECD-NEA performed the technical secretariat function.

The CSWG members understood that the convergence of codes and standards was not possibly in the near future. A realistic goal for the CSWG needs better understanding of the commonalities and differences in order to determine their usability through identifying and resolving important differences among codes and standards. The specific pressure boundary codes and standards for the comparison are chosen as follows:

- ASME B&PV Code, 2007 (USA)
- AFCEN RCC-M, 2007 (France)
- JSME S NC I, 2008 (Japan)
- KEA KEPIC, 2007 (Republic of Korea)

The institutional requirements such as General Requirements and Quality Assurance depend highly on the licensing systems and industry practices of each country. Thus, the big differences are found during the codes and standards comparison. These institutional differences will be more difficult than technical requirements' harmonization or convergence. The final completion table will be submitted by May, 2009 from

SDOs. The final codes and standards comparison table will be useful to support the launching or expanding new nuclear power programme.

Project Review Meeting to design two new TC projects (CPR 2007002 and CPR 2007005), Shanghai and Wuhan, China, 11- 15 August 2008

A new Technical cooperation (TC) project focused on Qinshin nuclear power plant (NPP) life extension programme and material degradation programme.



A new TC project will handle the reactor pressure vessel and piping integrity, steam generator tube inspection programme and in-service inspection technique. China Nuclear Power Operation Technology Corporation (CNPO: previous Research Institute of Nuclear Power Operation: RINPO) is responsible for managing new TC project. The purpose of the new TCs focus on the extending ageing management conceptions/practice in a wider range including life management, life extension, economic considerations, related domestic nuclear regulatory requirements, procedure on structural integrity, etc. It is expected that based on achievements of the on-going TC project, the new two TCs will have significant contribution to formulate technical foundation for life extension and license renewal for Chinese NPPs.

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Nuclear Power Plant Operation

Consultants meeting on Information Technology Solutions for Design Basis and Configuration Management

The consultants meeting on new document on the subject of Information Technology Solutions for Design Basis and Configuration Management was held from 2 to 4 September, 2008 at IAEA Headquarters in Vienna.

In order to increase Member States capabilities in utilizing good engineering and management practices transferred by the IAEA a new Nuclear Energy Series Report document describing good examples of Information Technology (IT) utilization for Configuration Management (CM) is under development. The document will complete a trilogy for NPP Configuration Management (CM) by complementing the existing IAEA-TECDOC-1284 (Information Technology

Impact on Nuclear Power Plant Documentation) and IAEA-TECDOC-1335 (Configuration Management in Nuclear Power Plants). The goal of the meeting was to review the document draft and discuss related details.

Workshop on NPP Outage Management and Optimization

The Regional Workshop on NPP Outage Management and Optimization was conducted under the IAEA Technical Co-operation Project RAS/4/028 at the Tianwan Nuclear Power Plant, China from 8 to 12 September 2008.



Workshop participants, 8-12 September 2008, Tianwan China

The purpose of the workshop was to familiarize the participants with and to exchange experiences on various methods and techniques to maintain nuclear safety during the outage, reduce outage durations, and plan and perform outages more effectively. The main topics of the Workshop were: outage planning and organization, outage work control and criteria for on-line maintenance to reduce the scope of outage work.

The workshop was attended by 32 participants from different NPPs in China, Republic of Korea and Pakistan. All participants express satisfaction with topics discussed and it was suggested to continue in discussion best practices in outage managements.

Technical Meeting on Maintaining and Operating the Power Reactor Information System Database and its Products

The biannual Technical Meeting on Maintaining and Operating the Power Reactor Information System Database and its Products was held in Vienna on from 13—16 October 2008.

PRIS is considered an authentic reference database on nuclear power plants which consists of nuclear power plant basic information, design characteristics, decommissioning data, energy production and unavailability, outages and performance indicators.

The objective of the Technical Meeting was to provide information about the current status of the system, its

latest development and to get a feedback from the Power Reactor Information System (PRIS) users and data providers. Through a common discussion and topical work-group sessions the recommendations concerning the PRIS activities and future development have been formulated.



Meeting participants, 13-16 October 2008, Vienna Austria

The meeting was attended by 22 experts from 2 international organizations (WANO and OECD/NEA) and 18 Member States. The participants were designated national correspondents and PRIS users from nuclear power plant operating utilities, regulatory bodies and other organizations.

The meeting participants recognized the services provided by PRIS to the nuclear industry. They appreciated efforts rendered by the IAEA in maintaining and operating PRIS with quality data and developing a new PRIS reporting system. The participants supported further enhancement and optimization of PRIS related application and outputs in view of current and future development of nuclear industry.

Consultants meeting on Risk Informed In-Service Inspection (RI-ISI) of Piping Systems in Nuclear Power Plants

The consultants meeting on Risk Informed In-Service Inspection (RI-ISI) of Piping Systems in Nuclear Power Plants was held in Vienna from 23—25 September, 2008

In service inspection is an integral part of the defence in depth program for NPP to ensure safe and reliable operation. Traditional ISI programs were developed using deterministic approaches. However, as probabilistic approaches are developed, risk insights are being used to optimize ISI programs by focusing ISI resources on the most risk significant locations.

The objective of the consultants was to finalize the draft of the IAEA Nuclear Energy Report on Risk Informed In-Service Inspection (RI-ISI) of Piping Systems in Nuclear Power Plants. The team of consultants did a section by section review of the draft document and discussed numerous suggestions on revision to the content and layout. After three days of discussion and numerous revisions, participants agreed the final version of the draft.

This publication will describe the general process of developing and implementing RI-ISI methodologies, the technological issues which lie behind the methodologies, application status, and the current development activities. It will be useful for managers, ISI supervisors, and lead ISI engineers of NPPs, Technical Support Organizations and for regulatory staff reviewing RI-ISI programs.

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Consultants meeting to maintain and operate the Nuclear Economic Performance Information System (NEPIS)

Since 1997, in anticipation of privatization and deregulation in the world electric power industry, IAEA and Nuclear Committee (NC) of Electric Utility Cost Group (EUCG) have worked cooperatively to develop NEPIS database for various regions of the world, which mainly include operation and maintenance cost data, and exchange data with EUCG-NC Nuclear Integrated Information Database (NIID), which mainly include operation and maintenance cost data of US NPPs. The data exchange of NEPIS/NIID has occurred 10 countries over the past years. A consultants meeting was organized on October 21–23, 2008 to finalize NEPIS future development, to define the NPP construction and commissioning cost survey and to confirm the future work plan. NEPIS will be kept as a forum for Nuclear power plant economic performance. A workshop on economic and financing was suggested in 2009-2010 to exchange the experience in Member States and figure out pilot projects in construction and commissioning cost for guiding nuclear power newcomers.



Meeting participants, 21–23 October 2008, Vienna Austria

Management Systems

The Safety Standard Committees and the Commission of Safety Standards approved the last member of the Management System safety standards guidance on management system for nuclear installations, GS-G-3.5. This Safety Guide is issued in support of the Safety Requirements publication on The Management System for Facilities and Activities, GS-R-3. It provides recommendations in relation to nuclear installations that

are supplementary to the general recommendations provided in Safety Guide Application of Management System for Facilities and Activities, GS-G-3.1. It supersedes Safety Guides numbers Safety Series No. 50-C/SG-Q8-Q14.

GS-G-3.5 is applicable throughout the lifetime of a nuclear installation, including any subsequent period of institutional control until there is no significant residual radiation hazard. For a nuclear installation, the lifetime includes site evaluation, design, construction, commissioning, operation and decommissioning. These stages in the lifetime of a nuclear installation may overlap. It may be applied to nuclear installations in the following ways:

- To support the development, implementation, assessment and improvement of the management system of those organizations responsible for research, site evaluation, design, construction, commissioning, operation and decommissioning for a nuclear installation;
- As an aid in the assessment by the regulatory body of the adequacy of the management system of a nuclear installation;
- To assist an organization in specifying to a supplier, via contractual documentation, any specific element that should be included within the supplier's management system for the supply of products.

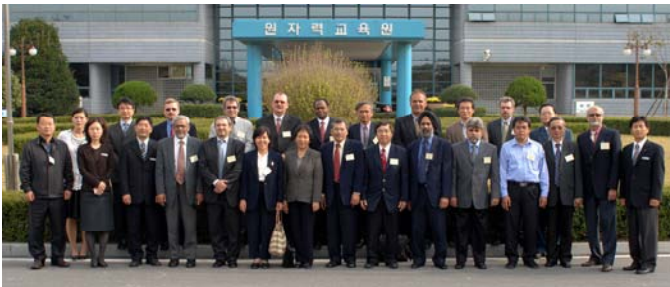
Regional Workshop on Application of effective management systems, 21–24 October 2008. Busan, Republic of Korea

The objective of the workshop was to promote the IAEA safety standards on management systems (GS-R-3, GS-G-3.1. and DS349), to discuss the PNC Nuclear Codes and Standards WG/TG activities and, to provide information on the transition from traditional QA approach towards the integrated management system in facilities and activities. The following key issues were addressed:

- Integration of safety, health, environmental, security, quality and economic areas;
- Key Issue 2: Leadership and safety culture
- Key Issue 3: Assessment and Improvement of Management Systems

The workshop was attended by representatives of 12 countries from the region. It provided a forum for exchanging experiences and information related to the integration of management system elements. The main focus was on common difficulties, possible solutions and good practices to improve overall performance with regard to safety. It also addressed improvement in the Management Systems and Safety/Organizational Culture

in the Operating Organizations. The workshop fostered exchange of practical lessons learned in the establishment of integrated management systems. The workshop consisted of a series of leading lectures given by IAEA and PNC experts, followed by working sessions on specific topics discussing the issues raised and difficulties envisaged (see below). All participants were actively involved in discussions and workshop activities. Feedback of the working sessions is available on <http://entrac.iaea.org>.



Workshop participants, 21–24 October 2008. Busan, Republic of Korea

Regulatory oversight of management systems

A second meeting was held in Vienna, 5–9 May 2008 on ‘Regulatory oversight of management systems’ with the purpose to develop a guidance document on how regulators can promote, verify and enforce compliance with the requirements for management systems as stated in the IAEA requirements and guides for management systems (GS-R-3, GS-G.3.1 and DS349). The document accomplishes this by providing guidance that helps a regulatory body develop a consistent and effective process for regulatory oversight of integrated management systems. A draft guidance document was produced, as well as a draft describing a tool for inspection of management systems.

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Strengthening Nuclear Power Infrastructure

Member States that are considering the introduction of nuclear power face the challenge of building the necessary national nuclear infrastructure for the first NPP. The IAEA response to this demand is provided through increased technical assistance, missions and workshops, and with new and updated technical publications.

Assistance is currently provided to implement 10 national and 2 regional Technical Cooperation projects supporting the introduction of nuclear power. Each can generate multiple missions, meetings and documents. Integrated missions consisting of experts from different IAEA Departments to ensure a holistic approach to

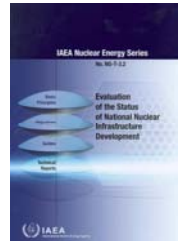
national infrastructure development are currently provided.

Technical meeting on Evaluation Methodology for Nuclear Power Infrastructure Development

A technical meeting/workshop (TM/Wsp) on Evaluation Methodology for Nuclear Power Infrastructure Development is organized from 10–12 December 2008 in Vienna, with co-sponsorship by the Governments of Canada, China, France, India, Japan, Republic of Korea, Russian Federation and United States of America. This is a continuation of the TM/Wsp’s on nuclear power infrastructure development held in December 2006 and November 2007. The 2008 TM/Wsp on evaluation of infrastructure development will also include special sessions on the NEPIO (the organizations created by a government to study the introduction of nuclear power) experience and on the role of the technology supplier countries.

NE Series Technical Reports

Regarding technical publications, a new NE Series Technical Report on Evaluation of National Nuclear Infrastructure Development Status is available at the Web link http://www-pub.iaea.org/MTCD/publications/PDF/Pub1358_web.pdf.



This publication provides a holistic approach to evaluate progress in the development of the nuclear power infrastructure based on the IAEA guidance laid out in the publication NG-G-3.1 Milestones in the development of a National Infrastructure for Nuclear Power.

The following NE Series Technical Reports are in advanced development and planned to be finalized during 2008:

- Improving the Prospects of Financing Nuclear Power Projects
- Responsibilities and Competencies of a Nuclear Energy Programme Implementing Organization (NEPIO)

Work is going on in the preparation of the following NE Series Technical Reports planned to be finalized during 2009:

- Initiating a nuclear power programme—Responsibilities and capabilities of the owner/operator
- Invitation and Evaluation of Bids for Nuclear Power Plants
- Managing Sitting Activities for Nuclear Installations
- Work force planning for new nuclear power programmes

- Alternative contracting and ownership policies for nuclear power plants

Regarding future technical guidance, there are additional aspects of nuclear infrastructure — beyond those covered in the documents described above — where existing IAEA publications need updating. The target audience is those countries considering the introduction of nuclear power. The planned new or revised publications for 2008 and 2009, beyond those described above, will cover the following:

- industrial capacity and availability in light of the expected growth in nuclear energy,
- infrastructure issues related to transportable or non-stationary reactors,
- infrastructure issues related to alternative contracting and ownership policies.

Recognizing the number of Member States that plan to order their NPPs in the near future, special focus will also be given to increasing advice on infrastructure preparation needs during the phase following the agreement of a contract for the first NPP. Specific guidance based upon recent international experience will be developed to help effective management and implementation of the phase of NPP construction and commissioning.

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Site Selection and survey for building Nuclear Power Infrastructure

Within the framework of the Technical Cooperation Project ALG/0/013 — Sustainable Energy Development and Preparation for Nuclear Power, a workshop on site survey and evaluation was held from 6 to 10 July 2008 at Alger, Algeria. The objective of this workshop was to provide advice and guidance that will help to (i) identify key issues that might affect decisions on the suitability of a site for new nuclear installations, (ii) establish appropriate organization and management structure for siting activities, and (iii) establish the basis for the control and verification of activities affecting quality of the survey and the selection of nuclear power infrastructure sites in Algeria.

This siting training event addressed all related areas in an integrated manner through addressing issues (i) that are concerned with the technical and socio-economic feasibility and minimizing the cost, (ii) related to the potential risks to the population and the environment, and (iii) that are more political and/or subjective such as public opinion and stakeholder involvement, availability of land and land use, political aspect, legal etc.



Workshop participants in Algiers, Algeria, 06–10 July 2008

Along the line, the increased demand for assistance on site survey and evaluation and the need to further provide improved materials and documentation to Member States, have urged NEPS to initiate the development of a guidance report on managing siting activities. The above publication will address activities related to feasibility and infrastructure development on siting for nuclear power plants. In this connection, a NE Series document on Managing Siting Activities for Nuclear Power Installations is under preparation and is expected to be published in 2009.

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Human Resource Development

Nuclear Societies Supporting Human Resource Development

Reliable supply of qualified and motivated workforce is a critical issue for the entire nuclear sector; and that is why many international and national entities support the development of human resources for the nuclear field. In particular, national nuclear societies pay attention to this. For example, the American Nuclear Society addresses human resource issues at its gatherings, and runs the special conference on nuclear training and education (CONTE) where the IAEA staff regularly present papers. Recently — in September and October 2008 — the Russian and Ukrainian national nuclear societies also conducted their conferences specifically dedicated to the human resources for the nuclear field, including education, training and nuclear knowledge management. The IAEA Nuclear Energy Department staff Alexey Kazennov and Andrey Kosilov presented there information on the world-wide developments and on the IAEA activities in these subject matter areas. Related material may be found in the ENTRAC <http://entrac.iaea.org> Library.

An Interesting Learning Initiative

How it is important to provide an opportunity for the particular people from the nuclear power plants to see other sites and to learn how their colleagues are working.

From 4 to 23 October 2008 a group of Russian nuclear power industry representatives undertook an auto touring across Europe visiting nuclear power plants and regulatory bodies, participating in the meetings and technical seminars in Russia, Finland, Sweden, Germany, Czech Republic, Hungary and Lithuania. It was an excellent exercise for exchange of experience, benchmarking, learning from others and establishing relationships. They have also visited the IAEA Headquarters, where the Nuclear Energy Department staff Alexey Kazennov and Andrey Kosilov acquainted the visitors with the status and developments in the field of nuclear power and specifically in the areas of human resource development and nuclear knowledge management that were the subjects of special interest for the guests from Russian NPPs.



From Temelin through the IAEA to Paks

Visit ENTRAC : <http://entrac.iaea.org>.

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Coordination of the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)

Common User Considerations

Between September 22nd and 25th 2008, INPRO organized the second 'Common User Considerations' (CUC) workshop. The workshop was attended by 54 participants from 43 countries and 2 international organizations (around 20 of them participated to the first CUC workshop in November 2007).

The CUC activity is a 2 year activity finishing at the end of 2008. The objectives of the CUC activity are to identify needs and concerns from developing countries and possible actions by Technology-Users (TU) and Technology-Holders (TH) for development and deployment of new energy systems in these developing countries.

In 2007 (Stage 1) the INPRO team established the draft CUC that were reviewed and agreed by the participants of the 1st CUC workshop.



Workshop participants, 22-25 September 2008, Vienna Austria

In 2008 (Stage 2), the INPRO team refined some of the common user considerations related to safety regulation and licensing, cost information, optimization of resources, 'proven-ness' of technology and standardization. The participants to this 2nd CUC workshop reviewed and discussed these topics and provided recommendations on future possible actions by Technology-Users and Technology-Holders to address them. The participants from both TU and TH countries emphasised the benefits of early and quality dialogue and discussed the conditions under which such dialogue and joined actions related to innovative technologies could be continued under the umbrella of INPRO, in synergy with other existing related IAEA activities and international initiatives.

CUC report for Stage 1 (NE Series report NP-T.2.1) is in the process of being published. The report on CUC Stage 2 activities is planned to be published first half of 2009.

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INPRO at the General Conference

The General Conference, in its 52nd session in September 2008, reiterated its recognition of the unique role the IAEA can play through the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) in nuclear technology innovation, and calls upon the IAEA to strengthen its effort in this area (General Conference resolution GC(52)/RES/12). This resolution was initially adopted in 2000 and reiterated annually since then.

The main message continues to be on the need to foster the development and deployment of innovative nuclear technology and on accompanying institutional innovation. The message was highlighted in this year's resolution, which specifically recommended that INPRO continue and initiate activities aimed at identifying and facilitating development and deployment, including capacity building, of innovative reactor technologies and fuel cycle options. It also acknowledges that innovation

in technologies may lessen infrastructure requirements on the part of potential technology users in developing countries. Also recognized is the need to have dialogues between these potential users and the holders of nuclear technology to address innovative institutional and infrastructural issues, as part of the effort to foster the development of innovative nuclear technology.

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General Conference Scientific Forum and INPRO

'The envisaged renaissance depends very much on the success of international cooperation and approaches, and thus on the IAEA.'

R. Lubbers, Chair, Scientific Forum of the General Conference 2008

Innovation in nuclear technology and thus INPRO topics were also discussed prominently at the Scientific Forum of the General Conference. The Scientific Forum, traditionally featuring one guiding theme each year, addressed 'The Role of the IAEA' in four topical sessions. Peter Gowin, Scientific Secretary of Session 1 on 'Nuclear Energy: The Role of the IAEA in Meeting Energy Needs': 'The first session explored future roles of the IAEA to support Member States in meeting energy needs through nuclear technology in the coming decades. It addressed the expected role of the IAEA in the contexts of expected energy demand and climate change concerns, desirable innovations in nuclear energy technology, support to newcomer countries to build new nuclear programmes, infrastructure and capacity, nuclear energy sustainability and multinational fuel cycle approaches.'



Opening Session of the Scientific Forum.

From left to right: J. Bouchard (France, Chair of Session 1), P.J. Gowin (IAEA, Scientific Secretary of Session 1), R. Lubbers (The Netherlands, Chair of the Scientific Forum) and M. ElBaradei (IAEA Director General).

The Scientific Forum was chaired by the Hon. Ruud Lubbers from the Netherlands; speakers included Mr Jacques Bouchard from France (chair of Session 1), Mr Kritayakirana Kopr from Thailand, Mr Vladimir Asmolov from the Russian Federation, Mr Roberto Cirimello from Argentina and Mr Helmut Engelbrecht from the U.K. Ruud Lubbers, in his report to the plenary

session of the General Conference, named five points that are all of relevance to INPRO:

'To sum up, let me reiterate those five items which were the most relevant messages that we heard in the course of this Scientific Forum and which are vital from the point of view of the IAEA's dual mission for development and security:

1. The nuclear landscape is changing. In modern organizations there is no success without a strategic framework, where a shared vision is a critical focal point giving shape and direction to the organization's future. The world needs the IAEA to plan to stay ahead of the curve and should provide it with the required mandate, strengthened capabilities and necessary resources.
2. The IAEA needs to provide more technical assistance to individual Member States, working through the transfer of technology, decision making support, planning tools, capacity and knowledge building and R&D coordination.
3. The IAEA needs to work towards enhancing acceptability, accessibility and affordability of nuclear technologies for development.
4. The IAEA needs to make sure that all existing and planned nuclear installations respect safety, security and safeguards requirements.
5. The IAEA needs to be the place in the world where technical visions are shared and — hopefully — harmonized to build one nuclear future that the world creates jointly.'

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Technology Development for Water Cooled Reactors

John Cleveland Retires

After 16 very productive years with the Nuclear Power Technology Development Section, Mr. John Cleveland retired at the end of October 2008. John initially coordinated the Gas Cooled Reactors Project, and then, in 1996, became the Technical Head of the Water Cooled Reactors Group. John's vision and expertise have been instrumental to building a widely renowned program that fosters information exchange and collaborative research and development in the area of advanced water cooled reactor technologies needed to meet the increasing energy demands of the world in a sustainable manner. Under John's leadership, the important advising role of the Light Water Reactors and Heavy Water Reactors Technical Working Groups flourished, resulting in many relevant initiatives and publications. While John's

guidance and insight will be sorely missed, we all wish him the best in his well deserved retirement.

Starting November 1st 2008, Dr. Sama Bilbao y León (S.Bilbao@iaea.org) becomes the new Technical Head of the Water Cooled Reactors Group.



John Cleveland(second from left) with his colleagues at a farewell party, 16 September 2008, Vienna Austria

International Collaborative Standard Problem (ICSP) on Heavy Water Reactor Thermal-hydraulic Code Validation with SBLOCA Experimental Data

Accurate prediction of system thermal-hydraulic behaviour expected to occur during the accident transient is very important for safety analysis of nuclear power plants. Most internationally recognized computer codes used for Light Water Reactors (LWRs) have been subjected to systematic validation procedure through a number of international programmes. The ICSP to validate thermal-hydraulic computer codes for Heavy Water Reactor (HWR) systems have been conducted under the auspices of IAEA. The objectives of this ICSP are to improve the understanding of important phenomena expected to occur in SBLOCA transients, to evaluate code capabilities to predict these important phenomena, their practicality and efficiency, by simulating an integrated experiment, and to suggest necessary code improvements or new experiments to reduce uncertainties.

AECL committed to provide the experimental data collected from the RD-14M experiment for a SBLOCA scenario. RD-14M is an 11 MW, full-elevation-scaled thermalhydraulic test facility possessing most of the key components of a CANDU primary heat transport system. The facility operates at typical CANDU primary system pressures (up to 10 MPa) and temperatures (up to 310°C). Two RD-14M SBLOCA experiments were selected for blind calculations. Test B9006 was a 7-mm Inlet Header SBLOCA which credited high and low pressure emergency core coolant injection, power reduction to decay power level at 0.6s after break (simulation of reactor trip), exponential pump rundown simulating loss

of class IV power, linear secondary pressure ramp simulating opening MSSVs. Test B9802 was a 3-mm Inlet Header SBLOCA representing very small break LOCA. Emergency core coolant injection was not credited and no pump ramp and no secondary pressure ramp were assumed.

Organizations and computer codes participating in the ICSP include CNEA/Argentina — CATHENA, AECL/Canada — CATHENA, Tsinghua Univ./China — CATHENA, AERB/India — RELAP5, NPCIL/India — ATMIKA, KINS/Rep. of Korea — MARS-KINS, KAERI/Rep. of Korea — CATHENA, CNE PROD/Romania — CATHENA. The second meeting was held at Winnipeg, Canada in August 2008. The results of steady state calculations were presented and compared by participants. Common ground rules for blind calculation such as initial and boundary conditions were discussed. Participants had also the chance to observe the RD-14M experimental facility and it was very helpful for participants to understand and model the experimental facility.

Workshop on Best Practices for Heavy Water Reactor Operation

Heavy water reactors are the second most common type of nuclear reactor installations in the world, second only to Light Water Reactors. Member States operating Heavy Water Reactors are interested in exchanging information with other experienced operators to improve the performance of their own reactors. The Technical Working Group on Advanced Technologies for Heavy Water Reactors (TWG-HWR), which is a part of the IAEA Department of Nuclear Energy, proposed this activity to share best practices on Heavy Water Reactor operation.

A workshop on the best practices for heavy water reactor operation was organized in September 2008 with support from IAEA Department of Technical Cooperation. Toronto of Canada was selected as the venue for the workshop to facilitate the participation from Canadian utilities since Canada has the most HWR operational experience and several utilities. It was expected that Member States would benefit from the workshop through performance improvements of currently operating Heavy Water Reactors and enhancement of new reactor designs.

The purpose of the workshop was to share best practices on the operational experience of heavy water reactors including the following areas:

- Regulatory aspect
- Improvements in performance
- Reduction in operation and maintenance costs

- Reduction in occupational dose exposure.

The message from the presentations and discussions in workshop could be summarized as:

- Improved technology and understanding create opportunities for improvement.
- Good ideas originate everywhere
- Operational excellence requires an integrated approach.
- We must identify and understand the challenge before we can solve it.
- Developing the business case for change is part of the improvement process.
- Training should never stop since human performance is critical.



Workshop participants, September 2008

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IAEA Course on Natural Circulation Phenomena and Modelling in Water Cooled Nuclear Power Plants, San Piero a Grado (Pisa), Italy, 22 to 26 June 2009

The University of Pisa will host the IAEA Course on Natural Circulation Phenomena and Modelling in Water Cooled Nuclear Power Plants at San Piero a Grado (Pisa), Italy on 22 to 26 June 2009. Detailed course information and application method is available from the following website;

http://www.grnspg.ing.unipi.it/natural_circulation

Passive safety systems based on natural circulation are key to several evolutionary water-cooled designs and many innovative water-cooled reactor designs. Some designs also utilize natural circulation to remove core heat during normal operation.

The IAEA fosters international cooperation in examining natural circulation for removal of core heat under normal operation and accident conditions, and to provide cooling of the containment. Several organizations worldwide are collaborating in an IAEA Coordinated Research Programme on 'Natural Circulation Phenomena, Modelling and Reliability of Passive Systems that Utilize Natural Circulation'. This activity is building on other recent IAEA activities on passive safety systems,

thermo-hydraulic relationships and experimental tests and qualification of analytical methods to address thermo-hydraulic phenomena, and valuable information from research projects on natural circulation and passive system reliability within the European Commission is being contributed.

This Course on Natural Circulation Phenomena and Modelling in Water-Cooled Nuclear Power Plants utilizes information, results and expertise shared through these various activities, and especially the current IAEA Coordinated Research Programme on 'Natural Circulation Phenomena, Modelling and Reliability of Passive Systems that Utilize Natural Circulation'.

The objectives of the Course are to provide participants with instruction on:

- Natural circulation during reactor start-up and operation, methods of analyses and governing equations, passive system initiation and operation, flow stability, scaling laws for experiments;
- Phenomena that influence natural circulation (e.g. behaviour in large pools of liquid, effects of non-condensable gases on condensation heat transfer; condensation on containment structures, behaviour of containment emergency systems, thermo-fluid dynamics and pressure drops in various configurations, steam-liquid interaction, gravity driven cooling, liquid temperature stratification, behaviour of emergency heat exchangers and isolation condensers, stratification and mixing of boron);
- Experimental databases for these phenomena;
- Methodology for determining the reliability of passive systems that utilize natural circulation.

Opportunity to Participate in the IAEA ICSP (International Collaborative Standard Problem) on Natural Circulation Stability and Accident Behaviour in Integral PWR

A new IAEA ICSP (International Collaborative Standard Problem) on 'Integral PWR Design Natural Circulation Flow Stability and Thermo-hydraulic Coupling of Primary System and Containment during Accidents' has been prepared as a follow-up to the CRP on 'Natural Circulation Phenomena, Modelling and Reliability of Passive Systems that Use Natural Circulation'. The specific objectives of the ICSP are:

- Compare best-estimate computer code calculations to experimental data from integral test for integral type reactor
- Improve the understanding of thermal-hydraulic phenomena expected to occur in normal operation and transients in integral reactors

- Evaluate the capability of computer codes to adequately predict the occurrence of important phenomena, and the corresponding behaviour of nuclear systems during operating, upset and accident conditions, which are represented in experiments.

Oregon State University (OSU) of USA has offered their experimental facility, and several organizations have indicated their interest in this ICSP. The scope includes two types of experiments:

- 1) Single and two phase natural circulation flow stability test with stepwise reduction of primary inventory, and
- 2) Loss of feedwater transient with subsequent ADS blowdown and long term cooling by primary-containment coupling.

The experiments are scheduled to start in 2009 at Oregon State University. Participating organizations will perform blind and post-test simulation for experiments with their own computer codes. IAEA encourages the relevant organizations of Member States to participate in this ICSP to evaluate their computer codes. The Application for participation will be closed on 31 January 2009. The first Workshop is scheduled on 2 to 5 November 2009 at OSU, USA.

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Activity on Advanced Nuclear Power Plant Construction Technologies

Two of the primary drivers of plant cost are the cost of financing and the cost of skilled labour during the planned construction schedule. If the construction schedule can be reduced, the cost of construction will, in turn, be lowered. The initial construction techniques of nuclear power plants were adopted from fossil power plant construction experience in the industrialised countries. However, considerable development and improvements have been achieved in this area since the first nuclear power plants have been constructed. The development was primarily driven by the need to respond to new regulatory requirements and quality assurance concepts, such as licensing, safety classification, document control, quality assurance, and the preparation of safety analysis reports and other regulatory documents. The simplified, efficient and cost effective means of designing and constructing nuclear power plants are key factors in improving the quality and reducing the construction schedules and costs of the plants.

Currently, work is ongoing in different Member States to develop various techniques to improve the plant design, ensure the quality of the construction, and to reduce the construction period. The IAEA Nuclear Power

Technology Development Section (NPTDS) is embarking on an activity to develop a document on nuclear power plant construction activities through assimilating knowledge on advanced construction technologies that could be used to carry out these activities and reduce the construction costs and schedule time line for future nuclear power plants. The document is expected to incorporate insights from a variety of technology improvement programs, consequently consolidating global experience

To kick-start the process, the first consultants meeting was organized in Vienna on 9–10 October 2009, with an objective to formulate a detailed table of activities during NPP construction and to consolidate information on different construction technologies, as a starting point to the ultimate document on Advanced Nuclear Power Plant Construction Technologies which is envisaged to be produced towards the end of 2009. Five participants from four Member States (India, South Africa, Republic of Korea and the USA) participated in the meeting. The Member States who participated in the meetings showed that different advanced construction technologies are either planned for use or have already been used in their countries, for example, modularization has been successfully used in different NPP construction projects in the Republic of Korea, the PBMR in South Africa is also considering slip forming and massive modularization for the PBMR demonstration plant, India has used the open-top installation of heavy components for their recent NPP construction projects etc. A consolidation of these experiences and lessons learnt from them will provide a good information source for Member States planning on building new NPPs and this is the main motivation for initiating this activity.

A very good basis for the activity was formulated at the meeting and plans for future activities were developed. It is envisaged participants from construction companies as well as nuclear power plant vendors and other non-nuclear large build projects will be invited to participate in subsequent meeting and in the review of the draft document to be produced.

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Technology Advances in Fast Reactors and Accelerator Driven Systems

The areas of collaboration between Member States are identified by the Member States through participation in the IAEA Nuclear Energy Department's Technical Working Group on Fast Reactors (TWG-FR). The TWG-FR assists in defining and carrying out the IAEA's activities in the field of nuclear power technology development for fast neutron systems. It promotes the

exchange of information on national and multi-national programs and new developments and experience, with the goal of identifying and reviewing problems of importance and stimulating and facilitating cooperation, development and practical application of fast neutron systems. The following summarizes recent progress and plans.

The 41st Annual Meeting of the Technical Working Group on Fast Reactors (TWG-FR) was held from 26–29 May 2008 in Vienna at IAEA Headquarters. The meeting participants exchanged information on the national fast neutron system programmes, reviewed the status of the ongoing joint activities, and discussed possible future (2009 and beyond) joint activities.

The Project convened three Research Coordination Meetings (RCMs): the 2nd RCM of the CRP on ‘Analyses of, and Lessons Learned from the Operational Experience with Fast Reactor Equipment and Systems’ (Vienna, 20–23 May 2008), and the two kick-off RCMs of the CRPs on ‘Benchmark Analyses of Sodium Natural Convection in the Upper Plenum of the MONJU Reactor Vessel’ (Vienna, 22–24 September 2008), and on ‘Control Rod Withdrawal and Sodium Natural Circulation Tests Performed During the PHENIX End-of-Life Experiments’ (Vienna, 24–26 September 2008). The first RCM reviewed progress of the CRP tasks and updated the corresponding work plans, milestones, and deadlines. The two kick-off RCMs discussed and agreed on the respective collaborative R&D topics, work packages, detailed tasks, work plans, responsibilities, milestones and deadlines.

As part of its educational and information exchange activities, the Project gave a lecture on the status of advanced fast neutron systems research and technology development (Joint ICTP-IAEA Workshop on Nuclear Reaction Data for Advanced Reactor Technologies, Trieste, Italy, 19–30 May 2008).

At PHYSOR 2008 (Interlaken, Switzerland, 14–19 September 2008), the Project presented the paper ‘IAEA coordinated research project (CRP) on ‘Analytical and experimental benchmark analyses of accelerator driven systems’’ which summarized the preliminary results obtained for some of the benchmarks performed within the framework of the CRP.

The Project collaborated with OECD/NEA in the ‘Tenth Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation’, hosted by the Japan Atomic Energy Agency (Mito, Japan, 6–10 October 2008) and presented the paper ‘IAEA Activities in the Area of Partitioning and Transmutation’ in the opening plenary session. The meeting highlighted the relevance of the development of the fast reactor and of

full recycling of plutonium and (some) minor actinides for the P&T option.

The Project convened the topical Technical Meeting (TM) on ‘Design Features of Advanced Sodium Cooled Fast Reactors with Emphasis on Economics’ (Vienna, 20–23 October 2008). The participants discussed various options for, and results obtained within national research and technology development programs aiming at enhancing the competitiveness of fast reactor concepts. Based on the contributions presented at the TM, the Project will prepare a technical document.



20 MWe China Experimental Fast Reactor (CEFR), first criticality planned for 2009 (courtesy of CIAE)

Among the planned near term activities, it is noteworthy to mention two upcoming Consultants Meetings: the first one (Vienna, 3–4 November 2008) being the ‘First Meeting of the International Advisory Committee (IAC) to prepare IAEA’s International Conference on Fast Reactors and Related Fuel Cycles—Challenges and Opportunities (to be held in Kyoto, Japan, 7–11 December 2009)’, and the second one (in collaboration with INIS NKM, Vienna, 17–20 November 2008) to ‘Coordinate the IAEA Fast Reactor Knowledge Preservation Initiative’. Finally, before the end of the year, the Project is convening a topical TM on ‘Fuel Handling Systems of Sodium Cooled Fast Reactors’ (hosted by the Indira Gandhi Centre for Atomic Research, Kalpakkam, India, 24–27 November 2008).

Visit:

<http://www.iaea.org/inisnkm/nkm/aws/fnss/index.html>.

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Common Technologies and Issues for Small and Medium Sized Reactors

Nuclear Energy Series report on Design Features to Achieve Defence in Depth in Small and Medium Sized Reactors

A new Nuclear Energy Series report titled ‘Design Features to Achieve Defence in Depth in Small and

Medium Sized Reactors' has been approved for publication by the IAEA Publications Committee. The objectives of this report are, inter alia, to assist potential users of innovative SMRs in their evaluation of the overall technical potential of SMRs with passive safety design features, including their possible impacts in areas other than safety and to present the approaches for implementation of the defence in depth strategy in such reactors in line with the definitions and recommendations of IAEA Safety Standards Series No. NS-R-1. Structured descriptions of safety design concepts/features for 11 advanced SMR concepts, representing 5 reactor lines, have been collected from 8 Member States, and summary chapters were prepared by the secretariat and thoroughly reviewed by all contributors in member states and in the house. The preparation of this report, which previously had a working title 'Passive Safety Design Options for SMRs', was mentioned with satisfaction in the IAEA General Conference resolution GC(51)/RES/14/B2(k) of September 2007.

CRP on Small Reactors without On-site Refuelling

The CRP 'Small Reactors without On-site Refuelling' is in its last, fourth year with 16 participating institutions from 9 member states. The research topics include development and application of a risk-informed methodology to justify reduced off-site emergency planning for innovative SMRs, benchmarking for whole core depletion models of lead-bismuth cooled reactors, benchmarking for cells and fuel assemblies of light water reactors with coated particle based fuel, data and information exchange regarding fuel and coolant properties and progress in design development for the SMR concepts addressed, and inter-regional and intra-regional scenario studies for energy systems with small reactors without on-site refuelling. Upon an arrangement with the NEA OECD, several participants of this CRP from non-OECD countries participate in a benchmarking exercise for natural circulation of lead-bismuth coolant based on the tests performed in the HELIOS loop at the Seoul National University (the Republic of Korea). The final research coordination meeting for this CRP will be convened on 3–6 November 2008, in Vienna. For this meeting, a final draft of the CRP report chapter 'Revising the Need for Relocations and Evacuation Measures Unique to NPP with Innovative SMRs' was submitted (see Fig. 1), and well as several other materials for the final CRP report. An updated Web page of the CRP is at: <http://www.iaea.org/NuclearPower/SMR/CRP1/>.

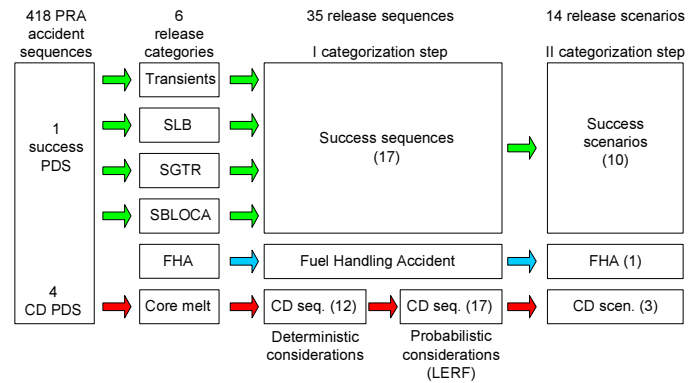


Fig. 1. Accident Sequence Re-categorization Summary Schematic
CRP on Development of Methodologies for the Assessment of Passive Safety System Performance in Advanced Reactors

A CRP entitled 'Development of Methodologies for the Assessment of Passive Safety System Performance in Advanced Reactors' (2008–2011), the detailed programme of which has been approved earlier this year, is finalizing the collection and evaluation of the applications for research agreements and research contracts. This project has the objective to determine a common analysis-and-test based method for reliability assessment of passive safety system performance. Such a method would facilitate application of risk-informed approaches in design optimization and safety qualification of the future advanced reactors, contributing to their enhanced safety levels and improved economics. The CRP is conducted in cooperation with the Technical Working Groups on Advanced Light Water Reactors and Fast Reactors of the Department of Nuclear Energy and the Safety Assessment Section of the IAEA's Department of Nuclear Safety and Security. By November 2008, seven research agreements and contracts were granted to participants from Argentina, France, India, Italy, the Russian Federation, and the USA and discussions the evaluation process is progressing with several other targeted participants. The first research coordination meeting is scheduled for 24–27 March 2009. More details on this CRP and application procedures is at: <http://cra.iaea.org>.

A new Nuclear Energy Series Report 'Approaches to Assess SMR Competitiveness' is under preparation, which has the objectives to assist potential customers in their assessment of technical and economic performance of SMRs and to provide a framework to assist potential stakeholders in the definition of a competitive strategy regarding design and deployment of SMRs. The report, which is prepared in cooperation with the IAEA's Planning and Economic Studies Section is to be submitted for publication by the end of 2008.

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Technology advances for gas cooled reactors (GCRs)

Gas cooled reactor technology development activities within the Nuclear Power Technology Development Section (NPTDS) are overseen by the Technical Working Group on Gas Cooled Reactors (TWG-GCR). The TWG-GCR provides a forum from which to review national and international gas cooled reactor (GCR) programmes and advise the IAEA on GCR related activities. Through different collaborative activities, a review of proven technologies as well as an improvement on them is gradually yielding gainful benefits on safety and economics of GCRs to all Member States.

A number of activities are currently underway or planned within the Nuclear Power Technology Development Section (NPTDS) to address technological challenges as well as economics for gas-cooled reactors (GCRs):

Technical Meeting on HTGR Economic Analysis

The IAEA Technical Meeting on HTGR Economic Analysis was organized to take place immediately after the HTR 2008 Conference in Washington D.C. USA, on 02–03 October 2008. This Technical Meeting was in response to the recommendations made by the Technical Working Group–Gas Cooled Reactors (TWG-GCR) at its meeting held in January 2007 and was also a follow-up of the Technical Meeting on HTGR Economics Analyses–G4ECONS Training Workshop which was held in Vienna in July 2008. The purpose of this Washington D.C. meeting was to:

- Follow-up on the use of G4ECONS software by Member States and to receive feedback on the capabilities of this tool
- Create an opportunity and insight into similar software and methodologies other than G4ECONS used in HTGR economics modelling
- Create a broader platform for institutions and organizations in Member States involved in economics modelling of advanced reactor systems to enable them to share their experiences, challenges and to propose solutions to such challenges

Nine participants from five Member States (USA, South Africa, Indonesia, Republic of Korea and the Netherlands) attended the meeting. Participants discussed the issue of cost estimation by using material quantities such as steel and concrete as these are major materials in construction of nuclear power plants. A point was made that the quantities of these materials may look massive but the costs associated with these commodities is quite small. The major part of the cost comes from value added activities such as how concrete

is poured, how steel is manufactured etc. Member States expressed their interest in using the GIF G4ECONS not only as a scoping tool but to the extent where it can be used for making decisions. Accordingly, the capabilities of G4-ECONS will be modified to be able to do a direct comparison between costs for NPP as well as other sources, e.g. fossil, wind, solar etc without major effort. Furthermore, the code will be extended to include financial analysis so that it can be of much value to decision makers regarding investment decisions.



Participants at the IAEA Technical Meeting on HTGR Economic Analysis, 02–03 October 2008, Washington, D.C., USA

Member States also expressed the need for the IAEA to produce a publication which can be used by IAEA Member States to assess the viability of HTGRs in terms of economic performance by looking both into electricity production as well as process heat applications. Such a document can be very useful in identifying the costs drivers and also presenting different scenarios and sensitivity studies. The contents of such a document are still under discussions and consultation with Member States will continue, culminating in the drafting of that document in 2009.

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Non Electrical Applications of Nuclear Power

Meeting on Status of Hydrogen Production

Nuclear energy can play a significant role in hydrogen production. The current annual worldwide hydrogen production amounts to more than 50 million tons. Today, hydrogen demand is mainly satisfied by the use of steam methane reforming. In future, several highly promising applications of hydrogen are expected to grow further such as the fertilizer industry, petrochemicals, transportation, pharmaceutical, iron production and other chemical industries. As hydrogen demand is growing globally, hydrogen economy is poised to become a reality. Hydrogen uses in transportation (fuel cells or

synthetic fuel) is expected to represent the major part of this growth. Nuclear hydrogen production could be a suitable candidate to replace current fossil fuel-based processes and reduce GHG effects.



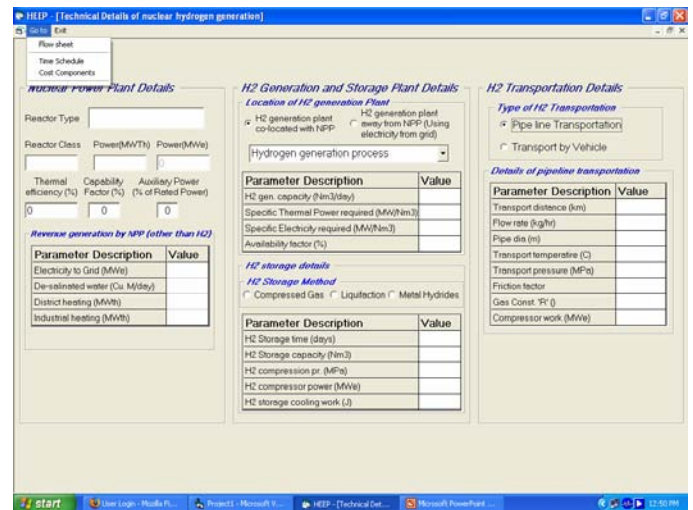
Meeting participants

Hydrogen generation by combining nuclear reactors with Solid Oxide Electrolysis Cells (SOEC) utilizing High Temperature Steam Electrolysis (HTSE) has been demonstrated. However, improvement in materials is required for long-term operation, and cost optimization. Several thermo-chemical cycles such as S-I, Hy-S, and Cu-Cl are being evaluated around the world for their technical and economic viability and appear to be promising. Scale up of these processes requires international collaboration. Safety and coupling issues will depend on both reactor designs and H- production processes. Licensing issues will be of importance for any specific coupling schemes. Safety assessment (e.g. transients and failures of one system and its effect on the other system, risks of H-explosions, radiological and chemical risks, etc.) for the overall coupling is also of importance.

The meeting provided an opportunity for the participants from Member States to exchange information and share experience on nuclear hydrogen activities and perspectives.

Expected Release of the First Version of HEEP

The development of the IAEA Hydrogen Economic Evaluation Programme (HEEP) software is progressing well and significant milestones have been achieved. Expected date for the release of the first version of HEEP is end of January, 2009. From economics perspective, HEEP will be utilized for the evaluation and comparison of various hydrogen-producing technologies. HEEP code has three major modules viz. A FORTRAN based model carrying out economic analysis, a Microsoft Visual Basic based graphical user interface, and the Results module for post processing and display of the results in the forms of graphs, charts etc.



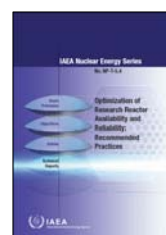
HEEP software

Contact: I.Khamis@iaea.org.

New NE Series Publications Now Available

Over the past several months, the IAEA Nuclear Energy Series (NES) has published a number of new technical Reports that are now available on our web site as downloadable PDF files or for purchase in hard copy format. These recent reports provide detailed background information on specific nuclear energy topics and benefit both Member States without developed nuclear programmes and those with a full infrastructure. NES publications cover a wide range of issues, from information on the establishment and evaluation of nuclear programmes to improving the efficiency of existing programmes. Find these and other NES publications and supporting documents at: <http://www.iaea.org/OurWork/ST/NE/NESeries/ClickablMap/> :

Optimization of Research Reactor Availability and Reliability: Recommended Practices (NP-T-5.4)



draws upon data from heavily utilized research reactors of diverse sizes and usage, and provides information on specific operations and maintenance practices and programmes directed towards optimization of reactor performance.

The Role of Instrumentation and Control Systems in Power Upgrading for Nuclear Power Plants (NP-T-1.3)

addresses the role of I&C systems in nuclear power plant power upgrading projects. It applies to all reactor types and power levels used for commercial power production.

On-line Monitoring for Improving Performance of Nuclear Power Plants, Part 1: Instrument Channel Monitoring (NP-T-1.1) reviews the state of the art in on-line equipment monitoring for nuclear power plant (NPP) applications

On-line Monitoring for Improving Performance of Nuclear Power Plants, Part 2: Process and Component Condition Monitoring and Diagnostics (NP-T-1.2), the second report on the use of on-line monitoring (OLM) in nuclear power plants (NPPs), extends the application of OLM to equipment and process condition monitoring, encompassing an array of technologies.

Evaluation of the Status of National Nuclear Infrastructure Development (NG-T-3.2) provides a holistic approach to evaluate progress in the

development of the nuclear power infrastructure based on the IAEA *Milestones* publication. (Read more on page 9.)

Heavy Component Replacement in Nuclear Power Plants: Experience and Guidelines (NP-T-3.2) focuses on heavy components replacement considered strategic for nuclear power plant life management but not included in current maintenance activities carried out by utilities.

Financing of New Nuclear Power Plants (NG-T-4.2) addresses the issues associated with the financing of new nuclear power plants.

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Meetings in 2009

Start Date	End Date	Title	Location	Country
26-Jan-09	30-Jan-09	RCM on Analytical and Experimental Benchmark Analyses of Accelerator Driven Systems	VIC	Austria
10-Feb-09	13-Feb-09	Technical Working Group on Gas-cooled Reactors (TWG-GCR)	VIC	Austria
25-Feb-09	27-Feb-09	RCM on Benchmarking Severe Accident Computer Codes for Heavy Water Reactor Applications	VIC	Austria
25-Feb-09	27-Feb-09	14th INPRO Steering Committee Meeting	VIC	Austria
03-Mar-09	06-Mar-09	TM on non-electric applications of nuclear energy	Daejeon	Korea, Republic of
16-Mar-09	18-Mar-09	Technical Working Group on Life Management of NPPs (TWG-LMNPP)	VIC	Austria
17-Mar-09	19-Mar-09	TM on Workforce Planning to Support New Nuclear Power Programmes	VIC	Austria
24-Mar-09	27-Mar-09	RCM on Development of Methodologies for the Assessment of Passive Safety System Performance in Advanced Reactors	VIC	Austria
01-Apr-09	03-Apr-09	Standing Advisory Group on Nuclear Energy	VIC	Austria
14-Apr-09	17-Apr-09	TM on Industrial Capacity Development	VIC	Austria
20-Apr-09	21-Apr-09	International Ministerial Conference on Nuclear Energy in the 21st Century	Beijing	China
21-Apr-09	23-Apr-09	TM/Workshop on Erosion-Corrosion (E/C) including Flow Accelerated Corrosion and Environmentally Assisted Cracking (EAC) Issues in NPPs	Moscow	Russian Federation
21-Apr-09	23-Apr-09	TM on Performance of Test Reactors and Use of Data for Benchmarking	VIC	Austria
20-May-09	22-May-09	Technical Working Group on NPP Control and Instrumentation (TWG-NPPC&I)	VIC	Austria
25-May-09	29-May-09	Technical Working Group on Fast Reactors (TWG-FR)	TBD	TBD
27-May-09	29-May-09	TM on Methods and Experiences of Heavy Component Replacements in NPPs	Lynchburg, VA	USA
02-Jun-09	05-Jun-09	TM on Simulators, Advanced Training Tools and Technologies for the Nuclear Industry	VIC	Austria
08-Jun-09	10-Jun-09	TM of the International Desalination Advisory Group (INDAG)	VIC	Austria
09-Jun-09	11-Jun-09	TM on the Preparation and Evaluation of Bids for NPP Projects	VIC	Austria

Start Date	End Date	Title	Location	Country
22-Jun-09	26-Jun-09	Course on Natural Circulation Phenomena and Modelling in Water Cooled Nuclear Power Plants	Pisa	Italy
23-Jun-09	26-Jun-09	RCM on Analyses of and Lessons Learned from the Operational Experience with Fast Reactor Equipment and Systems	VIC	Austria
23-Jun-09	26-Jun-09	TM to Coordinate Case Studies on Competitiveness of Small and Medium Sized Reactors in Different Applications	VIC	Austria
07-Jul-09	09-Jul-09	RCM on Advances in Nuclear Power Process Heat Applications	VIC	Austria
25-Aug-09	28-Aug-09	RCM on Heat Transfer Behaviour and Thermo-hydraulics Code Testing for Supercritical Water Cooled Reactors	VIC	Austria
12-Oct-09	14-Oct-09	RCM on Benchmark Analyses of Sodium Natural Convection in the Upper Plenum of the MONJU Reactor Vessel	VIC	Austria
12-Oct-09	14-Oct-09	TM on status of H2 production	VIC	Austria
12-Oct-09	14-Oct-09	Advisory meeting with nuclear hydrogen experts	VIC	Austria
12-Oct-09	14-Oct-09	TM on Status of H2 production	VIC	Austria
12-Oct-09	23-Oct-09	Workshop on NPP Simulators for Education	Trieste	Italy
14-Oct-09	16-Oct-09	RCM on Control Rod Withdrawal and Sodium Natural Circulation Tests performed during the PHENIX End-of-Life Experiments	VIC	Austria
12-Oct-09	23-Oct-09	Workshop on NPP Simulators for Education	Trieste	Italy
27-Oct-09	30-Oct-09	International Conference on Opportunities and Challenges for Water Cooled Nuclear Power Plants in the 21st Century	VIC	Austria
27-Oct-09	28-Oct-09	RCM on Advances in Nuclear Desalination Technologies	VIC	Austria
02-Nov-09	06-Nov-09	15 th INPRO Steering Committee Meeting	VIC	Austria
03-Nov-09	06-Nov-09	TM on Options to Enhance Proliferation Resistance and Security of NPPs with Innovative SMRs	VIC	Austria
02-Dec-09	04-Dec-09	TM on NPP Infrastructure Project Review	VIC	Austria
07-Dec-09	11-Dec-09	International Conference on Fast Reactors and Related Fuel Cycles – Challenges and Opportunities	Kyoto	Japan
2nd quarter		Technical Working Group on Light Water Reactors (TWG-LWR)	VIC	Austria
2nd quarter		Technical Working Group on Heavy Water Reactors (TWG-HWR)	VIC	Austria
2 nd quarter		TM on the Country Nuclear Power Profile	VIC	Austria
2nd quarter		TM on Managing Siting Activities	VIC	Austria
2nd quarter		TM on Responsibilities and Competencies of Owner/Operator Organizations	VIC	Austria
3rd quarter		RCM on Advanced Surveillance, Diagnostics, and Prognostics Techniques Used for Health Monitoring of Systems, Structures, and Components in NPPs	Daejon	Korea, Republic of
3rd quarter		TM on Alternative Contracting for and Ownership of NPPs	VIC	Austria
3rd quarter		TM on Improving International and National Infrastructure Arrangements	VIC	Austria
4th quarter		Standing Advisory Group on Nuclear Energy	VIC	Austria
4th quarter		TM on Vendor and User Issues in Planning a Nuclear Power Programme	VIC	Austria
4th quarter		RCM on Conservation and Application of HTGR Technology	VIC	Austria

Start Date	End Date	Title	Location	Country
TBD		TM on the Development Status and Requirements to Advanced Computation Methodologies Using Computation Fluid Dynamics for Single- and Two-phase Coolant Flow	VIC	Austria
TBD		TM on Consideration of Human Factors in Design Optimization of Innovative SMRs	VIC	Austria

Vacancy Notice for Professional Posts

New vacancy notices will be available on the IAEA webpage addressing https://personnel.iaea.org/apps/phflink/p_vacancies.asp.

Applications from qualified women and candidates from developing countries are encouraged.

International Conference on Fast Reactors and Related Fuel Cycles – Challenges and Opportunities

hosted by JAEA in Kyoto, Japan, from 7–11 December 2009

The IAEA is organizing a large International Conference on Fast Reactors and Related Fuel Cycles - Challenges and Opportunities

to be hosted by the Japan Atomic Energy Agency (JAEA) in Kyoto, Japan, from 7–11 December 2009

Renewed interest in nuclear energy is driven by the need to develop carbon free energy sources, by demographics and development in emerging economies, as well as by security of supply concerns. Sustainability requirements (e.g. resource utilization and waste minimization), have lead to reconsider worldwide fast reactors and recycle. For example, four out of the six systems retained by the Generation IV International Forum (GIF) are based on fast neutron core concepts.

In 2009 major events are expected in this respect: the MONJU restart and the CEFR first criticality. By the same token, new fast reactors are expected to be commissioned in the very near future (PFBR, BN-800). Moreover, advanced prototypes and demonstration fast reactors are announced and expected at the horizon 2020–2030.

The necessary condition for successful fast reactor deployment in the near and mid-term is the understanding and assessment of innovative technological and design options, based on both past

knowledge and experience, as well as on ongoing research and technology development efforts. In this respect, the need for in-depth international information exchange is underlined by the fact that the last large international fast reactor conference was held as far back as 1991. The FR09 International Conference aims at promoting the exchange of information on national and multi-national programs. It will provide the adequate forum for presenting new developments and experience gained, with the objective of identifying and critically reviewing problems of importance, as well as stimulating and facilitating cooperation, development and successful deployment of fast reactors.

The Conference will consist of mostly plenary sessions, with some oral presentations scheduled for delivery in parallel sessions

In addition, there will be

- Two panels with the participation of world experts from public and private sectors
- A ‘Young Generation’ event
- And, on the last day, a special session in Tsuruga with a visit to the MONJU site

International Conference on Opportunities and Challenges for Water Cooled Reactors in the 21st Century

October 27–30 2009 Vienna



Water Cooled Reactors have been the keystone of the nuclear industry in the 20th century. As we move into the 21st century and face new challenges, such as the threat of climate change and the large growth in world energy demand, nuclear energy has been singled out as one of the sources that could substantially and sustainably contribute to power the world.

The conference is geared to senior policy-makers and government officials, decision-makers in climate change policy, energy planning and finance, managers and technical experts from nuclear design and research organizations, as well as operating organizations.

Technical Topics

- Challenges and Opportunities to Launch New Nuclear Power Programmes
 - Infrastructure and other considerations to launch a new nuclear power programme
 - Current nuclear power performance and outlook in different Member States
- Design and Construction of Advanced Water Cooled Reactors

- Trends in advanced water cooled reactors design and technology
- Safety objectives and utility requirements for advanced water cooled reactors
- Advanced construction technologies and management approaches
- Safety and Performance Achievement in Existing Water Cooled Reactors
 - Operational experience: Feedback, analysis and lessons learned
 - Optimized maintenance programme
 - Plant uprating, safety enhancements and performance improvements
- Innovative and Advanced Applications of Water Cooled Reactors
 - Transition to future nuclear systems: Fast breeder reactors, Generation IV reactors
 - Application of advanced monitoring, diagnostic, and prognostic systems

Key Deadlines:

- 14 April 2009 : Submission of Extended Synopsis (Electronic Version–800 words)
- 15 July 2009 : Notification of paper acceptance
- 14 August 2009 : Submission of Full papers

Registration

There is no registration fee. Please see the conference web page for the participation form and details for submission.

- Email address for paper submission : awcr@iaea.org
- Register now : All the most up-to-date information about the conference will be posted in the conference web site:
<http://wwwpub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=164>

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INTERNATIONAL MINISTERIAL CONFERENCE

BEIJING • 20 – 21 APRIL 2009



Nuclear Energy in the 21st Century

Addressing Energy Needs and Environmental Challenges

Organized by the



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