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Nuclear Power Newsletter

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http://www.iaea.org/NuclearPower/

Contents

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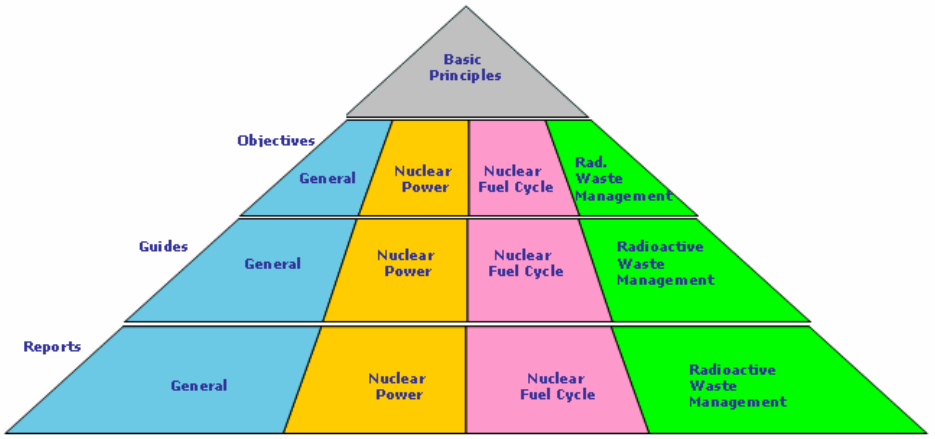
Nuclear Energy Series — Clickable Map to access all the NE Series publications



Clickable map on the IAEA webpage: http://www.iaea.org/OurWork/ST/NE/NESeries/ClickableMap/

The IAEA has implemented a publication series called Nuclear Energy Series (NES. See NENP Newsletter June 2006). The rationale for the development of NES and its review process is to give a visible and clear publication structure, improve credibility. The NE Series provides continuity of publications through an established preparation and review process and provides standard approach to publication preparation.

The Nuclear Energy Series consists of three levels Basic principles and Objectives, Guides and Technical Reports.

The Nuclear Energy Basic Principles publication manifests and describes the rationale and vision for the peaceful uses of nuclear energy.

The Objectives, Guides and Reports in the Nuclear Energy Series are organized into four subject areas: (1) Nuclear General; (2) Nuclear Power: (3) Nuclear Fuel Cycle; and (4) Radioactive Waste Management and Decommissioning.

Nuclear Energy Objectives publications identify the objectives which should be pursued in order to assure that the basic principles are satisfied, and describe what needs to be considered and to be achieved in the subject areas at different stages of implementation.

Nuclear Energy Guides present options and approaches which describe how the objectives relating to the subject areas can be achieved.

Nuclear Energy Reports provide information on technology status, development trends, and technical background, as well as good practices and recommendations within the subject areas.

The structure of the Nuclear Energy Series allows systematic analysis of existing publications and help to identify the gaps and areas not covered. Based on analysis, some of the existing publications (IAEA-TECDOC, Technical Reports Series, etc) will be revised/upgraded and will be integrated into the Nuclear Energy Series, as appropriate.

In order to support the systematic analysis and enable to the structuring of existing and future publications the clickable map was created:

(http://www.iaea.org/OurWork/ST/NE/NESeries/ClickableMap/).

The map consists of more than 1000 existing publications (IAEA-TECDOCs, Technical Reports Series and other publications) produced in the past and contains the published Nuclear Energy Series publication.

With the help of the clickable map the visitors of the web site can find the past publication through the clickable map (see the figure), i.e. identify those publications that belong to a certain area or a topic. With a series of clicks the visitors can find publications of an area or a topic, even the full text (in pdf format) of the publications can be downloaded. It is important to mention that the old publications are not part of the Nuclear Energy Series, but supports the Series and provides background information in each area.

A search engine was also created, which can be reached through the map. It helps to find the existing publications by title, identification code, or by a keyword.

As it was mentioned above the clickable will represent the new publications together with the existing once. At this moment there are two published Nuclear Energy Series publications: A guide on Milestones in the Development of a National Infrastructure for Nuclear Power (NG-G-3.1) and a Technical report on Establishing a Code of Ethics for Nuclear Operating Organizations (NG-T- 1.2). The full text can be also downloaded from the clickable map. Presently there is a large number of publications in preparation: the Basic Principles within the NE Series, the four Objectives (for areas of General, Nuclear Power, Fuel Cycle and Radioactive Waste management), 4 Guides (for the topics of Human resource management, Decommissioning, Radioactive waste management and Nuclear knowledge management) and 72 Technical reports. It is expected that after their approval the majority will be uploaded to the Clickable map in 2008.

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Message from the Director

In 2007, we continued to see rising expectation for nuclear power to meet increased energy needs while paying attention to energy security, environment and soaring fossil fuel prices. During 2007, construction started on seven new plants (Russia 2, Republic of Korea 2, China 2, and France 1), bringing the number of new plants presently under construction to 34. However, considering the history of the number of plants under construction (124 in 1970, 230 in 1980, 78 in 1990), we are far away from a 'renaissance' in the context of new construction. Also, even in countries with ambitious nuclear expansion programmes, the increase in nuclear power generation is far away from stabilizing GHG emissions from the energy sector. During the last year, the IAEA sent integrated missions consisting of experts with different expertise to seven countries which requested assistance from the IAEA in introducing nuclear power. An even larger number of missions have been conducted on specific technical areas such as human resource development, site evaluation, legal and regulatory framework and others in support of introduction of nuclear power.

In early 2008, the Division of Nuclear Power has seen increase in the number of staff including cost free experts in order to enhance our activities in infrastructure building support to countries planning to introduce nuclear power, and to INPRO. INPRO now has 2 dedicated regular staff and 7.5 dedicated cost free experts. Key activities of INPRO in the last three months include a steering committee meeting, preparation of a document on Common User Considerations for publication, several kick-off meetings for collaborative Projects, and others, as reported in this Newsletter. Notably, an interface meeting with the Generation IV International Forum (GIF) in February 2008, attended by more than 20 experts each from GIF and IAEA/INPRO, agreed on extended cooperation.

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NPP Instrumentation and Control Technologies

A consultants meeting was held with the participation of 13 experts at the IAEA headquarters on 11–13 March 2008 to initiate a reference base-document that defines the core knowledge on instrumentation and control (I&C) in general terms, relevant to both operating NPPs and future builds.

Numerous IAEA documents have been prepared describing in detail some of the more important issues with respect to NPP I&C systems. This unifying document intends to place those technical documents within the context of a global view of NPP I&C systems and their lifecycles. The preparation of this document was also driven by a need to have an introductory description of I&C systems which compiles the necessary basic information to understand I&C systems in NPPs. In addition, the significance of I&C systems is emphasized to present an understanding of their importance in almost all aspects of the safe and economical operation of NPPs by pointing to the appropriate IAEA technical documents or other reports that have been prepared to address these issues. Gaps and further needs are identified as well. This document also supports knowledge transfer at an introductory level on the topic of NPP I&C systems, their physical and functional definitions and lifecycles.

This document is prepared for a general audience. The introductory material presents a summary of I&C systems and functions which will be useful to non-experts, while also presenting a concise overview which may be a useful reference for more experienced I&C engineers. This document may present useful information to persons just starting a career in the nuclear industry, or transferring from another industry.

All readers not familiar with IAEA publications in the I&C field may find the literature guide useful not only to learn of the available documents but also how those documents fit into a broad view of I&C systems, their lifecycle, maintenance, and management. Highlighting the significant role of I&C systems in NPP operation may enlighten non-experts as well as provide justification to experienced I&C engineers seeking support to modernize an existing I&C system.

The following items are examples of the areas to be addressed in the document:

- Overview of I&C functions, applications, and systems in NPPs; Categorization and standards for I&C systems;
- Operational, maintenance, and reliability issues of ageing I&C systems;
- Overview of digital I&C technologies available for the NPP industry;
- Replacing analog I&C components and systems with digital ones in operating NPPs;
- Drivers for I&C modernization projects;
- Preventing software common-cause failures that can potentially disable multiple lines of defence;
- Human factors and reliability; hybrid main control rooms and human system interface technologies;
- Cyber security of digital I&C;
- On-line monitoring for improving NPP performance, including monitoring and diagnostics of instrument channels, processes, and components;
- Implementing and licensing digital I&C systems and commercial-off-the-shelf components in NPPs.

Meeting participants 11–13 March 2008, Vienna, Austria

The IAEA has initiated a new Coordinated Research Programme (CRP) on Advanced Surveillance, Diagnostics, and Prognostics (SDP) Techniques Used for Health Monitoring of Systems, Structures, and Components in NPPs. The project identifies research required in the fields of on-line monitoring, diagnostics, and performance prediction including data acquisition, processing and analysis techniques, integration, overall system operation and maintenance. Emphasis is given to (1) increased SDP needs in existing NPPs arising from power uprates and license renewals and (2) built-in SDP capabilities in new NPP designs. The technical subject of the CRP was identified by the TWG-NPPCI as an area of high importance.

The scope of the CRP includes methods and systems used in the field of reactor noise analysis, on-line monitoring, and diagnostics. Research activities focus on the development and applications of the following areas:

- Detecting and characterizing core instabilities and estimating reactivity feedback coefficients;
- Measurement of vibration of core internals: detector tubes, fuel assemblies, and core barrel motion;
- Vibration monitoring of main coolant pumps, reactor pressure vessels, steam generators, coolant pipes, sensing lines, turbine components, and transformers;

- Coolant and moderator flow diagnostics, flow oscillations, and detecting blockage;
- Estimating in-core coolant velocity based on temperature and flux noise measurements;
- Demonstrations of use of wireless sensors for vibration monitoring of equipment;
- Loose parts monitoring in primary and secondary side loops;
- Acoustic leakage monitoring, estimating rate of leak, acoustic monitoring of motor/air operated valves;
- On-line condition monitoring; in-situ response time estimation of flow/pressure transmitters, thermo-couples and resistance temperature detectors(RTDs);
- Anomaly localization and unfolding, anomaly detection of instrument channels, detectors, and associated electronics;
- Data acquisition systems; digital signal processing; advanced modelling techniques.

The first Research Coordination Meeting is scheduled for May 2008. For further details, please visit the website: http://www.iaea.org/NuclearPower/IandC/.

The IAEA is organizing a workshop on Neutron Fluctuations, Reactor Noise, and Their Applications in Nuclear Reactors from 22 to 26 September 2008, at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

The purpose of the workshop is 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 signal noise analysis in NPPs will also be discussed with an emphasis on I&C systems for surveillance, diagnostics, and prognostics. The workshop-like setting will allow all participants to interact and share their experience in the subject. The workshop is intended for scientists, researchers, engineers, and university personnel interested in broadening their understanding of the subject.

The workshop will be conducted by international experts involved in the education, research, and application aspects of the subject. The workshop can support the initiation of new research activities in developing countries and can contribute to the foundation of an academic area with the prospect of international recognition. The workshop will also support education in the area of reactor physics and nuclear engineering in developing countries considering the introduction of nuclear energy. For further details, please visit the website:

http://www.iaea.org/NuclearPower/IandC/

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Integrated NPP Life Cycle Management

Workshop on Continued Operations Beyond 60 Years in Nuclear Power Plant

Faced with the competing threats of global warming and a looming energy shortfall, NRC is contemplating whether another 20 years of service can be squeezed out of the ageing nuclear power plant without compromising safety. Many believed that the 104 nuclear power plant operating in the USA will be forced to retire faster than industry can replace them, unless regulators act to extend their lives to 80 years from the current 60-years maximum. Though it will be years before any license expires, the debate has urgency because utilities are making decisions that will affect how many nuclear power plants will be built during the next 20 years.

The NRC and Department of Energy (DOE) cosponsored a three day workshop at Washington DC, USA, 19–21 February 2008 to identify areas that may need additional research in order to confirm the ability of currently licensed commercial nuclear power plants to continue safe operation beyond the initial license renewal period (i.e. continued operation beyond 60 years).

As results of the workshop, general observations were:

- 10 CFR 54 (Licensing Renewal Application) has been successfully implemented for the first license renewal and does not need to be changed, however industry suggests that license renewal implementation guidance can be simplified;
- As no absolute barriers (‘show stoppers’) were identified for beyond 60 years operation, and positive reception expressed by all stakeholders, existing nuclear plants need to remain a significant part of the nation’s energy portfolio to affect climate change and energy security;
- Research is necessary to support plant life extension beyond 60 years and international interest is evident in R&D for plant life extension;
- Potential challenges to optimum long term operation are 1) Ensure systematic capture of operating experience for passive components (current and replacements), 2) Inspection capabilities, predictive diagnostics and 3) Better understanding of analysis limitations in determining service life of equipment;
- Ultimately, plant life extension is a utility business decision.

Identified/suggested R&D Topics are:

- Sustain High Performance of Reactor Materials
- Transition to State-of-the-Art Digital I&C
- Advances in Nuclear Fuel
- Implement Broad-Spectrum Workforce Development

- Implement Broad-Spectrum Infrastructure Improvements & Design for Sustainability
- Electricity Infrastructure-Wide Problems (Non Unique to Nuclear)
- Advanced Fabrication, Construction & Inspection Methods
- Extend the Application of Risk Management Technologies & Understanding of Safety Margins
- Improve Operational Performance
- Expand LWR Technology into New Missions & Markets
- Develop Desalination & Process Heat Technologies

Philippines' Bataan Nuclear Power Plant (BNPP) Expert Mission

Philippines' Bataan Nuclear Power Plant (BNPP), a completely built Westinghouse pressurized water reactor, has been mothballed since 1986 by a Government decision. However, recent developments in the Philippines with respect to the projected energy needs of the country, have led it to reconsider the option of using nuclear energy. The IAEA mission was held from 28 January to 1st February 2008 at site and NPC head office. The main objectives were to advise the Government on the feasibility of rehabilitating BNPP, particularly on the steps it needs to take to reach an informed decision on whether or not to rehabilitate the plant as part of the country's future nuclear power programme and to advise the Government on the general infrastructure requirements for launching a nuclear power programme. In order to fulfil this requirement the IAEA experts team together with the National Power Corporation (NPC), Department of Energy (DOE), and Philippines Nuclear Research Institute (PNRI) management team discussed the current status of BNPP and the national infrastructure to support a nuclear power programme. This included the current view of the preservation work and a visit to the BNPP for a walk down.

View of control room of Philippines' Bataan BNPP

Workshop on steam generator maintenance and replacement for Plant Life Management programme of Embalse NPP.

Embalse Nuclear Power Plant (ENPP), CANDU 6 type with 648 MW(e) output, began operation in 1983. In the last 10 years it has shown an excellent performance with an average capacity factor of 88.3%. As the end of the design life of Embalse NPP is foreseen for 2011, ENPP's life extension was decided based on excellent performance. The effective plant life management programmes are being prepared for life assessment and condition assessment for beyond design life operation. Especially replacement of steam generator (SG) and large scale fuel channel replacement (LSFCR) are planed in 2011 for ENPP's life extension. The workshop held from 31 October–2 November 2007 was focused on SG effective maintenance before replacement of SG and strategy of replacement of SG.

The maintenance and replacement of steam generators, presentation and discussion are divided into two parts as follows: Approaches to mitigate steam generator before replacement of SG, and Replacement of SGs.

Workshop on demonstration exercise on knowledge preservation and consolidation

The knowledge management process for collecting, analyzing, consolidating and transferring is designed as being an iterative and continuous process that provides the program with the inherent ability to adapt changes in the nuclear industry and regulatory environment now and in the future.

The workshop was held on December 11th–13th 2007 in Amsterdam, the Netherlands and was to addresses how to preserve and consolidate the desired knowledge on Water-Water Energy Reactor (WWER) RPVs. EC-JRC is conducting the programme to collect and assess the critical, relevant knowledge on embrittlement of WWER RPV using EC-JRC tool for knowledge management.

For the KM, the IAEA has published 31 technical documents on plant life management and ageing management since 1990s. These documents were categorized and divided into three sections and twelve sub-sections as follows:

- Integrity of system, structure and components and ageing management
- Advanced Surveillance, diagnosis and prognosis techniques for System Health monitoring
- Plant life management for long term operation

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Effective Preventive and Predictive Maintenance and In-Service–Inspection

The regional workshop on *Effective Preventive and Predictive Maintenance and In-Service Inspection* (ISI) was organized within the TC project at the IAEA headquarters in Vienna on 26-30 November 2007. This workshop was designed for maintenance staff of operating utilities, technical support institutes and regulatory organizations from the Asian Member States operating nuclear power plants. Invited countries were China, Republic of Korea, India, Japan, and Pakistan.

The purpose of the workshop was to familiarize the participants with preventive and predictive maintenance and ISI programmes and to exchange experiences on various methods and techniques: condition-based, risk informed, reliability-centered and performance based approaches of maintenance and in-service inspection.

15 professionals attended the workshop. Participants came from operating utilities, research and educations centers and regulatory authorities. Participants have got a clear overview about the strategy, concept and organizational framework of preventive and predictive maintenance and in-service inspection and its practical implementation in nuclear power plants in USA, UK and in Czech Republic.

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Databases to Support Nuclear Power

Initiating Event Data in PRIS

A consultants meeting on development of Initiating Events database was held at the IAEA headquarters in Vienna on 11–13 December 2007. The purpose of the meeting was to discuss suggested implementation of Initiating Event (IE) data into Power Reactor Information System (PRIS).

Meeting participants at Vienna, Austria, 11–13 December 2007

In 2005 the feasibility study for the international component reliability database was performed. Based on recommendations from this study the IAEA decided to continue in the effort to support reliability and initiating event data sharing within the Nuclear Industry. Reliability data supports probabilistic safety analyses as well as reliability centred maintenance - determining maintenance strategies.

IE frequency is of high importance for probabilistic safety analyses but due to rare occurrence of IE the statistics from plant specific experience might be inadequate. There is no existing worldwide database for IE. It was identified that PRIS can relatively easily be extended, and the user can report IE data together with the PRIS data. PRIS database already contains some important information required to calculate IE frequencies.

It was recommended to extend the existing outage coding system in PRIS by an initiating event code. This extension can be applied to scram records only.

During the meeting consultants discussed reactor type specific lists of IE for implementation into PRIS and identified all additional information needed for IE specification. They have developed a concept for implementation of IE data items into the PRIS-WEDAS application and a guideline how to assign an IE code to a scram record.

Information on NPP Construction and Commissioning

The length of the construction and commissioning phases of a NPP have historically been much longer than for conventional plants, having often a record of delays and additional costs. Completing construction in shorter periods, through improved technology and construction methods significantly reduces the net costs incurred prior to any production of electricity.

In recent years several countries have express interest in construction of new reactor units. For some of them it will be the first project for NPP construction. Information on construction and commissioning of recent NPP projects would support decision making in those countries.

To further maintain and possibly expand the information on construction and commissioning collected so far, the IAEA is considering developing systematic international collection of related information and its analyses. One of the suggested possibilities is to incorporation such information into the PRIS database.

The objective of the consultants meeting on Information on NPP Construction and Commissioning, organised at the IAEA headquarters in Vienna on 17–19 December 2007, was to discuss and develop a basic concept and requirements for international shared information on construction and commissioning of new nuclear power plants.

A questionnaire has been prepared for the following main topics: 1) project general information, 2) Contracting Strategy, 3) project Management, 4) project milestones, 5) project quantities, 6) Manufacturers of the Main Components, 7) Experience from construction and commissioning with respect to reduction of project schedule and improvement in quality.

Consultants recommended use the developed questionnaire to obtain data for on going and recently commissioned projects. When data from the pilot data collection are analyzed and required information optimized the information structure can be implemented into PRIS.

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Management Systems

In order to enhance the effectiveness and efficiency of the IAEA work programmes, NS and NE have merged their programmes in the areas of Management Systems, Management for Safety and Safety Culture. In addition, in 2007 an enhanced coordination of the corresponding programmes of NE and NS was implemented in these areas.

The purpose of this joint programme is to enhance effectiveness and efficiency of the IAEA work programmes in the area of management systems. This joint effort will lead to improvement of Member States' capabilities to maintain and improve the safety and overall performance of nuclear facilities through the establishment and implementation of integrated management systems. The management system approach integrates safety as the paramount objective in all processes and fosters the development of a strong safety culture.

In order to achieve this goal, five main objectives have been identified in the areas of Management Systems, Management for Safety and Safety Culture:

- To finalize the ongoing safety standards and establish supportive publications (Safety Reports Series, Guidelines, NE Series publications, Technical Report Series, IAEA-TECDOCs, etc.) related to management systems and safety culture;
- To promote the current and future standards;
- To provide safety review services to Member States;
- To provide assistance and support to nuclear organizations in the enhancement of management systems and safety culture;
- To foster information exchange with Member states as well as with other international organizations.

As a result of joint work the following major results are achieved:

- Safety standard related to 'Application of the management system for nuclear facilities (DS349)' was submitted for final approval to the Safety Standard Committees;
- SCART (Safety Culture Assessment Review Team) guidelines was published on the web;
- Safety report on the comparison of the IAEA standards with ISO 9001:2000 was submitted to publication;
- The first draft of the Regulatory inspection of integrated management systems, update of Technical Reports Series No. 296 (1989) — was prepared;
- The role of leadership for safety and overall performance of nuclear facilities– Draft outline of NE Series Report was prepared.
- Technical Meeting related to, feedback from Member states on the published standards was organized;
- 8th IAEA-FORATOM Workshop: Application of Effective Management Systems was held;
- SCART mission at Santa Maria de Garona was conducted in Spain (November);
- Support to the Chilean Nuclear Energy Commission, CCHEN (November/December);

This joint programme is led and coordinated by Christer Viktorsson, Department of Safety and Security, in coordination with Russell Clark, Department of Nuclear Energy, and implemented primarily by a team composed of four members from two departments. The team will continue to discuss and identify the future challenges, issues and trends from the Member States.

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Strengthening Nuclear Power Infrastructures

The first draft of a new NE-Series-Report on Assessment of the National Nuclear Infrastructure Development Status was produced and it is being circulated for comments by external as well as internal experts. The objective of the new Report is to provide a holistic assessment methodology based on the publication NE-Series-Guide NG-G-3.1: Milestones in the Development of a National Infrastructure for Nuclear Power. The scope of the new Report includes both the 'hard' (grid, facilities, etc.) and 'soft' (legal, regulatory, training, etc.) infrastructure issues needed for a NPP. A consultants meeting scheduled 16–18 April 2008 will review the comments received and provide recommendations for completing the draft. Final review and submission for publication is scheduled in the last quarter 2008.

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One of the outcomes of recent workshops on Infrastructure Milestones and related topics was the identification of Member States' needs for further information on concrete steps to be taken for the introduction of nuclear power. A consultants meeting is being organized in April to discuss the Responsibilities and Competencies of a Nuclear Energy Programme Implementing Organization (NEPIO), which a Government could launch to study the issues associated with nuclear power introduction and to form a strategy for its implementation. The consultants meeting will be asked to prepare a NE-Series-Report on the NEPIO, to be finalized by the end of the year. This work is closely related with and complementary to the development of a NE-Series-Report on the Competencies of the Owner-Operator, which will also be completed this year.

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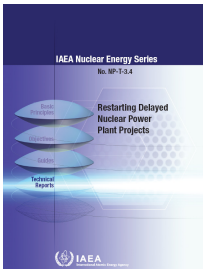

The restarting of NPP projects with delays of several years respect to the original scheduled commercial operation date presents particular management issues. They are beyond the normal management tasks needed for projects implemented within original planned schedules. The new publication NE-Series-Report No. NP-T-3.4: Restarting of Delayed Nuclear Power Plants, issued in March 2008, addresses specific management issues to be considered for a delayed project in the period after the decision for restarting is adopted.. Practical experience from restarted delayed projects were reviewed and included in the new publication that covers those management issues not considered within the normal processes described in other IAEA publications. The practical experience collected from delayed projects that were successfully restarted, completed and brought to commercial operation can provide useful assistance to the management of similar projects considering resumption of work. Intended users are senior managers and engineers of nuclear utilities and suppliers of equipment, services and technical support for construction and commissioning.

A further activity in this subject is the Technical Cooperation Workshop on Managing the Completion of Delayed Nuclear Power Plant Projects, scheduled 17–20 March 2008 in Buenos Aires, Argentina. The participants, senior managers or designated representatives directly responsible for the delayed NPP activities, will exchange their experiences, identify commons problems areas, possible solutions and means of cooperation.

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The changing global environment of increasing energy consumption and need for energy security is influencing the type of and means for obtaining the resources (material, human and financial) necessary for nuclear power projects. The effects of issues such as financing arrangements for capital intensive plants, international design approval/evaluation, harmonization of codes and standards, and assurance of fuel cycle services need to be considered. A consultants meeting was held on Dec. 3–5, 2007 to develop a NE-Series-Report on Issues Improving Prospects for Financing Nuclear Power Projects. The Report will provide a review and practical approaches on the effects of infrastructure developments and other related topics upon reducing investment risks, and the actions possible that may improve prospects for financing nuclear power projects. A Technical Meeting will be organized on July 23–25, 2008 in Vienna, Austria to review the draft.

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A consultants meeting will be organized on May 28–30, 2008 in Vienna, Austria to prepare the outline and the work plan for development of a NE-Series-Report on Evaluation of Bids for Nuclear Power Plants. The objective is to provide integrated and updated practical guidance on preparation and evaluation of bids for nuclear power plants with the state of the art information. The final draft is scheduled by end of April 2009. The scope of this Report will address the basis for the evaluation, the preparations and organization, implementation of the evaluation work, scope of the evaluation, evaluation approach and survey of bidders. Target users are decision makers, advisers and senior managers and staff involved in bid evaluations in the governmental, utilities and industrial organizations in countries initiating or extending nuclear power programmes.

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Improvements in Training and Performance of NPP Personnel

IAEA Workshop at the World's First AP-1000 Site, Sanmen Nuclear Power Company, China.

A national workshop on Information Management Systems for Nuclear Power Plant (NPP) Projects was held from 26–28 February 2008, hosted by the Sanmen Nuclear Power Company (SMNPC) in Zhejiang Province, China. This workshop was organized under IAEA TC Project CPR-4-027, Improvement in Self-Reliance and the Capability to Manage NPP Projects. The workshop was attended by representatives from all

of the Chinese companies that are currently implementing NPP projects.

The Sanmen site will have the world's first AP1000 NPP, with pouring of the first concrete scheduled to begin in March 2009, and commercial operation in 2013. This was the first IAEA workshop to be held at the site. It was also a historic week for the site, as during the time of the workshop a ceremony initiating excavation work for the basemat of the nuclear island was held, and the Preliminary Safety Analysis Report (PSAR) was submitted to the National Nuclear Safety Authority (NNSA).

Workshop participants,26–28 Feb. 2008, China

The main topics addressed during this workshop were:

- Comparisons of the characteristics of Information Management Systems (IMS) being used/developed for NPP projects in China and in Bulgaria, Hungary, Rep. of Korea, and the USA (the countries for which the IAEA-provided experts had experience).
- Systems for construction and design management
- Electronic document management systems
- Numbering/identification systems for plant equipment and activities
- Configuration management
- Cyber security
- Information portals and knowledge management, including current IAEA activities in these areas

The presentations and supporting materials provided during this workshop are available to registered ENTRAC users (information on how to register for ENTRAC is available at: http://entrac.iaea.org)

This workshop was jointly organized by the Division of Nuclear Power, the INIS/NKM Section of the Nuclear Energy Department, and the Technical Co-operation Department of the IAEA, along with the host organization, SNMPC.

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Full-Scope Simulators — Tools Important to Safety and Efficiency

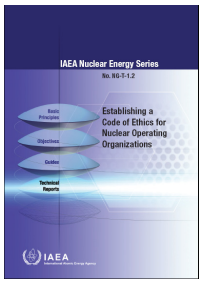
An IAEA workshop to discuss good practices in site acceptance testing of full-scope simulators was held at the Tianwan Nuclear Power Station (TNPS), Lianyungang, China, from 14 to 16 January 2008. It was organized in the framework of the IAEA Extrabudgetary Programme (EBP) on the Safety of Nuclear Installations in the South East Asia, Pacific and Far East Countries, in cooperation between the IAEA and Jiangsu Nuclear Power Corporation. Twenty-five participants from China - representing seven nuclear power plants being operated or under construction, and three research, design and engineering support organizations - took part. Four international experts from Germany, Ukraine and USA shared their experience. Alexey Kazennov of the IAEA Nuclear Power Division was a scientific secretary for that workshop; and has provided to the participants a comprehensive picture of the status and trends in the nuclear power sector and nuclear training.

Workshop participants at the TNPS, China, 14–16 Jan. 2008

Full-scope simulators are the important tools to ensure safety of the NPPs through the training, qualification and authorization of the control room staff, and training of other categories of personnel, and use for engineering purposes. Acceptance testing of full-scope simulators is a comprehensive activity requiring involvement of subject matter experts, training staff and simulator vendor personnel.

Acceptance testing should be supported by the solid management, verified and validated testing procedures, and software tools. Importance of a simulator acceptance testing can not be overestimated. Decision whether the simulator is Ready For Training (RFT) shall be taken only after quality performed acceptance testing of the simulator. The international experts (from KSG Simulator Centre, South-Ukraine NPP, FPL Energy Seabrook and GSE Systems) and participants from China presented and discussed the approaches, regulations, management practices, document control, and various tools employed for acceptance testing of full-scope simulators. Feedback received from the Chinese

participants at the last day of the workshop has shown that there are many strategic and specific take-aways from this workshop. After that three-day workshop, one IAEA expert assisted the TNPS training centre to prepare for actual site acceptance testing of their full-scope simulator after its modernization. It is remarkable that the IAEA publication Guidelines for Upgrade and Modernization of Nuclear Power Plant (NPP) Training Simulators, IAEA-TECDOC-1500 published in 2006, was actively used for conducting the workshop. It is a good example how the competence building and sharing good practices supported by the IAEA are performed through a combination of activities that include hands-on application of knowledge acquired. Contact: A.Kazennov@iaea.org.



A technical report on Establishing a Code of Ethics for Nuclear Operating Organizations (IAEA Nuclear Energy Series No. NG-T-1.2) was published. A code of ethics is a standard that governs and guides ethical behaviour of an organization towards its employees, and interactions between the organization and its external stakeholders. This publication is intended to explain the benefits for nuclear industry operating organizations of having a well functioning code of ethics, to propose areas that should be considered for inclusion in a nuclear industry operating organization's code of ethics, and to explain how to develop, implement and sustain such a code. This publication is addressed primarily to senior managers of nuclear industry operating organizations and will prove useful to those in the nuclear industry that are establishing a code of ethics or benchmarking their existing practices.

Contact: T.Mazour@iaea.org.

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

INPRO Steering Committee approves Action Plan for 2008–2009

The 12th meeting of the INPRO Steering Committee was held at IAEA, Vienna, Austria, 3–5 December 2007. The Steering Committee endorsed the proposed collaborative projects and approved the INPRO Action Plan for the period 2008–2009, which is now being implemented under the IAEA's Programme & Budget 2008–2009 under Subprogramme 1.1.4. Activities in the following areas have been approved by the Steering Committee for that period:

1. INPRO methodology;
2. Assessments and studies using the INPRO methodology;
3. Nuclear energy in the context of sustainable development;
4. Institutional and infrastructure issues;
5. Common user considerations by developing countries for new NPPs;
6. Collaborative projects;

Contact: A.Rao@iaea.org or P.Gowin@iaea.org.

Kick-off meetings start first INPRO Collaborative Projects

Under the Action Plan, work is progressing on twelve collaborative projects that were endorsed in July 2007 by the INPRO Steering Committee. Topics include nuclear power for small countries, nuclear fuel cycle issues, environmental impacts, safety issues, proliferation resistance, non-stationary nuclear power plants, and the global architecture of future innovative nuclear systems, including the fuel cycle.

Acquisition/Diversion Pathway Analysis for the Assessment of Proliferation Resistance (PRADA)

The kick-off meeting for the collaborative project on Proliferation Resistance Acquisition/diversion analysis (PRADA) was held on 19–20 November 2007. The objectives of the project are to develop appropriate methods for the identification and analysis of pathways for the acquisition of weapons-usable nuclear material and to evaluate the multiplicity and robustness of barriers against proliferation for the pathway by logic trees (success/failure trees, event trees, etc.). In doing so, the project will also use and further develop the INPRO methodology for the assessment of innovative nuclear system with regard to proliferation resistance.

Contact: H.Chayama@iaea.org.

Decay Heat Removal System for Liquid Metal Reactors

The kick-off-meeting for the collaborative project on Decay Heat Removal System for Liquid Metal Reactors was held in October 2007, the Terms of Reference have been approved and the data for the analysis has been distributed to the participants. The main objective of the project is the inter-comparison of results of a candidate robust decay heat removal system of liquid metal reactors, developing matured analysis methodologies for several phenomena and identifying relevant R&D areas. Seven studies will be undertaken representing different transient cases. The scientific basis of the collaborative project is strengthened by an internship of a Master student in mechanical engineering from Karlsruhe University (Germany), working at the IAEA/INPRO HQ to develop a thesis on that subject.

Contact: P.Villalibre@iaea.org.

Thorium fuel cycle

The kick-off meeting for the collaborative project on further investigations of the 233U/Th fuel cycle was held on 3 December 2007. The project has as overall objective to examine the potential of thorium-based fuel cycles in innovative configurations, aimed at enhancing the sustainability of nuclear power.

Contact: R.Sollychin@iaea.org.

Global Architecture of Innovative Nuclear Systems Based on Thermal and Fast Reactors Including a Closed Fuel Cycle (GAINS)

The GAINS project is at the centre of several INPRO activities and collaborative projects. Final Member States' commitment has not yet been obtained, but the project is expected to become operational soon. The objectives of the GAINS collaborative project are to:

- develop a framework (a common methodological platform, assumptions and boundary conditions) for the assessment of the transition from the current thermal reactors to a sustainable deployment of nuclear energy till 2050 and afterwards up to 2100,
- develop a reference base case for transition to architecture of the global innovative nuclear systems capable to meet in a sustainable manner requirements of energy supply, recognizing regional differences in availability of material resources, energy growth rate and nuclear energy deployment options,
- perform sensitivity studies to assess the impact of different key assumptions and to consider the effect different transition scenarios would have on sustainability metrics.

Contact: V.Usanov@iaea.org.

In addition to the four on-going projects, an additional eight collaborative projects are in various stages of preparation and activities are expected to start in the course of 2008.

Contact: m.khoroshev@iaea.org.

Common User Considerations

In stage 1 of the CUC activity, considerations by developing countries regarding future nuclear energy systems to be deployed by those countries were established. A limited number of developing countries were selected to represent the variety of characteristics of the overall set of the technology-user countries. A series of detailed discussions with stakeholders and experts, including government officials in charge of energy policy and nuclear program, nuclear regulators, researchers from national laboratories and universities, utilities and financial sectors, were conducted. Two workshops were held in November 2007 and March 2008 to finalize the considerations, representing the common considerations by potential users of future nuclear energy systems in developing countries.

Based on these inputs, IAEA report on Common User Considerations by Developing Countries for Future Nuclear Energy Systems is currently being revised for publication in 2008. Also at that meeting, Stage 2 of the common user considerations activity was prepared.

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Studies using the INPRO Methodology

The INPRO methodology (see, as most recent publication, IAEA-TECDOC CD 1575) is currently being used in *National Assessment Studies* performed by Argentina, Armenia, Brazil, China, India and Ukraine and in the *Joint Assessment Study* of a closed fuel cycles with fast reactors by China, France, India, Japan, the Republic of Korea and the Russian Federation. The Republic of Korea has already completed an assessment on proliferation resistance issues in 2006. A summary report on the results of the National Assessment Studies and a report on the Joint Assessment Study are under preparation for publication in 2008.

Contact: p.villalibre@iaea.org.

Extended IAEA/INPRO/GIF cooperation agreed

Coordination and cooperation with other international initiatives remains a priority for INPRO. In February 2008, more than 20 representatives each from INPRO and from the Generation IV International Forum (GIF) met in Vienna to discuss options for good coordination and synergies, the largest such coordination meeting to-date. The meeting shared and discussed information

Meeting participants at the IAEA/INPRO/GIF coordination meeting at the IAEA HQ in Vienna

- on those four GIF designs for which a System Agreement has already been established, i.e. the sodium cooled fast reactor (SFR), gas cooled fast reactor (GFR), very high temperature reactor (VHTR), supercritical water-cooled reactor (SCWR);

- on INPRO activities under the Action Plan 2008–2009, in particular on Common User Considerations; and
- on evaluation and assessment approaches used by GIF and in the INPRO methodology.

Several follow-up actions were agreed upon in three categories: synergies in the evaluation methodologies; effective cooperation and collaboration in development studies; and infrastructure needs for developing countries and sustainability.

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INPRO Web page: http://www.iaea.org//INPRO.

Technology Advances in Water Cooled Reactors

Coordinated research programme on benchmarking severe accident computer codes for heavy water reactor applications

Consideration of severe accidents at a nuclear power plant is an essential component of the defence in depth approach used in nuclear safety. Severe accident analysis involves very complex physical phenomena that occur sequentially during various stages of accident progression. Computer codes are essential tools for understanding how the reactor and its containment might respond under severe accident conditions.

In case of design basis accidents, computer codes are validated against integral and separate effects tests, whereas in the case of severe accident computer codes it is rather impossible, or at least quite expensive, to carryout a validation exercise against integrated experiments. Consequently, the code capabilities have to be assessed based on benchmarking against other severe accident computer codes. In view of this, a benchmarking exercise becomes necessary to assess the results from various computer codes to provide an improved understanding of modelling approaches, strengths and limitations. The exercise could also suggest ways to overcome code limitations and thereby increase the confidence in severe accident code predictions. A benchmarking exercise encompassing various severe accident codes in use within HWR community is therefore proposed not only for providing confidence in the overall performance of codes but also for the reduction of uncertainties in their predictions.

This CRP will promote international collaboration among IAEA Member States through the benchmarking exercise to improve severe accident analysis capability for heavy water reactors (HWRs). The CRP scope includes defining the severe accident sequence and conducting benchmark analyses for HWRs, simulating phenomenological experiments(s) relevant to severe accidents and comparing the results with experimental data, and evaluating the capabilities of existing computer codes to predict important severe accident phenomena and suggesting necessary code improvements and/or new experiments to reduce uncertainties.

The CRP has been planned on the advice and with the support of the IAEA Nuclear Energy Department's Technical Working Groups on Advanced Technologies for HWRs (the TWG-HWR). A consultants meeting was held in December 2007 to finalize the CRP proposal. The CRP announcement will be posted on IAEA website after the approval process. The CRP will be conducted by IAEA's Nuclear Power Technology Development Section, in cooperation with the Division of Nuclear Installation Safety.

Contact: J.H.Choi@iaea.org.

Technology Advances in Fast Reactors and Accelerator Driven Systems

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

The project has contributed to the joint IAEA/ICTP 'Advanced Workshop on Model Codes for Spallation Reactions' organized by the Physics Section of IAEA's Division of Physical and Chemical Sciences (Trieste, Italy, 4–8 February 2008) with a lecture on 'Spallation Data and Applications'. Another education and training activity consists in the preparation of another joint IAEA/ICTP Workshop on 'Nuclear Reaction Data for Advanced Reactor Technologies' (in collaboration with the Nuclear Data Section of IAEA's Division of Physical and Chemical Sciences (Trieste, Italy, 19–30 May 2008). At this workshop, a series of lectures will address the application of, and further nuclear data needs in relation to advanced reactor technology activities. The selection process resulted in 31 (of the total 84) applicants being offered participation in the workshop.

The draft of the Annex (titled 'Status of Fast Reactor Research and Technology Development, Design, Construction and Operation') to IAEA's '2008 Nuclear Technology Revue' was prepared.

The project contributed to two coordination meetings with other international initiatives, specifically the GIF/INPRO/IAEA Interface Meeting (Vienna, 28–29 February 2008, and the ISTC-Contact Expert Group on

Nuclear Partitioning and Transmutation Related projects (EC, Brussels, 29 February 2008). At the former, a presentation on 'IAEA's Programmatic Activities in Fast Neutron Systems Research and Technology Development' was given; at the latter, collaboration between ISTC projects and the IAEA Coordinated Research Projects in the area of P&T were discussed.

Preparation of two major meetings are ongoing, viz. the 41st Meeting of the TWG-FR (Vienna, 26–29 May 2008), and the Second Research Coordination Meeting of the IAEA Coordinated Research Project on 'Analyses of, and Lessons Learned from the Operational Experience with Fast Reactor Equipment and Systems' (Vienna, 20–23 May 2008).

For more information see http://www.iaea.org/inisnkm/nkm/aws/fnss/index.html

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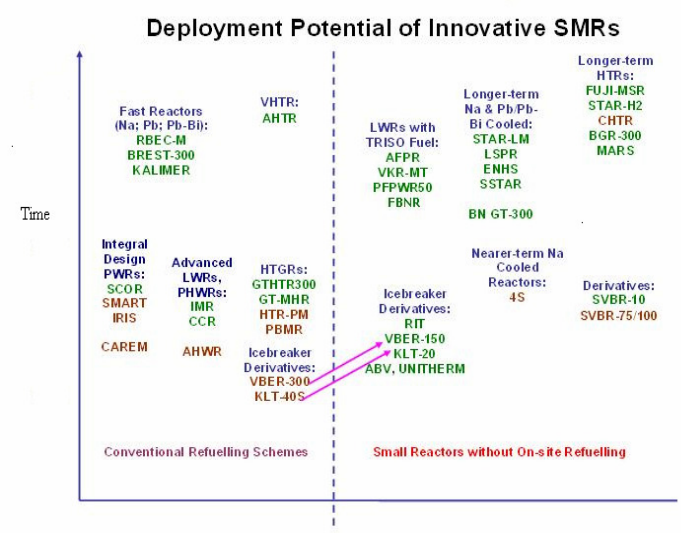
Common Technologies and Issues for Small and Medium Sized Reactors

A draft of a new Nuclear Energy Series (NES) report titled Passive Safety Design Options for SMRs is in preparation. Specific objectives of this report are (i) to present the state-of-the-art in design strategies for implementation of passive safety design options in pressurized water reactors, pressurized light water cooled heavy water moderated reactors, high temperature gas cooled reactors, sodium cooled and lead cooled fast reactors, and non-conventional designs within the SMR range with a focus on the approaches that are specific to the reactor type and capacity; to review the approaches for implementation of passive safety design options against the requirements of the IAEA safety standards; and to highlight benefits and negative impacts in areas other than safety arising from the implementation of passive safety design options. The preparation of this report was mentioned with satisfaction in the IAEA General Conference resolution GC(51)/RES/14/B2(k) of September 2007.

A detailed programme proposal for a new Coordinated Research Project (CRP) on Development of Methodologies for the Assessment of Passive Safety System Performance in Advanced Reactors is getting under way. This CRP aims on development of a common analysis-and-test approach to assess performance of passive safety systems. Such an approach could facilitate design optimization and safety qualification of the future advanced reactors, contributing to their enhanced safety levels and improved economics. The project is expected to pool together efforts of principal developers and holders of the relevant approaches and methodologies worldwide, and also to attract capable new participants. The CRP is proposed for 4 years (2008–2011); and an invitation to submit requests for research contracts and research agreements will be released soon. The CRP will be conducted carried in via broad in-house cooperation, involving the Nuclear Energy Department's Technical Working Groups on Advanced Light Water Reactors (LWRs), Heavy Water Reactors (HWRs), Gas Cooled Reactors (GCR) and Fast Reactors (FR) of the Nuclear Power Division and the Safety Assessment Section and Engineering Safety Section of the Department of Nuclear Safety and Security. Close cooperation with INPRO is foreseen.

Main part of the report on Approaches to assess competitiveness of SMRs, the material for which has been collected from member states in 2006–2007, has been started in preparation. This report will be to assist existing and potential stakeholders in the definition of a competitive strategy regarding design and deployment of SMRs, and to provide a framework to assist potential customers in their assessment of technical and economical performance of SMRs.

Eleven proposals for case studies on competitive applications of SMRs, to be performed in 2008, have been collected from India, Japan, the Russian Federation, and the USA. The participants and observers to this activity have performed ranking of the proposals and actual studies are expected to start soon. Their results and conclusions will be discussed at a dedicated IAEA technical meeting to be convened on 1–4 July 2008 in Vienna.



Cooperation with the IAEA infrastructure team and INPRO is foreseen to prepare reports on infrastructure issues associated with deployment of non-stationary reactors and elaboration of innovative infrastructure options for SMRs.

The figure above presents an updated deployment potential map for innovative SMRs. Brown colour indicates concepts that show real progress towards advanced design stages, licensing, or deployment.

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Technologies for Gas Cooled Reactors

A meeting was held at the VIC in December 2007 to review and discuss the Cost Estimating Guidelines for Generation IV Nuclear Energy Systems and related input data for the associated software G4Econs. This software has been prepared in the framework of Generation IV international forum and allows to perform cost calculations for innovative reactors. The meeting was attended by experts from 6 Member States currently pursuing or considering a deployment of GCRs in the future.

The Cost Estimating Guidelines for Generation IV Nuclear Energy Systems on the basis of the version from 26 September 2007 and the Users Manual for G4-ECONS Version 2.0 from 25 October 2007 were presented and necessary input data were discussed. The code itself is expected to be released in early 2008. Participants will then perform own calculations and discuss results achieved from the individual calculations and provide feedback to the originators of the code.

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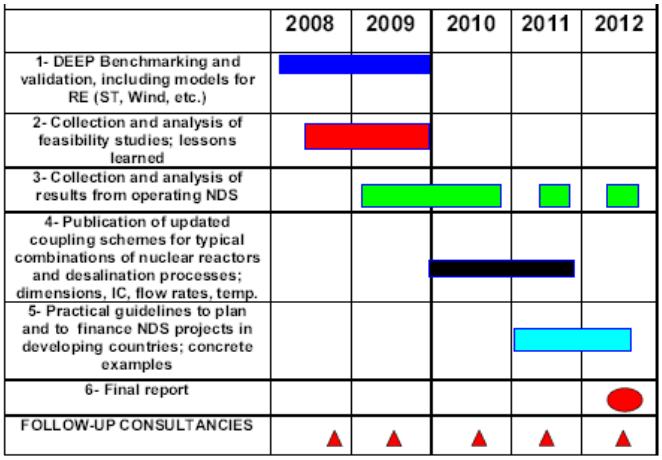
Nuclear Desalination Systems

Meeting participants at Cadarache, France, 3–5 December 2007

The Technical Meeting on Integrated Nuclear Desalination Systems was held in Cadarache, France, 3–5 December 2007. Representatives from participating Member States agreed that nuclear desalination will most likely be accepted in countries where nuclear power production is acceptable, and the existence of a nuclear power program in a country should considerably facilitate the deployment of nuclear desalination where needed. In many Member States there is still a need for more public information and education about nuclear power in general and nuclear desalination in particular. Appropriate infrastructures and manpower development are a prerequisite for nuclear energy deployment. Small and medium power reactors are preferred by some Member States for several reasons, especially their better match to smaller grids and relatively lower investment costs. In addition, hybrid nuclear desalination systems may have additional economic advantages due to their considerable flexibility. It was agreed that costs of the environmental impact of power and water producing systems should be considered in order to provide accurate and realistic cost figures to the decision makers.

The International Nuclear Desalination Advisory Group (INDAG) held its ninth meeting during the period of 7–9 January 2008. INDAG members exchanged information on the progress of national, international, and interregional activities in nuclear desalination and reviewed the progress of the IAEA's work, as well as activities planned for the year 2008. Further, INDAG discussed a proposed road map on the IAEA activities on nuclear desalination and recommended that the IAEA develop a 'nuclear desalination toolkit' that provide recommended guidelines and information on launching a nuclear desalination program in Member States.



IAEA activities on nuclear desalination

INDAG concluded that nuclear desalination is an inevitable option as the increase in water shortage, climate change and oil price would have a greater impact. There would be need for small, medium and large size nuclear desalination plants in the coastal areas which would be governed by the demand and quality of desalinated water requirement. Excellent prospects are foreseen in the next 10–20 years as long as the interested Member States (the majority of which currently have no access to required nuclear power technology) will be able to safely and economically generate nuclear power in the near future. The IAEA and INDAG are playing an important role in facilitating and providing advice on nuclear desalination activities in Member States.

Contact: I.Khamis@iaea.org.

New Staff in Nuclear Power Division

BEATTY, Randy

Mr. Randy Beatty has joined the Nuclear Power Technology Development Section as a Department of State supported cost-free expert for the INPRO Program. He has a B.Sc. in Chemistry from George Washington University, an M.Sc. in Engineering Administration from the University of Tennessee and a PhD in Chemical Engineering from Kennedy Western. He has been employed at the Oak Ridge National Laboratory since 1992 and is a specialist in Nonproliferation, Nuclear Fuel Cycle Technology, International Science Cooperation, and Project Management. He has worked overseas before as the Executive Director of the International Science and Technology Center headquartered in Moscow, Russia. He has a wife Cynthia and two children Brent 22 and Kate 20.

Contact: R.Beatty@iaea.org.

BILBAO, Leon Rosa Marina

Ms. Bilbao y Leon has recently taken up duties in the Nuclear Power Technology Development Section (NPTDS) as member of the International Coordination Group of the INPRO project. Sama has 9 years of professional experience. First she was a researcher at the UW-Madison (USA) where she conducted research on experimental and computational thermal-hydraulics and nuclear safety, and participated in the design of nuclear micro-batteries to power nano-devices. More recently, she has been in charge of the development and licensing of new methodologies for the thermal-hydraulic analysis of nuclear cores at the US utility Dominion. Sama was instrumental in the creation of a new Masters in Nuclear Engineering at Virginia Commonwealth University, and she taught the first class during the fall of 2007. Sama is one of the founders of the North American Young Generation Network and an active member of the American Nuclear Society.

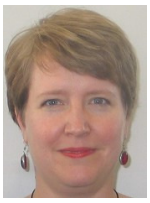
Contact: R.Bilbao-Y-Reon@iaea.org.

GOWIN, Peter

Mr. Gowin has recently taken up duties in the Nuclear Power Technology Development Section. He will assist in the implementation of the IAEA's International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), supporting both the INPRO Technical Coordinator in INPRO planning, organizational matters and INPRO Project Management, as well as the INPRO Policy Coordinator. Mr. Gowin has 12 years of experience in nuclear issues, including nuclear desalination and nuclear knowledge management; from 1999 to 2002, he was actively involved in establishing INPRO.

Prior to joining the IAEA, Mr. Gowin worked for Energie Baden-Württemberg, a large German energy utility. Mr. Gowin studied in Vienna, Austria, Stuttgart, Germany and Oxford, U.K., and holds a Masters degree in physics and a Dr. degree in energy economics.

Contact: P.Gowin@iaea.org.



STARZ, Anne

Ms. Starz has recently taken up duties in the Nuclear Power Engineering Section as a project coordinator. She will assist in the planning, coordination and implementation of the activities of NE's infrastructure project. Ms. Starz has over 11 years of experience in working for the US Government, initially as Program Analyst in the area of programme management support to USDOE and National Nuclear Security Administration international cooperative programs, then as Foreign Affairs Specialist in the area of technology development and commercialization projects with Russian nuclear complex, later on as Senior Policy Advisor to the Assistant Deputy Administrator for Nonproliferation and International Security and finally as Science Attache for Nuclear Energy at the US mission in Vienna.

Contact: A.Starz@iaea.org.

TYOBEKA, M. Bismark

Mr. Tyobeka has recently taken up duties in the Nuclear Power Technology Development Section as a nuclear engineer where he will assist in the formulation and implementation of the IAEA's technology development activities for gas cooled reactors and in the cooperation of related technical issues for other reactor design concepts. Mr. Tyobeka started his professional career in 2000 as a senior reactor physicist/nuclear engineer at Eskom Enterprises in South Africa from where he was seconded for research activities to the Pennsylvania State University, NRG Petten as well as USDOE/INL.

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

Vacancy Notice for Professional Posts in the Nuclear Power Division

Below is the list of current vacancies in the Division of Nuclear Power, IAEA. Applications from qualified women and candidates from developing countries are encouraged.

Technical Head (Water Reactor Technology Development)

As a member of the team led by the Section Head and a lead technical expert, the Technical Head directs, coordinates and supervises the IAEA's projects in water reactor (light and heavy water) technology in the Nuclear Power Technology Development Section in the Division of Nuclear Power.

The Technical Head is: (1) a team leader who plans, directs, coordinates and supervises the activities in the area of water reactor (light and heavy water) technology in accordance with Member States' needs and monitors their implementation; (2) a substantive expert contributor who manages projects of particular complexity and/or sensitivity; and (3) a scientific secretary for international scientific meetings, including the Technical Working Groups on light and heavy water reactors, and as such oversees the preparation and editing of scientific reports, manuals, proceedings and other scientific publications; (4) a coordinator of interagency collaborative projects within the UN system who reviews and provides a systematic overview and preparation of technical documentation and papers for discussion.

https://personnel.iaea.org/apps/phflink/p_vacancies.asp

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