IAEA International Atomic Energy Agency

Nuclear Power Newsletter

News from the Division of Nuclear Power
Vol. 11, No. 3, September 2014

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

Contents

Division of Nuclear Power
Department of Nuclear Energy, IAEA
PO Box 100, Vienna International Centre
1400 Vienna, Austria
Tel : +43 1 2600 –0
Fax: +43 1 2600 –7

GC Side Events on Nuclear Power Issues

During the 58th IAEA General Conference, the Division of Nuclear Power will hold three side events to brief GC delegates on activities to support Member States in maintaining or developing safe, sustainable and responsible nuclear power programmes.

4th Nuclear Operator Organizations Cooperation Forum: Nuclear Power Plant Construction Effectiveness

Wednesday, 24 September | 09:00 — 11:00 | Room C3, C Building, 7th floor

This event will focus on experiences and outlooks for effective construction management of new nuclear power plants, and potential ways to influence it. Factors such as reactor capacity, construction lead-time, design standardization, advanced construction technologies, experience of the project team in working together, project contract mechanisms and commodities will be discussed.

IAEA Support for Building Nuclear Power Infrastructure: Member States' Experience and Update on the IAEA 'Milestones' Revision

Wednesday, 24 September | 14:00 — 15:30 | Room C3, C Building, 7th floor

Speakers from newcomer countries will share their experience on how to tailor and make best use of the IAEA's services to support their infrastructure development, and how to coordinate and align the IAEA's support with national activities. IAEA staff will update participants on the revision of the widely referenced IAEA document 'Milestones in the Development of a National Infrastructure for Nuclear Power'.

What's New in Power Reactor Technologies, Cogeneration and Fuel Cycle Back End?

Wednesday, 24 September | 16:00 — 18:00 | Room C3, C Building, 7th floor

The event will highlight the technological advances in light and heavy water, small and medium sized (SMR), gas-cooled and fast reactors. It will discuss how technology can help solve industrial energy needs such as complementing solar/wind power, desalination, petro-chemical applications and development of oil sands. It will also showcase INPRO tools for evaluating the status, prospects, benefits and risks of innovative nuclear technologies, and will discuss legal and institutional issues of the back end of the nuclear fuel cycle and transportable SMRs.

Message from the Director

The International Conference on Human Resource Development for Nuclear Power Programmes: Building and Sustaining Capacity, was successfully held at the IAEA in mid-May 2014 with over 300 participants. The Conference focused on the global challenges of capacity building, human resource development, education and training, nuclear knowledge management and establishing and maintaining knowledge networks. The Conference concluded that good progress has been made in human resource development in the last few years. Also, capacity building continues to be important in ensuring the continued availability of competent personnel for the safe, secure and sustainable use of nuclear power.

During the 58th IAEA General Conference, to be held on 22–26 September 2014, the Division of Nuclear Power is organizing three side events which will address IAEA services on nuclear power infrastructure, the 4th Nuclear Operator Organizations Cooperation Forum, and new developments in power reactor technologies, cogeneration, and fuel cycle back end. Short descriptions of the side events are on the front page of this newsletter. We look forward to welcoming many delegates. The Division will also participate in the exhibition of the Department of Nuclear Energy held during the General Conference.

The past few months have been a busy time for all of us. Among other major activities were the Phase 2 INIR Mission to Jordan; the Joint IAEA-GIF Workshop on Safety of Sodium-Cooled Fast Reactors; the 22nd INPRO Steering Committee Meeting, the Technical Meeting on Updating the Milestones document; an Interregional Workshop on Design, Technology and Deployment Considerations for SMRs; an Interregional Training Course on Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power; and the first module of the 2014 International Nuclear Leadership Education Program, held at the Massachusetts Institute for Technology (MIT), USA. More information on these activities are included in this newsletter.

Many other activities are planned for the rest of the year: a follow-up INIR Mission to Viet Nam is scheduled for November, the 9th INPRO Dialogue Forum will focus on international collaboration on innovations, and the Technical Working Groups on Light Water and Heavy Water Reactors, and on Nuclear Power Infrastructure will meet at the IAEA. In addition, 25 technical meetings are scheduled between September and December 2014 covering many important topics addressed in the Division's work.

We welcome three new colleagues: Mr José Bastos from Brazil has joined the Nuclear Infrastructure Development Section; Mr Harri Varjonen from Finland is now with the Nuclear Power Engineering Section; Mr Ghulam Jilani, a cost-free expert from Pakistan, has joined the Nuclear Power Technology Development Section and Mr Anton Ponomarev, a cost-free expert from the Russian Federation, has returned to the INPRO Section. We also have to say good-bye and thank two colleagues for their excellent contributions: Mr Jeannot Boogaard from the Nuclear Power Engineering Section, and Mr Zoran Drace, Acting Section Head of the INPRO Section, who are both retiring from the Agency.

This is my last message to the readers of this newsletter, since I will be leaving the Agency at the end of November 2014. I would like to express my sincere appreciation to all readers of the Nuclear Power Newsletter for their interest in our activities. I also would like to extend my deep gratitude to all staff of the Division of Nuclear Power, who have or had worked with me over the past five years, for their great devotion, contributions and support of the IAEA's work.

I wish you all the best. Good bye!

Jong Kyun Park

J.Park@iaea.org

Capacity Building Key to Competent Nuclear Workforce

The International Conference on Human Resource Development for Nuclear Power Programmes: Building and Sustaining Capacity – Strategies for Education and Training, Networking and Knowledge Management, was held at the IAEA from 12 to 16 May 2014.

The following is an excerpt from the concluding statement of Conference President Marta Ziakova, Chairperson of the Slovak Regulatory Authority:

"This Conference has focussed on capacity building, human resource development, attracting the next generation of nuclear professionals, education and training, nuclear knowledge management and knowledge networks. I am pleased to say that the conference was very successful. It was attended by more than 300 participants from 65 Member States and 5 international organizations, a very good turnout, and an increase from the 2010 conference [held in Abu Dhabi, United Arab Emirates]. Participation was also very *broad* and covered all *types* of countries: newcomers, countries with expanding nuclear power programmes and 'mature' countries. It also covered all types of *institutions*: from industry to regulators to academia. This is clear evidence that capacity building and human resource development continues to be of high interest to many Member States. ….

… From the five sessions we followed in the course of the past five days, we made the following important findings:

Human resource needs analyses are now conducted more systematically both by mature and new nuclear programmes and sometime even at a regional level, e.g. Europe. These analyses are extremely useful to dimension education and training efforts in the short and medium term. Human resources are the backbone of every nuclear energy programme, and a significant variety of personnel in terms of skills and training are required.

Progress in human resource development has been made by considering both vocational training and academic education; by considering interfaces between technical, safety and security issues; by recognizing the importance of non-nuclear knowledge and by reaching out to society.

We heard several *good examples of managing and improving the education and training pipelines.* We looked at training needs analysis, the Systematic Approach to Training process, national programmes, and international support to newcomer countries. Key conclusions were that education and training is strengthening across all levels of the skills pyramid with good blending of theory, practical and hands-on experience.

Strategic outreach plans are crucial for workforce development, commitment of the next generation and for building acceptance of nuclear energy. Organizations should maintain and further develop pathways "from education to employment" and be ready to inspire, develop and encourage the next generation. There is also a need to engage better with the public, so that dialogue with prospective future nuclear professionals becomes more attractive.

Education and training programmes should *be integrated into an overall strategy* for building and maintaining capacity, supported by governments. For regulators, management of competencies is of particular importance, and the *Systematic Assessment of Regulatory Competence Needs* was presented as useful tool in that regard.

Networks have become a proven and key mechanism to support knowledge sharing and capacity building and to foster harmonization and cooperation. A large number of successful existing and new networks working at corporate, national and international levels were presented this week.

Nuclear programmes are large scale and long term. The *knowledge* required for the safe, reliable and efficient operation of nuclear facilities is an asset that should be properly managed. Knowledge management should address each area of a nuclear programme – from design through construction, commissioning, operation and decommissioning or closure of nuclear facilities. Proper knowledge management contributes to meeting a company's strategic and business objectives. It is vital not only for operating, design and construction companies, but also for regulatory bodies and technical support organizations, and for countries with mature nuclear programmes as well as for newcomer countries.

The IAEA is to be commended for this timely and fruitful conference, organized jointly by the Departments of Nuclear Energy and Nuclear Safety and Security. The conference concluded that capacity building is a major and important step in the process of ensuring a sustainable supply of qualified human resources for safe, secure and sustainable nuclear power programmes. The IAEA is invited to further develop its support for capacity building, to document good practices, to continue to develop tools and guidance, to provide services and assistance and to continue to facilitate international coordination and cooperation. Member States, in turn, are invited to join existing networks and *make use of available IAEA services,* including the new *Capacity Building Self-Assessment Methodology*."

Find the full concluding statement and all presentations at: http://www-pub.iaea.org/iaeameetings/46084/International-Conference-on-Human-Resource-Development-for-Nuclear-Power-Programmes-Building-and-Sustaining-Capacity

Contact: Brian Molloy, NPES; B.Molloy@iaea.org; Zoltan Pasztory, NKM; Z.Pasztory@iaea.org

Conference President M. Ziakova (center) delivers her summary and highlights of the Conference's deliberations at the closing session on 16 May 2014. (Photo: D. Calma, IAEA)

Supporting Nuclear Infrastructure Development

Revising the IAEA Milestones Document

The IAEA is updating one of its most popular guidance publications for countries considering or embarking on a new nuclear power programme, Milestones in the Development for a National Infrastructure for Nuclear Power.

First published in 2007 in response to rising expectations about nuclear power, this IAEA Nuclear Energy Series publication (NG-G-3.1) has been widely used and provides the basis for Agency work in this area. "All Member States planning for their first nuclear power plant are using the framework and terminology of the Agency's Milestones approach in developing their national nuclear infrastructure", said Alexander Bychkov, IAEA Deputy Director General and Head of the Department of Nuclear Energy. "This publication has been very well received by Member States and it is one of our most popular documents."

Forty-four experts from 30 Member States met at the IAEA in May 2014 to discuss the revision of the document, which is timely and takes into account several developments over the past seven years:

- The revision incorporates lessons learned from the Fukushima Daiichi accident and the implementation of the IAEA Action Plan on Nuclear Safety.
- In 2009, the IAEA began offering Integrated Nuclear Infrastructure Review (INIR) missions, based on the 'Milestones framework', to countries introducing or expanding nuclear power. These have generated practical lessons learned that are to be incorporated in this revision.
- Since 2007 the IAEA has published more detailed advice on many of the 19 nuclear infrastructure issues summarized in this document. Those documents incorporate developments after 2007, and the revision will harmonize this document with those more detailed publications.
- When the IAEA's Nuclear Energy (NE) Series was started, it instituted a practice of at least reviewing, and updating as necessary, all NE Series documents regularly.
- The Milestones document made assumptions about how countries would introduce nuclear power based on past experience as it stood at the time, but the strategic environment has changed.

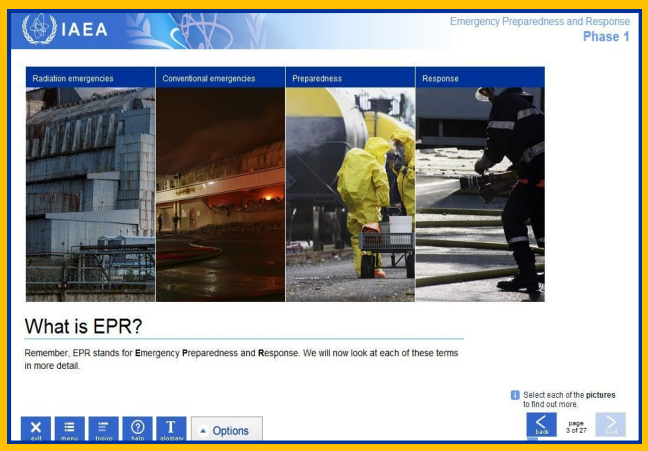
"For example, we assumed in 2007 that countries would likely use a competitive bidding process and did not anticipate the use of direct negotiations through intergovernmental agreements or the use of alternative contracting and ownership arrangements," said Anne Starz, Acting Section Head of the IAEA Nuclear Infrastructure Development Section. "Currently, Turkey is using a Build-Own-Operate, or BOO, approach under an intergovernmental agreement with the Russian Federation."

The revision process started already in 2012 with an extensive internal review. The annual Nuclear Infrastructure Workshop in February 2014 was the first opportunity to discuss the document with Member States and receive feedback. Prior to the May meeting, the Agency had received over 600 individual comments from Member States. The meeting provided ample opportunity for Member States to share their views on the current draft of the revision of the 'Milestones' document and provide clear guidance to the IAEA Secretariat for the finalization of the document. Following a final review within the IAEA, it is planned to publish the revised document towards the end of 2014.

Contact: Marta Ferrari, NIDS; M.Ferrari@iaea.org

IAEA E-learning Series for Nuclear Newcomers: Module 10 Issued

Module 10, Emergency Preparedness and Response (EPR), has been issued in the IAEA e-learning series for nuclear newcomers. It explains how to develop an EPR framework for a nuclear power programme.



The ten modules published to date cover different aspects of nuclear infrastructure development including an introductory module, developing a human resource strategy, stakeholder involvement, managing a nuclear power programme, construction management, a systematic approach to training (SAT), feasibility study, management systems and safety infrastructure. Two additional modules will be issued in 2014: Safeguards and management of spent fuel and radioactive waste.

All modules, accessible via the IAEA web site, are based on the IAEA publication *Milestones in the Development of a National Infrastructure for Nuclear Power,* other relevant IAEA publications and current experiences from newcomer countries.

This e-learning project is supported by an extrabudgetary contribution from the Republic of Korea under the IAEA Peaceful Uses Initiative. It is implemented by the Nuclear Power Engineering Section (NPES) and the Nuclear Infrastructure Development Section (NIDS) of the IAEA Division of Nuclear Power.

www.iaea.org/NuclearPower/Infrastructure/elearning/

INIR Mission to Jordan

A team of international experts, assembled at Jordan's request by the IAEA, conducted an Integrated Nuclear Infrastructure Review (INIR) mission in Jordan from 4 to 14 August 2014.

The INIR mission team, who reviewed Jordan's programme for introducing nuclear power, found that notable progress has been made in the development of the country's nuclear infrastructure. They recognized a few good practices, such as agreeing on pre-investment activities with the strategic partner, using graduate students for outreach to Jordan's youth population, and establishing a localization committee with wide participation from national industry.

"The INIR mission will greatly assist Jordan in developing its nuclear power programme in line with the IAEA recommendations," said Dr. Khalid Toukan, Chairman of the Jordan Atomic Energy Commission (JAEC). "Nuclear power will be an important contribution to alleviating our major energy challenges in the future."

INIR missions are designed to assist IAEA Member States to assess the status of the national infrastructure needed for introducing nuclear power. The INIR mission team consists of IAEA staff and international experts. By providing a comprehensive review of all facets of a nuclear power programme, spanning the regulatory body, utility and all relevant Government stakeholders involved, INIR is a valuable tool for promoting transparency and openness and confirming that the necessary infrastructure is being developed in an integrated way.

"Jordan was the first country to invite an INIR mission in 2009, and in this second mission, we have seen that our counterparts have made notable progress in developing the nuclear infrastructure in Jordan," said Jong Kyun Park, INIR mission team leader and Director of the IAEA Division of Nuclear Power. "We had extensive discussions on a wide range of issues and gained a deeper understanding of Jordan's programme during the mission."

The recommendations made by the INIR team included finalizing national policies and government commitment, improving coordination between the various Ministries, strengthening the legislative framework, and finalizing pre-investment activities.

Jordan decided to include nuclear power in its energy mix to ensure security of energy supply, reduce a large and growing reliance on energy imports (over 90%) and meet future increase in energy demand. The country plans to build a 2 x 1000 MWe nuclear power plant (NPP) at the Amra site, about 70 km east of Amman, in cooperation with the Russian Federation, which will also make a significant investment in the nuclear power plant.

Jordan and the IAEA have a long-standing cooperation. Jordan hosted the first ever INIR mission in August 2009, when the country was at the final stage of making a decision on establishing a nuclear power programme.

In all, eight Jordanian organizations involved in building the national nuclear infrastructure participated in the discussions with the INIR mission team, including the Jordan Atomic Energy Commission (JAEC), the Ministry of Energy and Mineral Resources, the Energy and Minerals Regulatory Commission, the National Electric Power Company, and others.

From left: Jordan's Minister of Energy and Mineral Resources, Mohammad Hamed, INIR Mission Team Leader J.K. Park, and Anne Starz, IAEA Nuclear Infrastructure Development Section, at the opening meeting of the mission, Amman, 4 August 2014. (Photo: JAEC)

The IAEA has developed guidelines and milestones to help countries work in a systematic way towards the introduction of nuclear power and ensure that the infrastructure required for the safe, responsible and sustainable use of nuclear technology is developed and implemented. The IAEA Milestones approach is documented in the IAEA publication *Milestones in the Development of a National Infrastructure for Nuclear Power* (IAEA Nuclear Energy Series No. NG-G-3.1).

This is the 13th INIR mission organized by the IAEA. It was implemented under a national IAEA technical cooperation project (JOR2009). Other embarking countries that have benefited from this service include Bangladesh, Belarus, Indonesia, Poland, Thailand, Turkey, the United Arab Emirates and Viet Nam. In 2013, South Africa hosted the first INIR mission to an operating country considering expanding its nuclear power programme.

Contact: Anne Starz, A.Starz@iaea.org, Matthew Van Sickle, M.C.Van-Sickle@iaea.org; both NIDS.

From left: JAEC Chairman Khalid Toukan, and JAEC Vice Chairman Kamal Araj at the closing meeting of the INIR mission, Amman, 14 August 2014. (Photo: JAEC)

2014 International Nuclear Leadership Education Program

For the second year, the IAEA is supporting the International Nuclear Leadership Education Program (INLEP) run by the Massachusetts Institute of Technology (MIT) in the USA.

The goal of the programme is to provide educational training on safe and successful nuclear power programmes to those in leadership positions in newcomer countries. This includes senior executives of nuclear operators, regulatory bodies, as well as high-level government officials in countries embarking on nuclear power.

The two-module programme focuses on the governance strategies, safety infrastructures, operational practices, and technologies required for a safe and successful nuclear energy programme. It draws on a wide range of experiences and insights from around the world. The instructors include faculty from MIT and other universities as well as an international group of prominent experts and practitioners from industry, government and the IAEA. Active learning through discussion, simulation, joint problem-solving and case studies is a key feature of the course.

The first module was held from 18 to 26 June 2014 at MIT. "The IAEA has worked with MIT to put this programme together and strongly supports the need for it," said J.K. Park, Director of the IAEA Division of Nuclear Power, in addressing the participants from eleven Member States that are considering or embarking on a new nuclear power programme. "The IAEA is working closely with all 'newcomers', providing services, guides, tools and other support for developing a safe and sustainable national nuclear infrastructure".

The first module covered topics such as basic nuclear physics, an introduction to nuclear reactor operations, nuclear safety and security, safeguards, regulatory affairs, economics of nuclear power and emergency preparedness. It also included a technical visit to a nuclear components manufacturing facility.

The second module, to be held from 22 to 31 October 2014 at the Institute of Nuclear Power Operators in Atlanta, Georgia, USA, will explore issues such as human resource development, regulations, and material transportation, as well as field visits to nuclear facilities including AP1000 new builds at Vogtle Electric Generating Plant, Barnwell Low-Level Waste Disposal Facility, and a fuel fabrication facility.

In between the two modules, participants undertake a research assignment on a nuclear power topic relevant to their country and will present their findings during the second module. There are eleven participants attending this year's programme, seven of whom are supported by an interregional technical cooperation project on "Supporting Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power" (INT2013).

This is currently the only international course of its type that is directed at the most senior levels of leadership in nuclear power programmes. Participants will gain new insights into the requirements for building safe and sustainable nuclear energy programmes.

MIT's Prof. Jacopo Buongiorno demonstrating nucleate boiling which improves heat transfer in a nuclear reactor. (Photo: L.Guild, MIT)

More information on INLEP is available at:
http://web.mit.edu/nse/education/exec/inlep.html

Contact: Anne Starz, NIDS; A.Starz@iaea.org and Brian Molloy, NPES; B.Molloy@iaea.org

Building a National Position on a New Nuclear Power Programme

Developing a strong and sustainable justification for a new nuclear power programme is central to ensuring its success.

Thirty-three experts from 25 IAEA Member States met in Vienna in June to discuss what constitutes a national decision for nuclear power and the importance of this process during the initial consideration of a new nuclear power programme. They also discussed how countries develop and implement the institutions and policies needed to support the development of a new nuclear power programme, as well as the roles and responsibilities necessary to ensure continued governmental support.

Launching a nuclear power programme is a major undertaking that requires careful planning, preparation and investment. The development of a national policy on nuclear power involves a broad range of stakeholders, including, politicians, policy makers, technical experts and the public. Although decision making mechanisms may differ greatly in Member States, there are some common elements and processes that, when shared, can help countries in developing a national nuclear policy.

As a result, the IAEA is developing a guidance document for governments seeking to establish a strong national position on the introduction of nuclear power. It will inform Member States about the process for establishing a national position as embarking countries prepare their national nuclear energy strategies. It should also help them build a sustainable position on nuclear energy with greater public acceptance in order to maintain the long term commitment required by nuclear power. It is planned to issue the document in the IAEA Nuclear Energy Series by the end of the year.

Contact: Matthew Van Sickle, NIDS;
M.C.Van-Sickle@iaea.org

Nuclear Power Engineering

Training Course on Capacity Building for Nuclear Power Programmes

Supporting Member States in building national capacity for introducing or expanding nuclear power programmes was the aim of a four-week IAEA training course held from 9 June to 4 July 2014 in the Republic of Korea.

This was the second time this programme was organized by the IAEA in cooperation with the KEPCO International Nuclear Graduate School (KINGS) and held in Ulsan, Republic of Korea. The first training course took place in 2013.

Nineteen technical professionals from 16 expanding and newcomer countries attended the training course which focused on activities outlined for Phase 2 and Phase 3 of the IAEA Milestones Approach. Phase 2 includes preparatory work for the construction of a nuclear power plant after a policy decision has been taken, while Phase 3 includes activities to implement a first nuclear power plant.

"Phase 2 of the three phases of development is very critical. During this phase, the country will carry out the technical, regulatory and financial work required to prepare for the construction of a nuclear power plant," said Ki Sig Kang from the IAEA Nuclear Power Engineering Section. The lectures by IAEA and Korean experts, and the group discussions addressed four major themes: (1) energy planning, pre-feasibility study and pre-construction activities; (2) financing and managing financial risks; (3) integrated approach to human resources and workforce planning; (4) site selection, Safeguards and security, and risk management.

The course provided participants with the technical knowledge required to take part in informed decision making necessary for launching or expanding a nuclear power programme. Also, participants from countries starting a new nuclear power programme shared their experiences and lessons learned.

In addition, weekly field trips to nuclear establishments, such as the Wolsung Nuclear Power Plant, the Korean Atomic Energy Research Institute (KAERI), and others provided new insights and additional information.

The IAEA Interregional Training Course on 'Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power' is part of the work plan of the IAEA interregional technical cooperation project INT2013: 'Supporting Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power'.

Contact: Ki Sig Kang, NPES; K-S.Kang@iaea.org

Optimizing Maintenance Programmes for Nuclear Power Plants

Maintenance keeps equipment reliable and functional and is essential for long term, safe and economic operation of nuclear power plants (NPPs).

The current situation of electricity markets in many countries creates pressure on utilities to improve the competitiveness of NPPs. To cope with this challenge and ensure that an NPP can operate safely and reliably in the short and long term, each plant should have a well-established maintenance programme.

A maintenance programme covers all preventive and remedial measures necessary to identify, prevent and mitigate the degradation of functioning structures, systems and components (SSC), or to restore the design functions of failed SSC to an acceptable level. However, reduced power production due to maintenance related activities is a main factor affecting electricity supply to the grid.

Participants received Certificates at the end of the Training Course on Nuclear Power Infrastructure Capacity Building in Member States Introducing and Expanding Nuclear Power, held in Ulsan, Republic of Korea. (Photo: K-S. Kang, IAEA)

Working session at the meeting to update the IAEA guidance publication on optimizing NPP maintenance programmes, IAEA, 3–5 June 2014. (Photo: IAEA)

Optimizing the maintenance process can ensure that appropriate maintenance tasks are carried out on critical and significant equipment to prolong the economic life of the plant or to optimize the use of limited resources, while maintaining the plant's availability to supply electricity.

The IAEA is revising one of its technical documents that addresses this issue: *Guidance for Optimizing Nuclear Power Plant Maintenance Programmes* (IAEA-TECDOC-1383), published in 2003. The update will reflect new technologies, methods, techniques, strategies and best practices that have been identified. The revised publication intends to provide a comprehensive overview, guidelines and examples to support NPP operating utilities in the optimization process of maintenance programmes. In June 2014, 14 experts from ten countries and two international organizations met at the IAEA to work on the first draft of this document.

To further collect and share information on this topic, the IAEA is also organizing a 'Technical Meeting on Maintenance Optimization to Improve Nuclear Power Plant Performance', in London, UK, in September 2014. The meeting is hosted by the Government of the UK through the World Nuclear Association (WNA).

The IAEA and the WNA are aiming at systematically improving the overall safe performance and competitiveness of NPPs through identifying and promoting best practices in technologies, engineering and management. Participants will share their experience on maintenance optimization programmes carried out in different IAEA Member States.

The main topics to be covered at the meeting are:

- Maintenance optimization as an ongoing process;
- Methods for maintenance optimization (including risk-based ones);
- Data requirements and collection;
- Experience and results from maintenance optimization;
- Regulatory aspects; manufacturers' views; and
- Contingency planning.

The meeting will also be informed about the revision of the IAEA technical document. Meeting presentations will be evaluated for their potential use as case studies for the new document. The outcome of the meeting will be a global overview of strategic approaches and implementation of the maintenance optimization process.

Contact: Jiri Mandula, NPES; J.Mandula@iaea.org

Research and Modelling on Flow Accelerated Corrosion

The IAEA is supporting a Coordinated Research Project (CRP) on flow-accelerated corrosion (FAC) in nuclear power plants.

The CRP focuses on elaborating FAC guidelines and benchmarking of prediction tools to help effectively reduce the number of piping and equipment failures caused by FAC.

FAC is a chemical effect that is primarily influenced by pH, hydrodynamics, oxygen, and temperature. As FAC wears away protective films (oxide layer) of piping and leads to corrosion of underlying metal, wall thinning in piping and vessels may cause sudden ruptures in high and moderate energy systems, resulting in plant shutdowns or other events and may risk personnel safety and affect safety and non-safety related equipment by leaking steam and water.

Research team members met at AREVA headquarters in Erlangen, Germany, in June 2014 to discuss recent progress of the project. Seventeen countries participate in the CRP which aims to benchmark commercially available software programs (BRT-CICERO, CHECWORKS, COMSY, and RAMEK) that are used to predict FAC-related pipe wear. Team members modelled and predicted wear rates for three real nuclear power plant (NPP) systems, and results were compared and discussed.

The next phase of the project is to adjust the models using actual wall thickness measurements obtained from the NPPs in question, to further predict future wear rates at a later point in time, and to compare results of the various programmes to actual wear rates obtained at that later point in time. FAC guidelines containing research results are being prepared and will be published in the IAEA Nuclear Energy Series following the completion of the project.

Further details on the project and CRP meeting at: http://www.iaea.org/NuclearPower/Engineering/CRP/FAC/ and http://www.iaea.org/NuclearPower/Meetings/2014/2014-06-04-06-06-RCM-NPE.html

Contact: John Moore, NPES; J.H.Moore@iaea.org

FAC caused pipe rupturing at the Mihama NPP in 2004. (Photo: http://www.corrosion-doctors.org)

Nuclear Power Technology Development

Small and Medium-Sized Reactor Development

Small and medium-sized reactors (SMRs) offer size options to meet the needs of a wide range of users and applications; they are more affordable, suitable for cogeneration and non-electric applications, and can enhance energy supply security in remote areas.

Many of the current SMRs under development are small modular reactors with an electric capacity of less than 300 MWe. They are built in factories and shipped to sites as modules to enable faster construction. This power range offers flexibility in locating generators, and this contributes to grid stability. The IAEA's current activities in the area of SMR include formulating a roadmap for technology development that incorporates safety lessons learned from major accidents, reviewing newcomer countries' technical requirements, and addressing economic competitiveness and regulatory and licensing issues.

Member States, particularly newcomer countries and those considering the expansion of their existing nuclear power programmes, have requested from the IAEA more in-depth technical information that will provide them with a comprehensive, balanced and up-to-date view of the current worldwide development on small modular reactors (see also p. 11).

Three meetings on specific aspects of SMR technology were held during the past few months:

Meeting on a Roadmap for the Development of Small Modular Reactor Technology, Oregon State University (OSU), USA, 22–24 April 2014

The meeting, hosted by the Nuclear Engineering Department of OSU, was one of a series of meetings to develop an IAEA Technology Roadmap for SMRs (see also Nuclear Power Newsletter, May 2014, p. 8). It fostered a dialogue among small modular reactor experts on specific issues of developing multi-module small reactor designs. China, France, India, Italy, Jordan, the Republic of Korea, the Russian Federation, and the USA as the host country were represented.

The meeting concluded that performance indicators for construction, operation and maintenance of SMR, and supply chain issues should be addressed. SMRs could also be operated and sited in more flexible ways. Power management and non-electricity applications are recognized as additional advantages of SMRs.

IAEA Technical Meeting on the Operating Fundamentals of Pressurized Water Reactor (PWR) Type-SMRs, Islamabad, Pakistan, 12–16 May 2014

The Pakistan Atomic Energy Commission (PAEC) initiated and hosted this technical meeting to introduce nuclear engineers from newcomer countries to the operating fundaments of water cooled SMRs and thus facilitate capacity building in these countries. Ten nuclear engineers from Algeria, Bangladesh, Indonesia, Jordan, Kenya, Malaysia and Thailand learned about the operating fundaments of this reactor type, including general design features, safety aspects and the technology of the 300 MWe class PWR. In addition to technical lectures and discussions, the meeting also included a technical visit to Pakistan's Chasma Nuclear Power Complex, a commercial nuclear power generation complex consisting of two 300 MWe PWRs units in operation and two units under construction. Participants were also able to visit Chasma's full scope training simulator for this reactor type.

Unit 1 and 2 of the Chasma Nuclear Power Complex, Pakistan. (Photo: PAEC)

As a follow up to the technical meeting, Pakistan has offered to host a comprehensive IAEA training workshop on SMR in early 2016.

Interregional Workshop on Design, Technology and Deployment Considerations for SMRs, IAEA, 2–5 June 2014

The four-day workshop was convened under the IAEA technical cooperation project 'Supporting Member States to Evaluate Nuclear Reactor Technology for Near-Term Deployment' (INT2014).

Over 30 experts from 22 Member States engaged in discussions of small modular reactor designs and concepts currently available or under development for near term deployment, i.e. potential deployment by 2022. This included water cooled reactors, high-temperature gas cooled reactors, and liquid metal cooled fast reactors.

Technology holders from countries such as Argentina, China, the Republic of Korea and the Russian Federation provided technical design descriptions of the major structures, systems and components of their advanced SMR products, the operating fundamentals and how they function in all modes of operation. Member States with an interest in SMR deployment presented their specific technical, deployment and infrastructure considerations. Participants also shared case studies and lessons learned. The technology associated with various non-electrical applications of nuclear reactors was presented, and IAEA staff provided an overview of approaches and options to assist countries in conducting nuclear reactor technology assessment.

Contact: Hadid Subki, NPTDS; H.Subki@iaea.org

47th Meeting of the IAEA Technical Working Group on Fast Reactors

The IAEA Technical Working Group on Fast Reactors (TWG-FR) held its 47th annual meeting in late May 2014 at the IAEA. Mexico, Romania, Slovakia, and the Generation IV International Forum (GIF) were welcomed as new participants in the TWG-FR.

TWG members from 18 countries and three international organizations reviewed the current status of national, international and IAEA activities on fast reactor and accelerator driven system (ADS) technology and provided input on the IAEA's programme in this area for the next two years.

"We believe that fast reactors have a key role to play for continued progress in nuclear energy," said Alexander Bychkov, IAEA Deputy Director General and Head of the Department of Nuclear Energy, in opening the meeting. "The IAEA remains the main international cooperation framework in this field. The fundamental support from the TWG-FR is crucial." Among the numerous initiatives recently undertaken and being launched at the IAEA, the development of a 'basic principles' simulator of a typical innovative sodium cooled fast reactor (SFR) will start this year. It will be a useful tool to educate and train students and young nuclear engineers. The IAEA has already significant experience in PC -based simulators for water-cooled reactors.

Construction of the BN-800 sodium cooled fast reactor, Beloyarsk Nuclear Power Station, Russian Federation. (Photo: Rosatom)

Fast reactor safety continues to be of high importance in IAEA activities. In addition to the joint initiative by the IAEA and the GIF on safety of SFRs, which emphasizes safety design criteria, two new studies will be conducted within the TWG-FR, on lessons learned from unusual and accidental situations in fast reactor operation, and on passive shutdown safety systems.

A new coordinated research project on the analysis of a turbine trip test conducted in the Japanese prototype reactor Monju will contribute to improving the knowledge on SFR operation and related analytical capabilities.

The IAEA has also launched a new activity to prepare a 'Catalogue on Experimental Facilities for Development and Deployment of Liquid Metal Cooled Fast Neutron System'. "We will identify experimental facilities for fast neutron systems currently operated, developed or planned by national and international programmes," said Stefano Monti, IAEA Scientific Secretary of the TWG-FR. All IAEA Member States with relevant fast neutron system programmes are participating in this project.

Contact: Stefano Monti, NPTDS; S.Monti@iaea.org

GIF and IAEA Cooperate on Safety Design Criteria for SFRs

Experts in the field of safety of sodium cooled fast reactors (SFRs) from IAEA Member States, the European Commission, GIF and the IAEA met in Vienna on 10–11 June 2014 for the 4th IAEA-GIF Workshop on Safety of SFRs.

GIF and the IAEA have been collaborating and sharing information in selected areas of mutual interest, including the safety of SFRs and in particular the harmonization of safety approach, safety requirements and safety design criteria for the GEN-IV SFRs under development worldwide.

In the past decades, SFRs have reached a high level of maturity through design, construction and operation of experimental and prototype reactors, such as the Fast Flux Test Facility (FFTF) in USA, the small size Prototype Fast Reactor (PFR) in the UK, the prototype PHÉNIX in France, the BN-350 in Kazakhstan, the demonstration plant BN-600 in Russia, JOYO and MONJU in Japan, and the commercial size SUPERPHÉNIX in France. Several countries are currently engaged in SFR design studies, such as Japan and the Republic of Korea, and in design and construction projects, such as China, France, India, and the Russian Federation.

The 3rd workshop in 2013 had confirmed the need to develop specific safety design criteria for innovative SFRs which should be harmonized at the international level and become part of the IAEA's recommendations for safety requirements for innovative SFRs. Subsequently, several regulators and international organizations reviewed the GIF Safety Design Criteria Report (Phase 1) and proceeded with to the next phase, which is intended to quantify the design criteria and develop detailed guidelines for implementation.

At the June Workshop, participants presented and discussed the status of this international review. Design organizations involved in the development of innovative SFRs from China, France, India, Japan, Korea, Russia and the USA presented their reactor concepts and engineering solutions to meet the agreed safety design criteria. Global safety objectives, prevention and mitigation of severe accidents in Generation IV SFRs, and specific technical safety issues such as the practical elimination of accident situations, design extension conditions, sodium risks, and sodium void reactivity effects were also discussed.

More information on this meeting and all presentations are available at: http://www.iaea.org/NuclearPower/Meetings/2014/2014-06-10-06-11-TM-NPTD.html

Contact: Stefano Monti, NPTDS; S.Monti@iaea.org

High Temperatures Materials for Reactor Deployment

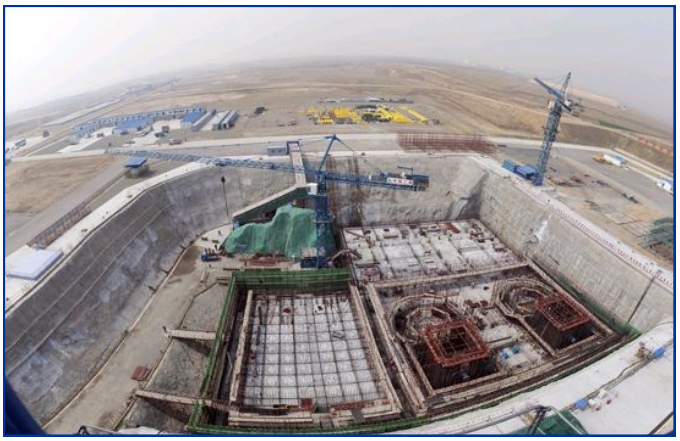
Graphite and metals used in High Temperature Gas cooled Reactors (HTGRs) are already available today for near term deployment at very high coolant temperatures.

At an IAEA Technical Meeting on High-Temperature Qualification of High Temperature Gas Cooled Reactor Materials, held in June 2014, twelve experts from seven Member States evaluated the latest available research and technology. They concluded that graphite and metals for HTGRs are already available today for near term deployment at gas outlet temperatures up to 800°C. For example, China is constructing the HTR-PM, a commercial demonstration high temperature gas-cooled reactor, with an outlet temperature of 750°C. Work is in progress to have materials qualified for even higher temperatures in the foreseeable future.

The high coolant temperatures of HTGRs make this technology attractive since it increases efficiencies in electricity production and is attractive for co-generation or process heat applications. This means HTGRs do not only compete in the electricity production market but in the total energy market. Ultimately, many countries are pursuing hydrogen production with HTGRs that ideally need temperatures beyond 900°C.

The historical experience with high coolant temperatures includes the operation of experimental and demonstration reactors in China, Germany, Japan, the UK and the USA. For example, the pebble bed type AVR reactor in Germany and the prismatic block type High Temperature Test Reactor (HTTR) in Japan have reached coolant temperatures of 990° C and 950°C, respectively. While the AVR stopped operation in the late 1980s, the HTTR demonstrated operation at such high temperatures (950 °C) without interruption (50 days non-stop) in 2010.

Recent high temperature material developments include new graphite grades being tested as part of the Next Generation Nuclear Plant (NGNP) and InnoGraph programs that can form the basis for the establishment of a new code in ASME (American Society of Mechanical Engineers). Codes and standards are already available for reactor vessels metallic



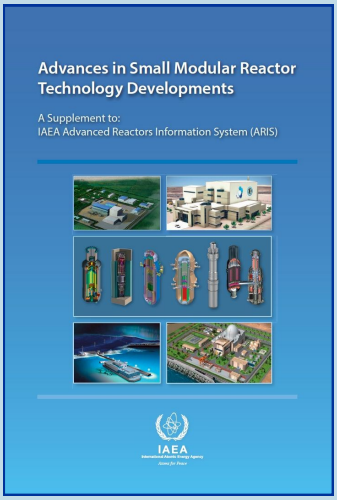
Construction site for the HTR-PM at Shidaowan in Shandong province, China (Photo: INET/Tsinghua University)

for near term applications (up to 800°C). Higher temperature materials such as Alloy 617 are being developed and added to the ASME code as part of the Generation IV VHTR activities and should be available soon.

The IAEA plans to publish a technical report related to all high temperature material performance aspects, including fuel performance and modelling, aspects presented at earlier technical meetings.

Contact Frederik Reitsma, NPTDS; F.Reitsma@iaea.org

New booklet: Advances in Small Modular Reactor Technology Developments



The IAEA, in cooperation with Member States, has developed a booklet on advances in small modular reactor technology worldwide, which showcases specific reactor designs and technologies.

Both water cooled and high temperature gas cooled designs are presented from specific viewpoints that include the motivation for development, milestones in the development, target applications, specific design and safety features, fuel characteristics and fuel supply issues, and licensing and certification status.

The new booklet will be published in September and available at http://www.iaea.org/NuclearPower/Technology/

It is a supplement to the **IAEA Advanced Reactor Information System (ARIS)** http://aris.iaea.org.

IAEA Tools for Desalination and Water Management

To enhance capacity building in Member States, the IAEA offers software programs on nuclear desalination and managing the water use and consumption for nuclear power plants.

The IAEA's **Desalination Economic Evaluation Program** (DEEP) is a cost-free tool to evaluate the performance and costs of different power and water co-generation configurations. The latest version of the programme, DEEP 5.0, includes several improvements to the previous version. It can be used to perform various studies on nuclear desalination and to enhance economic analyses for desalination plants. The scenario manager feature of DEEP 5.0 helps decision makers to choose the best option for cogeneration at a particular site. Some minor updates will still be made, relating to a few models embedded in the program.

Representatives from the DEEP Users Group met at the IAEA in May 2014 to share information and experiences on the utilization and robustness of DEEP. The participants presented results of latest research and development activities on seawater desalination using nuclear energy, discussed the increasing use of the DEEP software and evaluated new ideas for improving and updating DEEP to make the software even more user-friendly. They also recommended a number of activities including conducting training courses for beginners in the use of DEEP. More information on DEEP and a link to download the latest software are available at: http://www.iaea.org/NuclearPower/Desalination/.

The IAEA also provides to Member States the newly developed and released **Water Management Program** (WAMP) for estimating water needs during all phases of nuclear power plant construction and operation. WAMP is a powerful tool for efficient water management, especially for water cooled nuclear power plants. It can be downloaded free of charge at http://www.iaea.org/NuclearPower/wamp/

In July 2014, an IAEA Training Course on Water Management in Nuclear Power Plants addressed strategies that help reduce water use and consumption in NPPs, especially in areas suffering from a lack of sufficient water resources. It also provided training on estimation of water needs in NPPs based on the type of cooling systems, and the use of WAMP. Lessons learned from the Palo Verde NPP in the USA were presented, which is the only NPP that operates on 100% reclaimed water. This approach could be a solution for countries suffering from water scarcity which might limit their ability to introduce nuclear power.

Contact: Ibrahim Khamis, NPTDS; I.Khamis@iaea.org

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

INPRO Steering Committee holds 22nd Meeting

The INPRO Steering Committee consists of representatives from all INPRO Members, who meet regularly to review progress and provide guidance on future activities.

The INPRO Steering Committee held its 22nd Meeting on 24–27 June 2014 at the IAEA. The 40 representatives from INPRO Members and international organizations, who attended the meeting, unanimously approved the INPRO Action Plan for 2014–2015, and discussed initial planning for the 2016–2017. The meeting was chaired by Mr Indravadan Dulera (India); Mr Pascal Anzieu (France) and Ms Anna Bradford (USA) served as rapporteurs.

Since the last Steering Committee Meeting in 2013, Bangladesh has joined INPRO as its 40th Member. In May 2014, Finland was welcomed as an Observer in INPRO.

Following an overview of progress made within the INPRO Action Plan, INPRO Task Leaders presented detailed updates of recent activities:

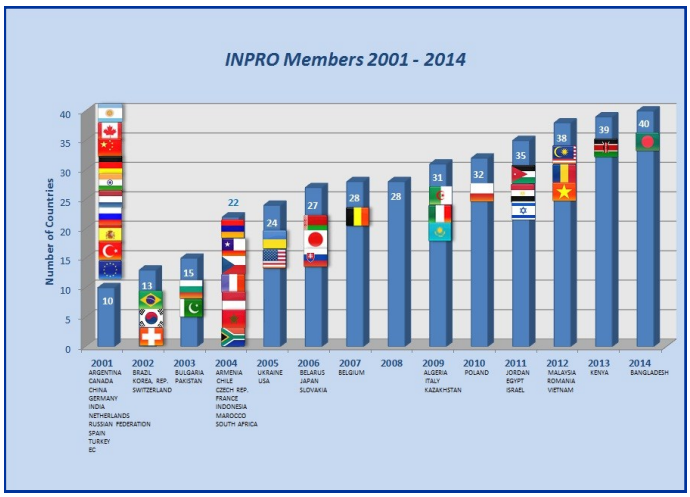
Task 1: Global Scenarios

Drafting of the report of the INPRO Collaborative Project (CP) on Synergetic Nuclear Energy Regional Group Interactions Evaluated for Sustainability (SYNERGIES) will be completed in 2014.

Good progress has been made in preparing the official launch of two CPs: Roadmaps for a Transition to Globally Sustainable Nuclear Energy Systems (ROADMAPS) and Key Indicators for Innovative Nuclear Energy Systems (KIND). A 'Users' Guide for Modelling of Nuclear Energy Systems with MESSAGE' is being developed jointly with the IAEA Planning and Economic Studies Section. Distance training events on nuclear energy sustainability continue.

Task 2: Innovations

The terms of reference, scope, and work plan with expected deliverables have been developed for the activity on dissemination of good practices in enhancing collaboration on innovations to support sustainable nuclear energy systems, and for the CPs on Review of Innovative Reactor Concepts for Prevention of Severe Accidents and Mitigation of their Consequences (RISC), Nuclear Fuel and Fuel Cycle Analysis for Future Nuclear Energy Systems (FANES) and Waste from Innovative Types of Reactors and Fuel Cycles (WIRAF).



Evolution of Membership in INPRO, 2001–2014.

Task 3: **Sustainability Assessment and Strategies**

Progress in the revision of the manuals on the INPRO Methodology was highlighted. Participants in the CPs on Proliferation Resistance and Safeguardability Assessment Tools (PROSA) and on Environmental Impact of Potential Accidental Releases from Nuclear Energy Systems (ENV-PE) are preparing their reports for publication.

The Nuclear Energy System Assessments (NESAs) in Indonesia, Romania and Ukraine are progressing well. Preparation for a proposed limited scope NESA of Liquid Metal Fast Reactor (LMFR) in China, India and the Russian Federation is underway.

Task 4: **Policy and Dialogue**

The Steering Committee was updated on the result of the 7th Dialogue Forum, held in November 2013, which focused on the 'Sustainability of Nuclear Energy System Based on Evolutionary Reactors'.

Participants were also briefed on the two 2014 Dialogue Forums: the 8th Forum, entitled "Towards Nuclear Energy Sustainability: Economics, Resource Availability and Institutional Arrangements", is taking lace from 26–29 August while the 9th Dialogue Forum, focusing on International Collaboration on Innovations, will be held from 18–21 November. Topics proposed for Dialogue Forum in 2015 were also discussed.

In addition, regional training activities on assessing nuclear energy sustainability have been proposed for 2014 in Latin America, and for 2015 in Asia and the Pacific region.

The Steering Committee recognized progress in joint activities with other IAEA programmes and encouraged INPRO to continue its excellent collaboration with international organizations. The contributions and dedication of Zoran Drace, who led the INPRO Group/Section on a temporary basis since November 2012, were acknowledged. Mr Drace retired from the IAEA at the end of July 2014 and recruitment of his successor will be finalized soon. Until then, Mr Vladimir Kuznetsov has assumed the responsibilities of Acting INPRO Section Head.

Contact: Vladimir Kuznetsov, INPRO Section;
V.Kuznetsov@iaea.org

Key Indicators for Innovative Nuclear Energy Systems

The first technical meeting of the new INPRO collaborative project on Key Indicators for Innovative Nuclear Energy Systems (KIND) was convened at the IAEA on 8–11 July 2014.

Nineteen experts from Armenia, Bulgaria, China, Croatia, France, Germany, India, Indonesia, Malaysia, Romania, the Russian Federation, Thailand, the United Kingdom, the USA and Viet Nam attended the technical meeting.

The overall objective of the KIND project is to develop guidance and tools for comparative evaluations of the status, prospects, benefits and risks associated with the development of innovative nuclear technologies to be used in a more distant future, and to support the prioritization/adjustment of resource allocations within national programmes on innovative nuclear technology development in Member States. Another objective of the KIND project is to examine the generic KIND approach for potential application to other problems which are of particular interest to newcomer countries.

The objectives of the meeting were to:

- Elaborate Terms of Reference for the project;
- Review and update the set of key indicators suggested by the IAEA Secretariat;
- Review and select prospective methods for judgement aggregation;
- Develop an outline of the project report; and
- Define the scope and schedule of further activities, including possible sample applications of the framework being developed.

The Scientific Secretaries presented the objectives of the KIND project and the results of preparatory activities. Discussions and brainstorming sessions were convened to achieve the meeting's objectives.

The participants concluded that the KIND project will proceed along the following major tracks:

Track 1 – Selection and elaboration of a set of key indicators and the method for the comparative assessment of innovative nuclear technologies and nuclear energy systems;

Track 2 – Selection and adaptation of judgment aggregation/uncertainty and sensitivity analysis methods to be applied in all other tracks of KIND;

Track 3 – Comparative assessment of nuclear energy evolution scenarios using scenario-oriented key indicators developed within the GAINS collaborative project;

Track 4 – Examination of the potential for the KIND approach in applying it to other problems, including those of interest to newcomer and user countries; alternative sets of key indicators would need to be developed for these.

The meeting noted that at present, and even in the near future, most newcomer countries have no capacity to be involved in developing innovative technologies for nuclear power. However, they could get involved in the process of innovation through providing envisaged technology holders

with information, data and proposals for innovation reflecting their national needs.

Participation of such countries in the KIND project would contribute to capacity building and better understanding of sustainability goals and the sustainability potential of nuclear energy, and the role which different countries could play in making collaborative transitions to regionally and globally sustainable nuclear energy systems.

Contact: Vladimir Kuznetsov, V.Kuznetsov@iaea.org and Galina Fesenko, G.Fesenko@iaea.org, both INPRO Section

Nuclear Fuel and Fuel Cycle Analysis for Future Nuclear Energy Systems

Innovative fuels and fuel cycles constitute an important approach towards sustainable nuclear energy development. Innovations in the fuel cycle can therefore significantly contribute to the growth of nuclear power.

The IAEA has published a number of reports in this area and further publications are under preparation. Most of them focus on technological aspects, but the choice of fuel and fuel cycles for future nuclear energy systems (NESs) will have to take into account various aspects influencing the suitability of the fuel cycle for particular types of future NESs.

Therefore, INPRO is initiating a collaborative project (CP) on 'Nuclear Fuel and Fuel Cycle Analysis for Future Nuclear Energy Systems' (FANES), which will focus on feasibility analyses of advanced and innovative fuels for different reactor systems and their influences on the development of future NESs. The FANES project will:

(1) Provide an overview of current fuel and fuel cycles and visions for future fuel and fuel cycles; **(2)** conduct feasibility analyses of selected advanced and innovative fuels, including fabrication, storage, and transportation for different reactor systems; the following fuels will be analyzed: mixed oxide fuel (MOX) for light water reactor (LWR); MOX-Pu for sodium cooled fast reactors (SFR); MOX-transuranic (TRU) for SFR; metallic mixed U/Pu and U/TRU alloy for SFR; nitride fuel with TRU for SFR and lead cooled fast reactor (LFR); Th-U fluoride for molten salt reactor; TRISO fuel for very high temperature reactor; and very high burnup uranium fuel for SFR; **(3)** conduct feasibility analyses of selected fuel cycle options, including reprocessing, storage and transportation of used fuel; fuel cycle reprocessing technologies to be analyzed will include advanced aqueous reprocessing for LWR, UOX/MOX fuel reprocessing for SFR, electrochemical reprocessing for SFR metallic fuel, and mixed aqueous-electrochemical reprocessing for LFR and SFR nitride fuel; and **(4)** identify and discuss potential advanced NESs using these selected fuel and fuel cycles.

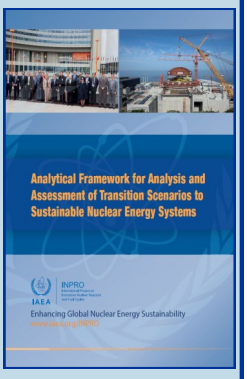
The Nuclear Fuel Cycle
© IAEA, AREVA, Cameco, Fortum, Posiva, TVO, WNA

The first Technical Meeting of the FANES project was held on 17-20 June 2014, with eleven participants from eight Member States attending. They agreed that this project would be a useful activity for Member States and should support efforts to improve the sustainability of NESs, both nationally and globally. They also recommended that experts from other Member States, such as Canada, China, Japan, the Republic of Korea and the UK, should be invited to participate.

The meeting achieved its planned objectives including formulating the project's terms of reference, selecting the nuclear fuel and nuclear fuel cycle technologies to be analyzed (as above), dividing different project tasks among participating countries, and starting preparations for an IAEA technical document on the results of the project. The next meeting of the FANES CP will be held in November 2014.

Contact: Alexey Grigoriev, INPRO Section;
A.Grigoriev@iaea.org

New INPRO Booklet: Analytical Framework for Analysis and Assessment of Transition Scenarios to Sustainable Nuclear Energy Systems



This booklet presents major elements of the international analytical framework developed by the INPRO Collaborative Project on Global Architecture of Innovative Nuclear Energy Systems Based on Thermal and Fast Reactors Including a Closed Fuel Cycle (GAINS).

The framework is a part of the integrated services which the IAEA is providing to Member States considering to develop or expand their nuclear energy programmes.

http://www.iaea.org/INPRO/download/news/2014/INPRO_GAINS_brochure.pdf

Recently Published

All IAEA publications can be downloaded at http://www.iaea.org/Publications/

Nuclear Power Reactors in the World 2014 Edition (Reference Data Series RDS/2)

Operating Experience with Nuclear Power Stations in Member States in 2013: 2014 Edition (CD-ROM, STI/PUB/1671)

INPRO Methodology for Sustainability Assessment of Nuclear Energy Systems: Infrastructure (NE Series NG-T-3.12)

INPRO Methodology for Sustainability Assessment of Nuclear Energy Systems: Economics (NE Series, NG-T-4.4)

Preparation of a Feasibility Study for New Nuclear Power Projects (Nuclear Energy Series NG-T-3.3)

Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes (Nuclear Energy Series NG-T-3.11)

International Safeguards in the Design of Nuclear Reactors (Nuclear Energy Series NP-T-2.9)

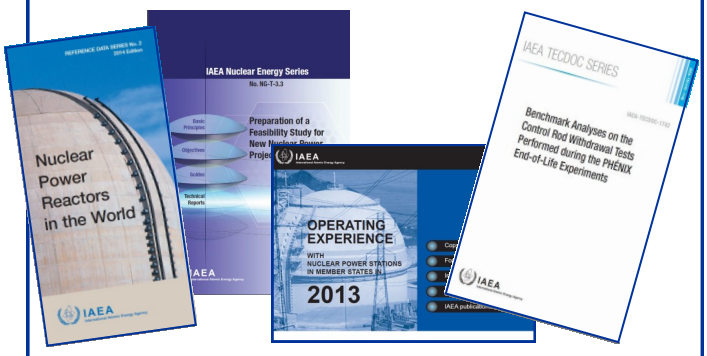
Managing Organizational Change in Nuclear Organizations (Nuclear Energy Series NG-T-1.1)

Options to Enhance Proliferation Resistance of Innovative Small and Medium Sized Reactors (Nuclear Energy Series NP-T-1.11)

Use of a Graded Approach in the Application of the Management System Requirements for Facilities and Activities (IAEA TECDOC 1740)

Benchmark Analyses on the Control Rod Withdrawal Tests Performed during the PHÉNIX End-of-Life Experiments (IAEA TECDOC 1742)

Heat Transfer Behaviour on Thermohydraulics Code Testing for Supercritical Water Cooled Reactors (SCWRs) (IAEA TECDOC 1746)



New on the Team

José Bastos, Nuclear Infrastructure Development Section

José Bastos joined the Division of Nuclear Power in July 2014 as Technical Lead for Nuclear Power Infrastructure Development. Before coming to Vienna, he was with the UAE's Federal Authority for Nuclear Regulation (FANR), where he was Manager for Technical Training and Capacity Building and then served as Advisor to FANR's Deputy Director General for Operations, focusing on cross-cutting issues including the implementation of a management system and the integration of safety, security and safeguards. Earlier in his career, Mr Bastos worked at the IAEA Nuclear Safety Division as Scientific Secretary of INSAG. He also was a safety specialist at AREVA for the ATMEA1 project and for the third periodic safety review of the 900 MW series in France.

Harri Varjonen, Nuclear Power Engineering Section

Harri Varjonen joined the Division of Nuclear Power as a Nuclear Engineer from Finland. He is responsible for maintenance and outage management activities of the Nuclear Power Engineering Section. Mr Varjonen has more than 25 years of experience, mainly in mechanical maintenance. His areas of expertise include construction, commissioning and maintenance, and inspection of nuclear power plants. For the past 12 years, he worked at the Finnish Olkiluoto Nuclear Power Plant as Head of Mechanical Equipment Services. Earlier, he held different maintenance positions in the paper industry.

Ghulam Jilani, Nuclear Power Technology Development Section

Ghulam Jilani joined the Division of Nuclear Power in June 2014 as Cost-Free Expert from Pakistan. Before coming to Vienna, he was with the Pakistan Atomic Energy Commission, where he worked as a design engineer. His areas of expertise include nuclear process design, and mechanical equipment design and analysis. Earlier in his career, Mr Jilani worked at the Chashma Nuclear Power Plant (C-1) as operation engineer.

Anton Ponomarev, INPRO Section

Anton Ponomarev joined the Division of Nuclear Power in August 2014 as Cost-Free Expert from the Russian Federation. Before coming to Vienna, he was with the State Atomic Energy Corporation "ROSATOM", where he was a Leading Expert in the Department of International Cooperation, focusing on cross-cutting activities related to infrastructure development in newcomer countries and nuclear knowledge management, as well as coordination of international cooperation in the area of non-proliferation and IAEA Safeguards. Earlier in his career, Mr Ponomarev worked at the IAEA as a Consultant in INPRO.

Upcoming Events: October to December 2014

All 2014 technical meetings organized by the Division of Nuclear Power at:
www.iaea.org/NuclearPower/Meetings/2014/

Date	Title	Location	Contact
6–9 Oct	Technical Meeting on the Power Reactor Information System (PRIS)	IAEA, Vienna, Austria	J.Mandula@iaea.org
13–15 Oct	Technical Meeting on Ageing Management of Buried and Underground Piping and Tanks for NPPs	EPRI, Charlotte, USA	J.H.Moore@iaea.org
3–5 Nov	Technical Meeting on Engineering Responsibility and the Design Authority Concept for the Review of New Nuclear Power Plant Designs	Istanbul Turkey	A.Kilic@iaea.org
3–7 Nov	Technical Meeting of the INPRO CP on Roadmaps for a Transition to Globally Sustainable Nuclear Energy Systems (ROADMAPS)	IAEA, Vienna, Austria	V.Kuznetsov@iaea.org
4–7 Nov	Technical Meeting on Effective Techniques and Messages to Engage with Decision Makers and the Public	Bristol, UK	B.Pagannone@iaea.org M.Ferrari@iaea.org
17–19 Nov	Technical Meeting on Severe Accident Mitigation through Improvements in Filtered Containment Venting for Water Cooled Reactors	IAEA, Vienna, Austria	C.Painter@iaea.org
18–21 Nov	9th INPRO Dialogue Forum: International Collaboration on Innovations	IAEA, Vienna, Austria	A.Grigoriev@iaea.org
24–26 Nov	Technical Meeting on the Engineering Impacts of the Fukushima Daiichi Accident	Ulsan, Rep. of Korea	A.Kilic@iaea.org
25–27 Nov	Meetings of the TWGs on Advanced Technologies for LWRs and HWRs	IAEA, Vienna, Austria	M.Harper@iaea.org M.Krause@iaea.org
1–5 Dec	Training Workshop on Technology Assessment of SMR Designs for Near Term Deployment	IAEA, Vienna, Austria	H.Subki@iaea.org
2–5 Dec	Technical Meeting on the Status of the IAEA Fast Reactor Knowledge Preservation Initiative	IAEA, Vienna, Austria	S.Monti@iaea.org
8–10 Dec	Technical Meeting on Economics Assessment of Plant Life Management for Long Term Operation of NPPs	IAEA, Vienna, Austria	K-S.Kang@iaea.org A.Kilic@iaea.org
11–12 Dec	Technical Meeting on the Status of the International Knowledge Base on Irradiated Nuclear Graphite Properties	IAEA, Vienna, Austria	F.Reitsma@iaea.org
15–19 Dec	Technical Meeting of the TWG on Nuclear Power Infrastructure	IAEA, Vienna, Austria	J.Bastos@iaea.org

Impressum

Nuclear Power Newsletter
Vol. 11 No. 3, September 2014

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

Vienna International Centre, PO Box 100, 1400 Vienna, Austria

Printed by the IAEA in Austria, September 2014

14-12832