IAEA International Atomic Energy Agency

Nuclear Power Newsletter

News from the Division of Nuclear Power
Vol. 9, No. 1, January 2012 ISSN 1816-9295

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

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International Workshop on Public Information and Understanding to Introduce New Nuclear Power Plants, 10–14 October 2011, Seoul, Republic of Korea.

Enhancing Public Information and Understanding for New Nuclear Power Plants

A Practical Agreement between the IAEA and the Korea Nuclear Energy Promotion Agency (KONEPA) on cooperation and promotion of public information and understanding of the peaceful use of nuclear energy, signed in July 2010, provided the framework for an international workshop in the Republic of Korea. The meeting was designed to enhance the competence of communications officers in Member States to manage nuclear power development programmes and facilitate a comprehensive understanding of stakeholder involvement in nuclear power issues.

Hosted by KONEPA in Seoul on 10–14 October 2011, the workshop offered 30 participants from 15 countries the opportunity to reflect on lessons learned from the Fukushima accident and share information and knowledge about theoretical and practical approaches to building effective strategies and plans for stakeholder communication.

The workshop was opened by Mr Jae Hwan Rhee, Chairman of KONEPA and Mr Alexander Bychkov, IAEA Deputy Director General for Nuclear Energy, who pointed out that "one of the lessons learned from the Fukushima accident is the importance of timely and accurate dissemination of information. This is important for both the planning and implementation phases of protective actions for the affected public locally, in a region and also in neighbouring countries." ***Continued on p. 3***

Message from the Director

Welcome to the first issue of the Nuclear Power Newsletter in 2012.

The 55th IAEA General Conference was successfully held in September 2011 with various events, including the exhibition of the Department of Nuclear Energy and the three side events on nuclear power issues, i.e. highlights of INPRO, developments in the introduction of nuclear power, and the Nuclear Industry Cooperation Forum where we discussed developing closer, mutually beneficial relationships with the nuclear industry. I would like to express my sincere appreciation to all participants and staff for their hard work in preparing these events.

Other major activities during the past few months included the preparation of detailed actions, in the short, mid, and long term, for the IAEA Action Plan on Nuclear Safety, the International Workshop on Public Information and Understanding to Introduce New Nuclear Power Plants held in the Republic of Korea in October, an Integrated Nuclear Infrastructure Review (INIR) mission to Bangladesh in November and the 18th INPRO Steering Committee Meeting in November. I am also pleased that a good number of publications were issued recently and you will find a listing of them in this newsletter.

I would like to acknowledge the good work and dedication of Mr Hussam Khartabil of the INPRO Group who moved to the Division of Nuclear Installation Safety (Department of Nuclear Safety and Security) in July 2011, Mr Ludovit Kupca of NPES who returned to the Bohunice Nuclear Power Station in Slovakia in November 2011, Mr Sunarko Sunarko of INIG, and Mr Vladimir Usanov (Russian Federation) and Ms Christina Johari (Indonesia) of the INPRO Group who returned to their home countries at the end of 2011.

Mr Thomas Koshy from US NRC assumed the position of NPTDS Section Head in September. Mr Mark Harper from the US Naval Academy and Mr Stefano Monti from ENEA, Italy, also joined the NPTDS team. Mr Arif Nesimi Kilic from Arizona Public Service Co., USA, and Ms Jaana Isotalo from TVO in Finland joined NPES. I also would like to introduce several new colleagues in INIG, i.e. Ms Marta Ferrari, who previously worked in the TC Department, Ms Fanny Bazile from CEA, France, and Mr Masahiro Yagi from the Ministry of Economy, Trade and Industry in Japan. Mr Pill Hwan Park from the Ministry of Education, Science and Technology, Republic of Korea, is now working with the INPRO Group.

The first retreat on administrative matters was held on 5 August with all general service staff of the NENP Division and Heads of the Sections/Groups. We are now planning the 4th Divisional Retreat during the first quarter of 2012. A great opportunity for networking and getting to know new colleagues was the first 'Divisional Sports Day' on 10 September on the outskirts of Vienna. In this issue, three staff members are introducing their home towns — Ballycastle, Northern Ireland (Brian Molloy), Phoenix, Arizona (Ness Kilic), and Multan, Pakistan (Kamran Qureshi).

The Nuclear Power Newsletters will now be published only three times per year, in January, May and September. The January and May issues will be published electronically only on the IAEA's websites, while the September issue will also be available in printed form for the participants of the General Conference. I trust our readers will find this change acceptable, as it also saves some money and people's time that can be used effectively for other purposes.

As we look forward to the coming months with many important activities on our agenda — both related to implementing the IAEA Action Plan on Nuclear Safety and the Division's biannual plan of activities — I wish you all a peaceful and prosperous year 2012.

Jong Kyun Park
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Keynote speeches were given by Mr Kun Mo Chung, Advisor to the Korea Electric Power Corporation (KEPCO) and Mr Sueo Machi, Japan Coordinator of the Forum for Nuclear Cooperation in Asia (FNCA).

"Before implementing a nuclear power programme, particularly in newcomer countries, it is clear that more emphasis needs to be placed on appreciating socio-political issues and addressing them in a comprehensive manner understandable to all stakeholders" said Mr J.K. Park, Director of the IAEA Division of Nuclear Power, who also attended the meeting.

Public information and understanding can come in many forms, from government mandated involvement of stakeholders in a decision making process to simple programmes that are designed to create awareness. No single approach will be suitable for all countries, and taking into account regional, national and local diversity is a key to any successful stakeholder communication programme.

The workshop, which was facilitated by IAEA and external communication experts, focused on basic principles of stakeholder communication, identification of stakeholders, devising a communication plan including messages to respond to stakeholders' concerns and identifying the most effective communication tools, and evaluating the effectiveness of communication activities. A session on crisis communication included lessons learned from the Fukushima nuclear accident. The participants also benefited from case studies presented by the representatives of Argentina, France, Japan and the Republic of Korea. Working in three groups, they developed frameworks for stakeholder communications strategies.

As one of the facilitators pointed out, the 'golden rules' of successful stakeholder communication include transparency, frank debate, targeted communication, a cross cutting outreach strategy aimed at internal and external stakeholders and establishing partnerships. Most important, trust is the foundation of any successful communications programme.

Participants listening to one of the case studies presented at the international workshop in Seoul, Republic of Korea.

The workshop enabled participants to gain a sound understanding of the main issues related to public information and communication in nuclear energy. They emphasized the usefulness of continuing this programme with IAEA support and, with the support of KONEPA, plan to be networking actively to exchange information and share experiences on their individual activities.

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GC Side Events on Nuclear Power Issues

Cooperating Closer with Nuclear Industry Post-Fukushima

At an Industry Cooperation Forum about 65 representatives from nuclear industry and the IAEA shared operating experiences and management strategies to enhance safety and improve performance in the wake of the Fukushima accident. The forum was the first of its kind and will become an annual event. Presentations on responses to Fukushima and how the IAEA could help were made by senior industry officials from Japan, the Russian Federation, the USA and Foratom.

The IAEA General Conference is traditionally a forum for diplomats, scientists and regulatory bodies, while the nuclear industry has remained in the background.

The forum participants made the following recommendations*:

- The IAEA should increase interactions with utilities and the nuclear industry to improve safety by better sharing operational experience and technological improvements.
- The IAEA should facilitate the interaction between operating organizations in experienced countries and newcomers to nuclear power generation.
- The IAEA should organize regular meetings to facilitate more effective communication between operating organizations and the public using existing IAEA communication tools.
- The IAEA should strengthen its capabilities to collect and disseminate best operational practices and enhance its cooperation with WANO.

All presentations are online at: http://www.iaea.org/NuclearPower/Engineering/Meetings/2011-09-21-GC55-SE.html

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**These recommendations do not necessarily represent the views of the IAEA*

Developments in the Introduction of Nuclear Power

INIG Side Event on 21 September 2011: Panel discussion on nuclear power infrastructure, chaired by Mr Yury Sokolov, Rosatom, Russian Federation.

More than 100 people attended a side event on the developments in nuclear power infrastructure. Speakers from Member States and the IAEA highlighted recent developments in international cooperation and partnerships for the introduction of nuclear power as well as steps taken by the IAEA to strengthen its support to interested Member States.

Uruguay presented the consequences of the Fukushima accident on newcomer countries and concluded that the interest in nuclear power remains strong.

The Russian Federation and Turkey made presentations regarding their cooperation on the Build-Own-Operate agreement including issues of financial support to the project, technology, operations and ownership. The United Arab Emirates (UAE) discussed building a new nuclear academic infrastructure with a special focus on human resource development.

International cooperation was described as being an essential aspect of the global nuclear industry. Vietnam highlighted the importance of coordinating IAEA, bilateral and multilateral assistance through an 'Integrated Work Plan'. The USA described its activities to support the use of nuclear energy for peaceful purposes with a particular focus on the Peaceful Uses Initiative (PUI).

An IAEA presentation highlighted actions related to the IAEA Action Plan on Nuclear Safety as well as IAEA services directed to support Member States in their efforts to develop safe and robust infrastructure for nuclear power programmes.

All presentations are online at:

http://www.iaea.org/NuclearPower/Infrastructure/Meetings/2011-09-21-GC55-SE.html

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Highlights of INPRO Projects – Adding Value for Member States

The INPRO side event focused on how INPRO's activities are adding value to Member States. Representatives of INPRO Members presented results of Collaborative Projects and a vision for INPRO's medium term development to over eighty participants.

The Russian Federation presented the results of the INPRO Collaborative Project GAINS, which has developed a framework for analyzing global nuclear energy system architectures and shown through sample analyses that sustainability could be achieved by technology innovations and global collaboration.

Belarus presented the status of its Nuclear Energy System Assessment (NESA) using the INPRO methodology. The NESA is nearing completion and the national team will provide the final report by the end of 2011. Belarus plans to install two nuclear power units (1200 MW(e) each) in 2016 and 2018. The share of nuclear power will be about 27% of the total installed electricity production capacity by 2030.

The Republic of Korea highlighted the results of the INPRO Collaborative Project PRADA that investigated proliferation resistance of nuclear energy systems, i.e. acquisition/diversion pathways. The project concluded that a proliferation resistance assessment should be performed at the State level, the innovative nuclear energy systems level, and the facility level. The robustness of barriers against proliferation depends on the State capabilities and is measured by determining whether the safeguards goals can be met effectively and efficiently. The INPRO methodology needs information regarding proliferation potentials from more quantitative analyses done jointly by technology developer (supplier), safeguards experts, and experts in proliferation resistance.

Opening of the INPRO Side Event on 21 September 2011.

The Chair of the side event, Mr Robert Speranzini of Canada, gave a preview of the INPRO 2017 Development Vision which was subsequently approved by the INPRO Steering Committee in November 2011.

All presentations are online at:

http://www.iaea.org/INPRO/News/articles/2011-09-21-GC55-SE.html

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Supporting Nuclear Infrastructure Development

Bangladesh Progresses Toward Nuclear Power

Bangladesh has achieved notable progress in its nuclear power infrastructure development, according to a team of international experts from the IAEA. An Integrated Nuclear Infrastructure Review (INIR) mission concluded that Bangladesh has mostly met the conditions for knowledgeable decision making and is actively preparing for the Rooppur nuclear power plant project.

"Bangladesh recently concluded an Inter-Governmental Agreement (IGA) with Russia for the first nuclear power plant. The results of the INIR mission will be useful to us as we progress to strengthen the national nuclear infrastructure," said Mr Architect Yeafesh Osman, Minister of State of the Bangladesh Ministry of Science and Technology.

"The mission team made 50 recommendations and 20 specific suggestions to assist the national authorities in preparing the infrastructure necessary to implement the project," said Mr JK Park, Director of the IAEA Division of Nuclear Power and INIR mission team leader. "We also recognised that Bangladesh has strong expertise especially in safeguards, security and radiation protection."

Bangladesh began consideration of nuclear power in the 1960s, and with the Government approval of a national action plan in 2000, reinvigorated its efforts in recent years. The nuclear power plant would contribute to solving dire energy shortages and future increased demand for energy.

The IGA with Russia is for two 1000 MW(e) units as well as fuel supply, take-back of spent fuel, training and other services. The Government of Bangladesh is considering either a Government owned turnkey project or a Build-Own-Operate-Transfer (BOOT) contract.

This is the sixth INIR mission conducted by the IAEA. The INIR is an international peer review of the comprehensive integrated infrastructure needed to introduce a national nuclear programme. The mission reviews the 19 issues of Phase 1 and Phase 2 identified in the IAEA's publication *Milestones in the Introduction of a National Nuclear Power Programme*, IAEA Nuclear Energy Series No. NG-T-3.1. The INIR mission was conducted under the Technical Cooperation Project BGD4024.

Inaugural Session of the INIR Mission to Bangladesh, attended by Minister Architect Yeafesh Osman (at center head table).

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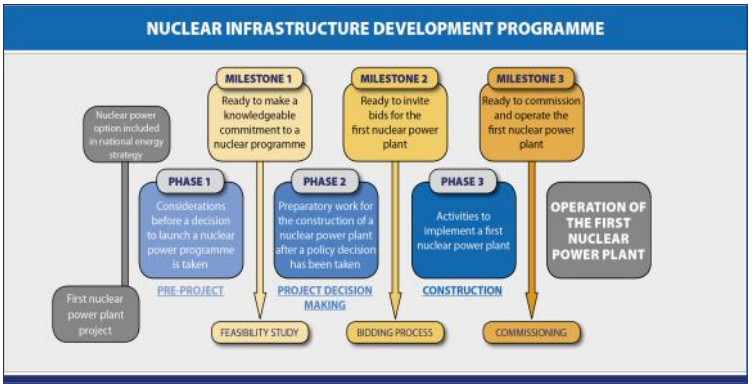
INIR Mission in Phase 3

In accordance with the IAEA Action Plan on Nuclear Safety and to facilitate the development of the infrastructure necessary for Member States embarking on a nuclear power programme, the Integrated Nuclear Infrastructure Group (INIG) initiated an extensive process of consultations between Member States and the IAEA Secretariat regarding INIR Missions in Phase 3 of the IAEA 'Milestones' approach.



Phase 3 consists of all the activities necessary to implement the first nuclear power plant. At the end of this phase the operator will have developed from an organization capable of ordering a nuclear power plant to an organization capable of accepting the responsibility for its commissioning and operation. An Integrated Nuclear Infrastructure Review (INIR) Mission in Phase 3 would be useful to Member States and to the IAEA to assure readiness for a comprehensive nuclear power programme prior to commissioning the first nuclear power plant. While other IAEA missions focus on specific facets of the programme and do not review the entire status of a national nuclear infrastructure, an INIR mission in Phase 3 will add value by integrating the results and experience of all previous IAEA missions and activities.

In developing the approach for an INIR mission in Phase 3, careful consideration is given to workload and scheduling issues of a Member State's nuclear power project. At the time this review is likely to be conducted, the project would enter a crucial stage of development from both the commercial and regulatory perspectives. INIR missions in Phase 3 should not interfere in the relationship between the regulator and the operator, nor in the contractual interaction between the owner/operator and the vendor. The first round of consultations regarding an INIR mission in Phase 3 was held in October 2011; further consultants meetings are planned for January and June of 2012.

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Human Resource Development for New Nuclear Power Programmes

Strengthened cooperation between the IAEA and two Russian organizations – the JSC Concern Rosenergoatom and the Central Institute for Continuing Education and Training (CICET) – is supporting nuclear infrastructure development and capacity building for new nuclear power programmes. 'Practical Arrangements' for this cooperative initiative were signed by the First Deputy Director General of Rosenergoatom, Vladimir Asmolov, the Rector of CICET, Yury Seleznev, and the IAEA Deputy Director for Nuclear Energy, Alexander Bychkov during the IAEA General Conference in September 2011.

Signing the 'Practical Agreement': Mr V. Asomov, Mr A. Bychkov, and Mr Y. Selezney (from left).

The cooperation will focus on assistance in training and capacity building, including development of joint educational and training courses on human resource development required in countries embarking on nuclear energy programmes; joint expert missions to assess country requests for support; and exchange and dissemination of information, including joint publications.

"We appreciate that Russia is willing to support newcomer countries with infrastructure development through these Practical Arrangements", said Mr Bychkov. "For any cooperation to be successful, it must benefit all parties. The primary beneficiaries of these Arrangements will be countries who wish to develop human capacity needed to implement nuclear power. Russian experts will be engaged at an international level; and the IAEA will benefit from Russian experience and expertise", commented Mr Bychkov.

CICET is the education and training institution of the State Atomic Energy Corporation Rosatom, providing education and training services for the Russian nuclear industry and for countries embarking on nuclear power. The JSC Concern Rosenergoatom is the Russian nuclear power plant operating organization with more than fifty years of experience in the operation of nuclear power plants. Both organizations provide a wide spectrum of nuclear training, ranging from basic training courses to specialized, practical training for managers and personnel involved in all phases of the life cycle of a nuclear power plant, and in all phases of building nuclear infrastructure.

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New Tool for Modeling Nuclear Power Human Resource Requirements

When countries consider adding nuclear power to the energy delivery infrastructure they need to know the number and types of qualified personnel that will be required to support the planning, procurement, construction, licensing, regulation, start-up and operation of a nuclear power plant. The skill sets required differ from country to country and depend upon the kind of reactor design used, as well as the existing national power and regulatory infrastructure. Planning is thus essential to ensure that the necessary educational programmes are in place to be able to deliver qualified personnel. Work force planning is an important component in the overall strategy for national infrastructural development.

A Nuclear Power Human Resources (NPHR) modeling tool, provided cost free to the IAEA by the US Government, will be invaluable in helping Member States understand their workforce requirements when planning to start a nuclear power programme. The US Department of Energy's Assistant Secretary for Nuclear Energy, Mr Peter B. Lyons, and Ms Anne Harrington of the US National Nuclear Security Administration handed over the modeling tool to Mr Alexander Bychkov, IAEA Deputy Director General for Nuclear Energy, during the IAEA General Conference in September 2011.

The USA has offered the IAEA free use of the modeling tool with its Member States. For its part, the IAEA is working with the developers to create a users manual and training materials. The IAEA also proposed plans to pilot the model's use among Member States in 2012, a programme funded by the Peaceful Uses Initiative (PUI).

US representatives Ms A. Harrington and Mr P.B. Lyons hand the NPHR modeling tool to Mr A. Bychkov.

The model's structure is consistent with the IAEA 'Milestones' approach in the development of a national infrastructure for nuclear power and the IAEA Nuclear Energy Series Report on *Workforce Planning for New Nuclear Power Programmes* (NG-T-3.10) published in 2011.

The modeling tool was originally developed by Los Alamos National Laboratory under contracts with the Office of Nuclear Energy/Department of Energy and the National Nuclear Security Administration as part of the US participation in International Framework for Nuclear Energy Cooperation (IFNEC).

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Supporting Nigeria's Human Resource Development

A TC workshop on human resource development for Nigeria's nuclear power programme was held in November 2011 in Abuja, with participation of more than sixty Nigerian experts and IAEA and international experts. IAEA experts introduced good practices that work well in experienced nuclear countries.

IAEA Workshop on Human Resource Development held in Abudja, Nigeria, 7–11 November 2011.

During the workshop, participants discussed and developed action plans to be incorporated into the country's 'Integrated Work Plan', which covers all nuclear power related activities of the Nigeria Atomic Energy Commission (NAEC), the Nigerian Nuclear Regulatory Authority (NNRA) and other stakeholders.

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Korean Mentoring Programme

The third Mentoring Programme which the IAEA has organized jointly with the Korea Hydro & Nuclear Power Company (KHNP), took place on 4–14 October 2011 in the Republic of Korea. Nine future leaders of national nuclear power projects in Egypt, Indonesia, Malaysia, Syrian Arab Republic, Thailand and Vietnam visited several nuclear facilities and organizations and benefitted from mentoring by recently retired KHNP executives.

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Closing ceremony of the third IAEA/KHNP Mentoring Programme, Seoul, Republic of Korea, October 2011

Assisting Future Owners/Operators in Newcomer Countries

The IAEA is developing assistance packages to enhance the future owner/operator capability in newcomer countries, as several countries already have or are moving to phase 2 of the IAEA Milestones approach, which is preparing for the construction of a nuclear power plant (see graph on p.5).

A consultants meeting held on 19 October identified priorities for the assistance packages to be used in overall project management, such as the development of an integrated management system in accordance with IAEA safety standards, establishment of a project team, becoming a knowledgeable customer, and specific issues such as preparation of siting, completion of the feasibility study or bids invitation specification (BIS).

These assistance packages for future owners/operators will be discussed further at the **IAEA Workshop on Topical Issues on Nuclear Infrastructure Development**, to be held at the IAEA on 24–27 January 2012 and will reflect the needs of nuclear power newcomer countries.

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Alternative Contracting and Ownership Practices for NPPs

An IAEA draft report is undergoing final coordinated review to incorporate feedback received through a process of extensive consultations with more than 20 Member States, representing all regions of the world. The report covers the latest developments in alternative approaches to nuclear power plant ownership and contracting as well as the associated motivations and challenges. Alternative models include the Build-Own-Operate-Transfer (BOOT) and regional approaches.

The BOO(T) structure potentially offers significant advantages for the host government because it transfers the risk of project completion to the developer. It also provides advantages to the developers as they can get access to markets and a guaranteed period for a return on investment. The regional approach describes the motivations and challenges to Member States collaborating on the development of a nuclear power project in order to pool resources and address siting issues. Case studies from joint projects in the UAE/Republic of Korea and in Turkey/Russian Federation, as well as in Finland (Olkiluoto), Slovenia/Croatia (Krško), Lithuania (Baltic regional initiative) and Romania (Cernavoda 3 and 4) illustrate alternative approaches.

While the report addresses alternative approaches to nuclear power plant ownership and contracting, Member States must always recognize that developing such a programme involves a process. This process is described in the IAEA Milestones approach for building the appropriate nuclear infrastructure. Even if these alternative models enable a Member State to overcome obstacles in their path, it must be recognized that certain obligations, such as safety and security, must always remain within the core competency and sovereign responsibility of the Member State. The report is expected to be published in 2012.

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Going Nuclear, Staying Environmental

How to maintain environmental stewardship while implementing a nuclear power programme, even when starting from scratch? In the six Member States that have signed or are preparing to sign a contract for their first nuclear power plant, appropriate environmental infrastructure is now considered imperative and the issue is taken very seriously. In their efforts and progress evaluation, the majority of these Member States have continually made wide use of the IAEA Milestones approach for the development of a national nuclear infrastructure. In turn, the IAEA has recognized their need for more detailed guidance. Now, extending this IAEA guidance, INIG is preparing a publication on environmental issues in new nuclear power programmes.

A consultants meeting was held in September 2011 at the IAEA, attended by experts on environmental impact assessment in the nuclear field. During the meeting, a comprehensive document was drafted, covering topics that are likely to be of high interest in the nuclear newcomer countries.

The scope of this document includes issues of organizational nature, legal and regulatory framework, content and purpose of the environmental studies, their implications in a variety of issues — from stakeholder involvement to bidding — as well as mitigation options, monitoring programmes and environmental management. Much attention was paid to the interfaces within an overall environmental protection system. Thus, the draft document includes all relevant topics and objectives which characterize a new nuclear programme as being environmentally sound.

A follow-up consultants meeting will take place in January 2012. Structured by relevant experiences, it is expected that the final version of this publication will be available to the Member States in 2012.

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Nuclear Power Engineering

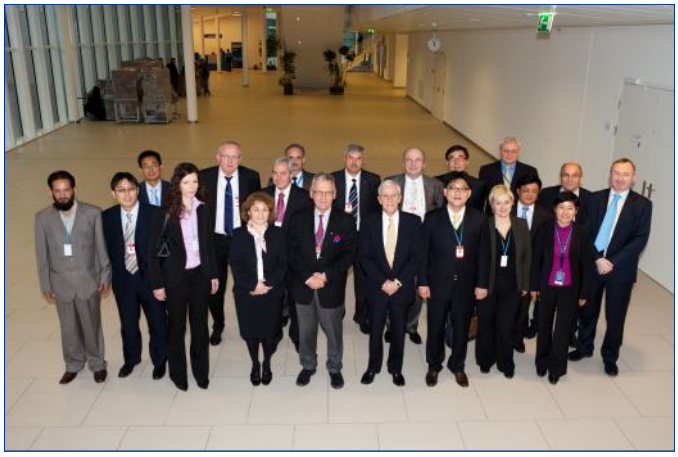
Strategic Partnerships for Expanding a Nuclear Power Programme

The expansion of a nuclear power programme in a country and its successful execution is dependent on good relationships between the many parties that will be involved. One way to ensure long term, reliable and sustainable relationships is for the parties to establish ‘strategic partnerships’, for example between the operator of a nuclear power plant and the design authority or vendor for the plant, or that between the regulatory body and technical support organizations. Member States have asked the IAEA to provide a forum to share practical experiences on the development and implementation of such strategic partnerships.

Thus, in late November 2011, over twenty senior managers from nuclear organizations of twelve countries attended a technical meeting organized by the IAEA to meet this need. They represented government ministries, vendors, regulators, and operators, mainly from countries considering the expansion of their nuclear power programmes, as well as a couple of newcomer countries.

Assisting Member States with expansion is just as important as the IAEA’s assistance to countries developing new programmes. “While it is not proper for us to become directly involved with contractual or business agreements, it is possible and proper for us to facilitate the sharing of knowledge and experience that may lead to the more effective and efficient expansion of sustainable nuclear energy with the social and environmental benefits that it may bring”, said Mr Bychkov, IAEA Deputy Director General for Nuclear Energy. Several countries described their approaches and experience in building the relationships necessary for a successful nuclear power project, and participants discussed how this may apply to their own situations.

Mr Gustavo Caruso, Special Coordinator of the Department of Nuclear Safety and Security, presented the progress in implementing the IAEA Nuclear Safety Action Plan in response to the Fukushima accident. “We must proceed in all our activities with full mindfulness of the additional challenges as a result of the Fukushima accident”, emphasized Mr Park, Director of the Division of Nuclear Power.



The IAEA Technical Meeting on Strategic Partnerships for the Expansion of a Nuclear Power Programme was held at the IAEA from 22–25 November 2011.

It was agreed by the meeting that formalized strategic partnerships could contribute significantly to strengthening existing capabilities. In the current situation, new and creative arrangements for the construction and operation of new nuclear plants seem to go beyond the typical supplier/customer relationships of the past.

The participants strongly supported ongoing assistance from the IAEA in the expansion of nuclear power programmes, and in particular requested regular meetings, such as this one, to share experiences. The meeting also concluded that an appropriate guidance document outlining the benefits and challenges of strategic partnerships would be helpful.

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Promoting an Up-to-date Approach to Stakeholder Involvement

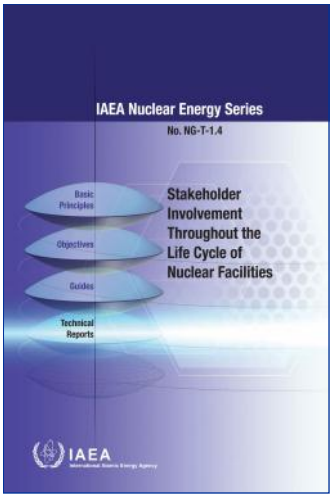
During the 55th IAEA General Conference in September 2011, Director General Mr Yukiya Amano highlighted that a continuous growth in nuclear power continues to be expected in the next two decades, despite the Fukushima Daiichi accident. The accident has not provoked high level decision makers to reconsider plans for nuclear energy development in most countries, but on a local level the accident has caused anxiety and damaged confidence in nuclear power among civil society organizations and the public.

More than ever, mechanisms to involve all stakeholders in all stages of the life cycle of nuclear facilities are needed. Beyond the groups traditionally involved in the decision making process, such as the nuclear industry, scientific bodies and relevant national and local governmental institutions, stakeholders also include the media, the public, local communities and non-governmental organizations.

Underlying principles: Often contrary to former communication practices, the information and participation of stakeholders now relies on a number of new principles:

- It is essential that the distribution of responsibilities between the operator, the regulatory body and the State are well -known and understood by all.
- Stakeholder involvement should be acknowledged as a key component in the development and implementation of a nuclear power programme.
- Stakeholders should be identified and informed about the means and scope of their participation in the nuclear power project as early as possible.
- Building trust is crucial and one way it can be achieved is through good relationships with independent experts and the involvement of civil society representatives.
- Disclosure and transparency are indispensable in order to increase public confidence.
- It is very important to recognise that approaches to stakeholder involvement have recently evolved and that there is a trend to replace traditional communication strategy, e.g. 'decide-announce-defend' with more open and interactive processes, such as 'engage-interact-cooperate, relying on modern methods and tools.

Using modern methodologies: To support Member States who have been asking for guidance in this field, the IAEA has published a new report on stakeholder involvement.



While acknowledging the existence of different national approaches, the document shows the path towards stakeholder involvement throughout the main phases of the life cycle of nuclear facilities, i.e. construction, operation, radioactive waste management and decommissioning. By using up to date methods for stakeholder involvement, the main objective for all parties is to reach a common understanding and enhance mutual trust on issues related to nuclear energy production through an open and transparent dialogue.

The report '*Stakeholder Involvement throughout the Life Cycle of Nuclear Facilities'* is published in the IAEA Nuclear Energy Series, No. NG-T-1.4; available at http://www-pub.iaea.org/books/IAEABooks/8694/Stakeholder-Involvement-Throughout-the-Life-Cycle-of-Nuclear-Facilities; it can be ordered from sales.publications@iaea.org

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Maintenance Optimization and Outage Management in Nuclear Power Plants

Maintenance activities include servicing, overhaul, repair and replacement of parts; they may, as appropriate, also include testing, calibration and in-service inspection. As plants strive to reduce costs and increase equipment reliability, it becomes necessary to be sure that the right tasks are being performed on the right equipment.

Many differing techniques are used to decide what work to do, and many of these techniques can create unnecessary expenses and take equipment out of service at the wrong times. When equipment fails to function or causes system or plant outages, one of the first impulses for corrective actions is to increase the number of predefined maintenance tasks (preventive maintenance) and increase the frequency of the tasks that have already been established. These actions may cause more failures and decrease the overall plant reliability.

"A systematic evaluation approach to establishing what maintenance tasks are to be performed on which systems, structures or components and at what frequency can optimize the use of available resources", said Richard Shouler, a nuclear engineer at the IAEA Nuclear Power Engineering Section. This includes maintenance costs, personnel doses, equipment and tools and competent personnel allocated for maintenance and plant availability. In addition, a systematic method of prioritizing should cover which systems should be worked on and what combination of systems can be worked on at the same time.

"A maintenance optimization process is normally applicable when it is attached to the improvement of monitoring and diagnosis instrumentation and implementation or improvement of a predictive monitoring programme, and associated with structures systems and components focusing on equipment reliability", Mr Shouler explained.

Outage management is a key factor for safe, reliable and economic plant performance and involves many aspects: plant policy, coordination of available resources, nuclear safety, regulatory and technical requirements, and all activities and work hazards, before and during the outage.

A technical meeting, held at the IAEA on 17–21 October 2011, provided an international technical forum for

Experts participating in the Technical Meeting on Maintenance Optimization and Outage Management in Nuclear Power Plants, IAEA, 17-21 October 2011.

discussing the experience, challenges and issues related to the management and implementation of a plant life management programme and its influence in the maintenance structure that supports a nuclear power plant. The meeting targets were countries that operate nuclear power plants or are expanding their nuclear power programmes.

There were two objectives in the meeting, 1) maintenance optimization and 2) outage management, utilizing the plant life management programme to improve the overall performance and competitiveness of nuclear power plants, with due regard to safety through the application of best practices in technology and engineering, including quality assurance/ management and the utilization of relevant databases.

The meeting included presentations, roundtable discussions and break-out sessions covering national utility experience in maintenance and outage management practice; the most recent lessons learned and operating experience improving maintenance of systems, structures and components focusing on equipment reliability; presentations by invited experts of issues related to and lessons learned on maintenance and outage management; and roundtable discussions on the topical issues and future trends important to the maintenance.

"This meeting helped to disseminate information and guidance that will support Member States to improve and optimize their maintenance areas related to plant life management" confirmed Mr Shouler. It also was an excellent opportunity to discuss proven and modern approaches 'face to face', and to share information on needs and experience.

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Periodic Safety Review for Third Qinshan Nuclear Power Company

The Third Qinshan Nuclear Power Company (TQNPC) in China has operated two CANDU reactors (650 MW(e), PHWR) since 2002. According to the IAEA's safety guide *Periodic Safety Review of Nuclear Power Plants* (NS-G-2.10) of 2003, the Chinese regulatory body issued a corresponding safety guide in 2006.

In 2012, TQNPC will submit the first Periodic Safety Review (PSR) report to the regulatory body to assess the cumulative effects of plant ageing and plant modification, operating experience and technical developments in the light of current safety standards and practices. The report will be submitted prior to 10 years of operation.

An IAEA workshop held at the Shanghai Nuclear Energy Research and Development Institute (SNEDRI) earlier in 2011 introduced 33 engineers from nuclear facilities in China to relevant IAEA publications, i.e. *Nuclear Power Plant Life Management Process: Guideline and Process for Heavy Water Reactors* (IAEA TECDOC-1503) and *Periodic Safety Review of Nuclear Power Plants: Experience of Member States* (IAEA-TECDOC-1643).

The first PSR after the start of commercial operation of a nuclear power plant is very important. Once a systematic infrastructure related to PSR has been set up through the first PSR,

The Shanghai Nuclear Energy Research and Development Institute hosted an IAEA Workshop on Periodic Safety Reviews of Nuclear Power Plants.

it can be used as a good reference and thus reduce the need for human resources and cost for following PSR reports.

A systematic infrastructure can be achieved by securing the technical appropriateness and objectivity of the results. PSR procedures are composed of the project management procedure, quality assurance procedure and review procedure for each safety factor. It is important to establish review procedures for all safety factors, e.g. 14 safety factors require 14 procedures.

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Multimedia Training for WWER Reactor Pressure Vessel Irradiation Embrittlement

The first generation of senior nuclear experts is retiring and interest of the younger generation in nuclear studies has decreased, resulting in a shortage of qualified professionals and the risk of losing valuable knowledge for the nuclear community.

In an effort to avoid a possible loss of capability and knowledge in the EU, the IAEA and the Joint Research Centre's Institute for Energy of the EU (JRC-IE) initiated a nuclear knowledge preservation and consolidation programme to preserve and disseminate required knowledge to the new

generation of nuclear engineers, scientists and other interested parties.

Based on the IAEA and JRC-IE technical competence, the selected areas for NKP&C included water-water energy reactor (WWER) reactor pressure vessel (RPV) irradiation embrittlement, plant life management and nuclear engineering materials testing. In a pilot project, the IAEA and JRC-IE have conducted a number of workshops since December 2007 to collect and assess critical and relevant knowledge on irradiation embrittlement of WWER RPV material. About 300 papers were collected, reviewed and categorized in ten domains to preserve and consolidate the desired knowledge on WWER RPVs:

- Start of life toughness;
- Surveillance programme;
- Irradiation shift effect;
- Cladding;
- Material factors;
- Environmental factors;
- Mechanisms and micro structural evolution;
- Annealing and re-irradiation.

Using the collected knowledge base, a multimedia training course has been developed to support knowledge preservation and dissemination to the young generation of nuclear specialists.

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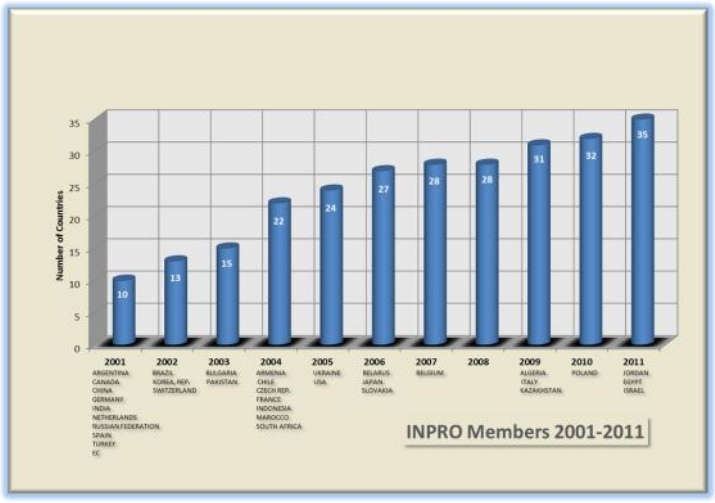
International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)

New INPRO Members

Egypt and Israel have recently joined INPRO as full members. This brings the number of INPRO Members to 35, i.e. 34 Member States and the European Commission.

"I would like to express the IAEA's appreciation for the interest in and expression of support of the Governments of Egypt and Israel to INPRO and welcome both countries as members of INPRO" said Mr Alexander Bychkov, IAEA Deputy Director General for Nuclear Energy and INPRO Project Manager.

As of 1 December 2011, the following countries are official members of INPRO: Algeria, Argentina, Armenia, Belarus, Belgium, Brazil, Bulgaria, Canada, Chile, China, Czech Republic, Egypt, France, Germany, India, Indonesia, Israel, Italy, Japan, Jordan, Kazakhstan, Republic of Korea, Morocco, Netherlands, Pakistan, Poland, Russian Federation, Slovakia, South Africa, Spain, Switzerland, Turkey, Ukraine, United States of America and the European Commission.



INPRO's Future Strategy and Activities

In early November, forty-one representatives of INPRO's Members, observer countries and international organization met at the IAEA for the **18th Meeting of the INPRO Steering Committee** in early November 2011. This meeting, chaired by Robert Speranzini of Canada, was the final one in a series of three planning meetings which started a year ago. Its main objective was to finalize and approve the mid-term strategy and vision for INPRO's development to 2017, and the INPRO Action Plan with strategic directions and new activities for the next two years.

"Both documents have been developed in a consultative and cooperative process. We appreciate the contributions of INPRO Members in developing these two strategic documents ", said Mr. Alexander Bychkov, IAEA Deputy Director General for Nuclear Energy and INPRO Project Manager in opening the meeting.

The Steering Committee heard presentations on the implementation of the INPRO Action Plan for 2010-2011 and new activities for the next biennium as well as Member States' expressions of interest for, and participation in, new INPRO projects, financial and other contributions to INPRO and further comments and recommendations.

"We had good discussions and concluded, as a Steering Committee, that we approve the 2017 INPRO Vision and the Action Plan for the upcoming years 2012-2013. This is one of the good outcomes of the meeting", remarked Mr Speranzini.

Opening of the 18th Meeting of the INPRO Steering Committee, held on 2–4 November 2011 at the IAEA.

INPRO Development Vision 2017

The vision and strategy for INPRO's development over the next five years highlights the added value that INPRO brings to its members and the unique strength of the project which lies in a holistic view of the entire nuclear energy system; the development focuses on the key concepts of global nuclear energy sustainability and long range nuclear energy strategies, as well as active and mutually beneficial cooperation with Member States and within the IAEA.

INPRO Action Plan 2012–2013

The INPRO Action Plan for the next biennium will focus on four main projects:

Project 1: National long range nuclear energy strategies and NESA
Project 2: Global nuclear energy scenarios
Project 3: Innovations in nuclear energy technology and institutional arrangements
Project 4: Policy, Management, Communications and Dialogue Forum.

Subject to available funding, new activities and collaborative projects will address, among others, proliferation resistance and safeguardability assessment (PROSA); synergetic nuclear energy regional group interactions evaluated for sustainability (SYNERGIES); roadmaps for transition to globally sustainable nuclear energy systems; load following capability in innovative designs (LOADCAPS), and investigating options for an international project on fast reactors, fuel cycles and materials R&D.

"The INPRO methodology, INPRO's flagship tool for assessing the sustainability of a country's existing or planned nuclear energy system, will be revised and enhanced over the next two years, mainly based on feedback from Member States and input from those countries that have applied the methodology in a national nuclear energy system assessment", said Mr Randy Beatty, INPRO Group Leader.

The INPRO Development Vision 2017 and the Action Plan 2012–2013 are available on the INPRO homepage: www.iaea.org/inpro

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Introducing a New Project: SYNERGIES

Building on and enhancing the analytical framework developed within the INPRO GAINS project (Global Architecture of Innovative Nuclear Energy Systems), a new INPRO Collaborative Project titled **Synergetic Nuclear Energy Regional Group Interactions Evaluated for Sustainability** (SYNERGIES) will model and examine more specifically the various forms of collaboration among nuclear technology suppliers and users, and the driving forces and impediments to achieving globally sustainable nuclear energy systems. The goal is to identify those forms of collaboration that would ensure a 'win-win' strategy for both technology holders and users.

First steps towards launching the project were made when a group of 18 international experts met at the IAEA on 10–14 October 2011 to define the overall structure and scope, develop basic elements of the implementation plan, including task objectives and task descriptions with tentatively defined task teams and leaders, and the interrelationships between the tasks of the project (see http://www.iaea.org/INPRO/CPs/SYNERGIES/2011_October_CM/index.html).

Participants were also able to enjoy an invited lecture by Dr Ratan Kumar Sinha, Director of the Bhabha Atomic Research Centre (BARC) in India, who presented an Indian view on the role of cooperation among countries making a transition to a globally sustainable nuclear energy system.

A simple presentation of the project objectives with a link to other INPRO projects was elaborated as follows:

GAINS (previous project): What are the *advantages* of *transition* to a globally sustainable nuclear energy system?
SYNERGIES: How could *collaborations* facilitate this *transition*?

The following tasks of the project were defined:

Participants in the Consultancy Meeting on the SYNERGIES project, IAEA, 10–14 October 2011.

Task 1 (Core Task): Evaluation of Synergistic Collaborative Scenarios of Fuel Cycle Infrastructure Development;

Task 2 (Support Task): Evaluation of Additional Options for NES with Thermal and Fast Reactors;

Task 3 (Support Task): Evaluation of Options for Minor Actinide Management;

Task 4 (Cross-cutting Task): Elaboration of key indicators specific for synergistic collaboration, including economic assessment methods.

It was decided that the SYNERGIES project will focus on short term and medium term collaborative architectures capable of developing pathways to long term sustainability. Following the approach established in GAINS, drivers and impediments for collaboration among countries would be assessed using appropriately defined key indicators in economics, security of supply, resource constraints, national infrastructure requirements, aspirations of being a technology provider, proliferation resistance and other subject areas of INPRO.

The 18th meeting of the INPRO Steering Committee approved the implementation of the SYNERGIES project. Algeria, Argentina, Armenia, Belgium, Brazil, Bulgaria, Canada, Czech Republic, France, India, Indonesia, Israel, Italy, Japan, Jordan, the Republic of Korea, Pakistan, Romania, the Russian Federation, Spain and Ukraine expressed their interest in participating in the project or contributing as observers. Altogether, 29 Member States and international organizations have expressed interest so far in this new Collaborative Project.

The kick-off meeting for the SYNERGIES project will be convened in April or June 2012. The project will be implemented in 2012–2013, and the final report is to be produced in 2014.

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Assessing Indonesia's Planned Nuclear Energy System

Indonesia is planning to include nuclear power in its energy mix to strengthen the country's energy security and mitigate climate change. As the national nuclear agency in Indonesia, BATAN carries out the responsibility to assess and prepare the national policy in the field of research, development and peaceful applications of nuclear energy.

This serves as a foundation for BATAN to conduct an assessment of its nuclear energy system, i.e. fuel cycle facilities for the front end (mining and milling, conversion, fabrication) and back end (waste management), with several options regarding the reactor types. The assessment is necessary given the complex issues, concerns and impediments related to the nuclear fuel cycle, such as large capital investment, depleted/limited uranium reserves in the world, assurance of fresh fuel supply, safety of nuclear materials and issues of waste management.

In late October 2011, an INPRO 'kick-off' meeting for the Indonesian nuclear energy system assessment (NESA) using the INPRO methodology was held at BATAN in Serpong, Indonesia, in coordination with the IAEA Technical Cooperation programme. More than 30 experts from BATAN, the Nuclear Energy Regulatory Agency (BAPETEN), the State-Owned Electricity Company (PT. PLN), the University of Gadjah Mada (UGM), and the Bandung Institute of Technology (ITB) were trained how to apply the INPRO methodology in a NESA.

Hands-on Training during the NESA meeting in Indonesia, 17–21 October 2011.

The workshop familiarized the participants with IAEA tools for energy system planning and modeling and provided instructions on how to undertake a NESA in all seven assessment areas of the INPRO methodology: economics, infrastructure, waste management, proliferation resistance, physical protection, environment, safety of nuclear reactors and nuclear fuel cycle facilities. The application of software tools, i.e. e-NESA and the NESA economic support tool (NEST), quizzes, work sessions and case studies assisted the national team to acquire a good understanding and the skills necessary to perform the assessment. Applying Indonesia's own data and discussing strategies to collect input data from suppliers/designers and operators of reactors and fuel cycle facilities will be addressed in future workshops.

"This workshop has been very useful for us; it has given the assessment team a clear picture of how to perform a NESA and use the computerized support package from the Agency", said Mr Adiwardojo, Deputy Chairman for Development of Nuclear Energy and Technology of BATAN, who is also a member of the INPRO Steering Committee. "We plan to start the assessment in 2012 with a limited scope NESA to familiarize the team with the approach and the available tools", commented Mr Adiwardojo. The plan is to continue with a full scope NESA in 2013, which will comprise nuclear reactors and nuclear fuel cycle facilities.

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CUC for Small and Medium Sized Nuclear Power Reactors

Common user considerations (CUC) for small and medium sized nuclear power reactors (SMR) were the focus of the third workshop in the **INPRO Dialogue Forum** series, held at the IAEA on 10–14 October 2011. The workshop was convened jointly by the Nuclear Power Technology Development Section and INPRO and was held as a TC project activity .

Sixty-three participants from forty countries and the WNA discussed considerations of both developing and developed countries for SMRs in the light of recent developments in SMR technologies. An earlier CUC study (IAEA Nuclear Energy Series No. NP-T-2.1) covered the opinions of developing countries who are considering nuclear power programmes. That study had focused on large nuclear reactors but also noted opportunities and potential advantages of SMRs.

"We are now witnessing a renewal of global interest in SMRs. So it is timely that this INPRO Dialogue Forum addresses issues related to these reactor types", said Mr Alexander Bychkov, IAEA Deputy Director General for Nuclear Energy in opening the meeting.

SMRs can offer important advantages for nuclear newcomers, particularly to those with small electric grids, less developed infrastructure and limited investment capabilities. Countries with existing nuclear power programmes may consider SMRs as a small incremental addition to the existing fleet of nuclear power plants and for specialized applications, for example deployment in remote areas, process heat applications, desalination and hydrogen production.

"Many newcomers have expressed interest in SMRs, but are still in favour of 'proven' technology; so they want SMR technology to be first deployed in the country of origin to minimize licencing and performance risks", Mr Bychkov pointed out as one of the challenges facing this technology.

However, advanced SMRs are not yet commercially available although several countries are moving in this direction: for example, Argentina is starting the site excavation for the CAREM reactor in the country; in China, two modules of gas cooled reactors, called HTR-PM, are under construction for domestic use; SMART in the Republic of Korea is in the final stage of design approval; in the Russian Federation, two KLT -40s floating nuclear power plants are under construction and excavation for the SVBR-100 reactor is starting; and in the USA, mPower and NuScale are the two advanced SMR designs that have been prioritized for design review by the Nuclear Regulatory Commission.

The dialogue on user considerations for SMRs was free-flowing and constructive. The mix of States considering initial investments in nuclear power, States with existing nuclear power programmes and States that are potential equipment suppliers encouraged a diverse exchange of views. This helped build understanding about the possible role of SMRs in a country's optimal energy mix, and about the technical requirements of newcomer countries, as well as their current and projected energy demand and supply scenarios.

Newcomer countries, as the imminent SMR technology users, obtained a better understanding of the common technologies and issues of SMRs. They acknowledged that SMRs have several advantages, such as fitness for smaller electricity grids in countries with less developed infrastructure. SMRs also require lower upfront capital cost with easier financing schemes; modularization technology will result in shorter construction periods, and innovative SMRs offer enhanced safety and reliability as well as more flexibility.

An important part of the workshop was the consideration of desired features for SMRs covering the areas of economics and financing, infrastructure, nuclear safety, environment, proliferation resistance, physical protection, deployment, nuclear fuel and waste management.

In many cases, the user considerations included in the earlier CUC study are directly relevant to SMR, although in certain cases, the particular nature of SMR implies changes in those considerations. In the case of medium sized reactors, the existing descriptions of user considerations appear to be satisfactory. As the reactor units become smaller and increasingly modular, the diversity of potential users broadens, and economic and other characteristics differ from large reactors. Users from developing nations have a keen interest in SMR technology but they have specific considerations when choosing SMR as part of their energy supply plan.

One area of broad interest remains the development of a regulatory framework and business models for the newcomer countries. For example, different approaches should be considered to develop competent national regulatory authorities — that would be working with the supplier countries — as nuclear power is being deployed and operated within that Member State. New approaches to financing, ownership, operations and governance that would promote near-term deployments are also of interest under these same conditions and were discussed.

"It is important to highlight that since some innovative SMRs contain a certain degree of 'first-of-kind' engineering systems and components, licensing and regulatory issues must be addressed", said Mr Kwaku Aning, IAEA Deputy Director General for Technical Cooperation during the closing session. "Common challenges for all are post-Fukushima action items that should address design, safety, institutional issues, and, most importantly, public acceptance", Mr Aning emphasized.

It seems to be clear that the unique technical issues and potential advantages related to SMRs are important to the participants of the Dialogue Forum — and there would be value in developing updated Common User Considerations specific to SMRs. All presentations are available at http://www.iaea.org/INPRO/3rd_Dialogue_Forum/index.html

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Nuclear Power Technology Development

GIF/IAEA: Safety Aspects of Sodium Cooled Fast Reactors

Sodium cooled fast reactors (SFRs) have already been in operation for sixty years. Today, countries such as France, India, Japan, the Republic of Korea, the Russian Federation and the USA, as well as the European Commission have active programmes using this technology. China started operation of a pilot SFR last year and connected it to the electricity grid this year.

Technical issues uniquely or particularly relevant to the safety of SFRs and sodium as a fast reactor coolant were the focus of the **Second GIF/IAEA Workshop on Safety Aspects of Sodium Cooled Fast Reactors** held at the IAEA from 30 November to 1 December 2011. The meeting was organized jointly by the Generation IV International Forum (GIF), INPRO and the Technical Working Group of Fast Reactors (TWGFR).

Experts from China, France, India, Japan, Republic of Korea, Russian Federation, USA, the EC Joint Research Centre (JRC) and the OECD Nuclear Energy Agency (NEA) discussed basic safety characteristics of fast spectrum reactors, issues associated with the use of sodium as a fast reactor coolant, historical experience with sodium fast reactor safety issues, proposed approaches to achieving SFR safety, and innovative design concepts. Particular attention was paid to the safety implications of the lessons learned from the Fukushima Daiichi accident on future areas of emphasis, as the next generation of SFRs is designed.

“Post Fukushima, people are quite worried about the safety of plants. People need to have confidence that reactors built on various technologies are safe”, said Mr Prabhat Kumar, Project Director of BHAVINI, a Government of India Enterprise, in Kalpakkam. “This requires robust design, experienced construction personnel, and competent fabricators so the plant can be safe. The ultimate goal has to be that operators cannot make mistakes irrespective of what happens, and the plant remains safe, irrespective of scenarios”, he added.

“This meeting offered a valuable opportunity for us to share technology features of SFRs. Exchanging information and experience gives us confidence in the design and safety methods. It has also been very important for India to get feedback from the international expert community on the Prototype Fast Breeder Reactor (PFBR) currently being constructed in Kalpakkam”, said Mr P. Chellapandi, Director of the Nuclear and Safety Engineering Group at the Indira Ghandi Centre for Atomic Research (IGCAR), India.

The workshop represents considerable progress towards outlining current gaps in SFR safety knowledge and summarizing what each country is currently doing in the areas of SFR safety while also looking at common approaches or remaining differences in safety philosophy and licensing strategies.

“There were interesting conclusions” explained Mr Randy Beatty, INPRO Group Leader. “One is that attention still needs to be put on emergency planning. Any design, regardless of how inherently safe it is, will require continued emphasis on being prepared in case of a severe accident and on attention to the community in which the reactor is located” Mr Beatty added. Also, there are advantages from a technical standpoint which would answer some of the issues associated with Fukushima, e.g. inherent or passive decay heat removal because of the high heat content of the sodium coolant even without active circulation. These interesting issues show that the innovations that GEN IV reactors are providing will help make nuclear deployment for the future safer and more sustainable.

Lively discussions characterized the constructive spirit at the GIF/IAEA Workshop on Safety Aspects of SFRs at the IAEA.

“The Joint Workshop on Safety Aspects of Sodium Cooled Fast Reactors is one of the finest and most productive examples of cooperation between GIF and IAEA/INPRO” emphasized Mr Harold McFarlane, Technical Director of GIF. “This second workshop was focused by the nuclear accident at Fukushima-Daiichi, with participants eager to share lessons learned as applied to advanced reactor design and siting. For GIF the timing was fortuitous, just days prior to the meeting of the Task Force on SFR Safety Design Criteria. Having the input of the Indian experience in the construction of PFBR provides additional insight into this important subject."

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Fast Reactor Physics and Technology

A technical meeting on Fast Reactor Physics and Technology was held in Kalpakkam, India, on 14–18 November. The meeting was hosted by Indira Gandhi Centre for Atomic Research (IGCAR) and organized jointly by the IAEA Departments of Nuclear Sciences and Applications, and Nuclear Energy. Sixty-seven participants from 14 countries attended the technical meeting and presented 47 papers.

The presentations and discussions focused on the following main areas: (1) status of national programmes in the field of fast neutron systems (both critical and subcritical); (2) reactor physics and core design; (3) advanced reactor design including accelerator driven systems; (4) structural materials development; (5) coolant technology and component development; (6) thermal hydraulics; and (7) reactor safety.

Technical visit to the construction site of the PFBR, Kalpakkam, India.

The programme included a technical tour to the IGCAR sodium facilities as well as to the Indian fast breeder test reactor (FBTR) which recently celebrated twenty-five years of safe and successful operation, and to the site of the 500 MW(e) prototype fast breeder reactor (PFBR). PFBR is in an advanced construction phase and is expected to enter into operation in 2013. The technical meeting also offered the occasion to discuss new IAEA initiatives in the area of advanced technologies and simulation tools for innovative FR design.

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Benchmarking Severe Accident Computer Codes for HWRs

Seven institutes from five Member States with heavy water reactors (HWR) are participating in a coordinated research programme (CRP) on benchmarking severe accident computer codes for heavy water reactor applications.

"The objective of this CRP, which started in 2009, is to improve the safety of currently operating plants and facilitate more economic and safe designs for future plants", explained Mr Jong Ho Choi, scientific secretary of the project. Station blackout (SBO) was selected as the reference scenario for a severe accident. Participants tried to use the same assumptions to facilitate a comparison of simulation results. The SBO scenario was divided into four phases similar to what may happen during a severe accident: phase 1 from accident initiation to fuel channel dryout; phase 2 up to core collapse; phase 3 up to calandria vessel failure; and phase 4 up to containment failure.

During the third Research Coordination Meeting, held at KAERI in Daejeon, Republic of Korea, in early September 2011, the participants presented their preliminary analysis results up to Phase 3 or 4. Discussions focused on the limitations of their simulation tools, how to model the expected phenomena more realistically, and how to improve the comparison of analytical results. The expected outcomes from this CRP are:

- Improved understanding of the importance of various phenomena contributing to event timing and consequences of a severe accident;
- Improved emergency operating procedures or severe accident management strategies;
- Advanced information on computer code capabilities to enable the analysis of advanced HWR designs.

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Thermal-hydraulics of Supercritical Water Cooled Reactors

Member States have pursued the concept of supercritical water cooled reactors (SCWR) to achieve high thermal efficiency and resulting low capital cost. Understanding the thermal-hydraulics of supercritical pressure water, such as flow and heat transfer in fuel bundles, critical flow, and flow stability, is one of the most critical challenges in realizing this concept.

Therefore the IAEA is supporting Member States through an ongoing Coordinated Research Programme (CRP) on 'Heat Transfer Behaviour and Thermo-hydraulics Code Testing for SCWR' which offers a forum for discussion of research results and exchange of information; it has two key objectives: 1) to establish a base of accurate data for thermal-hydraulics of fluids at supercritical pressure; and 2) to test analytical methods for SCWR thermo-hydraulic behaviour and identify code development needs.

Representatives of the fifteen participating organizations in the CRP met for their fourth meeting in late September at the Atomic Energy of Canada Limited (AECL) Sheridan Park Office, Mississauga, Canada. "We had very constructive discussions on the progress of each institute during the last year" said Mr K. Yamada, IAEA's Scientific Secretary of this Research Coordination Meeting. "We also reviewed the draft of the final report and planned our activities for the next year", he added.

4th Research Coordination Meeting on SCWRs held on 19–23 September 2011 at AECL in Mississauga, Ontario.

At least five organizations indicated that they would contribute their new experimental data to the CRP database, which is hosted by OECD/NEA. Participants were also briefed about the Joint ICTP-IAEA Training Course on 'Science and Technology of SCWRs' held for the first time in June at ICTP, Italy (see Nuclear Power Newsletter, September 2011) and expressed their strong support to continue this training opportunity in 2012.

The CRP, which started in 2008, will be completed in September 2012 with the following results: 1) a thermal-hydraulics database for supercritical pressure fluids; 2) the final report of the CRP highlighting technology advancements achieved through the project; and 3) several joint papers presented at international conferences.

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Enhancing Nuclear Engineering Education on Water Cooled Reactors

The IAEA PC based 'Simulators for Education' simulate the response of a number of water-cooled reactor types to normal operation and accident conditions. The simulators are designed to understand and learn about the general design and operational characteristics of various power reactor systems. They are used in many educational institutions.

An IAEA Workshop on **Enhancing Nuclear Engineering Education through the Use of the IAEA PC-based Nuclear Power Plant Simulators** was held on 3– 14 October 2011 at the Italian university 'Politecnico di Milano'. Thirty nuclear engineers from fifteen countries including representatives of educational institutions, regulatory bodies, research organizations, universities and nuclear power plants, as well as thirteen Masters Degree students of Politecnico di Milano participated in the workshop. Experts from Canada, the Russian Federation, Switzerland and the USA trained the participants in using the simulators.

Students and experts of the IAEA Workshop on PC-based Nuclear Power Simulators in Milan, Italy.

"We covered the demonstration and use of eight simulators", said Mr Seong Deuk Jo of the Nuclear Power Technology Development Section, who was the scientific secretary of the workshop. This included a WWER-1000, a PWR with active safety systems and a PWR with passive safety systems, a BWR with active safety systems and a BWR with passive safety systems, a CANDU-9, an Advanced CANDU (ACR700), and a TRIGA research reactor.

"By using the simulators in combination with lectures and the training material, the participants were able to develop a good understanding of the operational response characteristics of the various reactor types", said Mr Jo.

The workshop was interactive in nature and included many discussions and feedback from the participants. They offered constructive suggestions for improving the workshop and the IAEA simulators. They also acknowledged the content and value of this workshop.

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IAEA's Advanced Reactor Information System (ARIS)

http://aris.iaea.org

Countries considering their first nuclear power plant or expanding existing nuclear power programmes require access to the most up to date information about advanced nuclear power plant designs and important trends in technology development. To meet this need, a web accessible database offers balanced, comprehensive and up to date technical information about advanced reactor designs and concepts to Members States.

The Advanced Reactor Information System (ARIS) addresses evolutionary designs presently being deployed, designs in advanced stages of development that are expected to be available for deployment in the near to medium term, and innovative designs developed for the longer term.

A careful IAEA review and editing process of the information received ensures that ARIS presents balanced and objective technical information on design descriptions. Although the extent of the design descriptions may vary, the reports basically follow the same structure, including a description of the nuclear systems and of the safety concept, proliferation resistance, safety and security (physical protection), description of turbine generator systems, electrical and I&C systems, spent fuel and waste management, plant layout, plant performance, development status of technologies relevant to the nuclear power plant, and deployment status and planned schedule. Reports are available at http://aris.iaea.org/ARIS/reactors.cgi — click on '*View Reports*'.

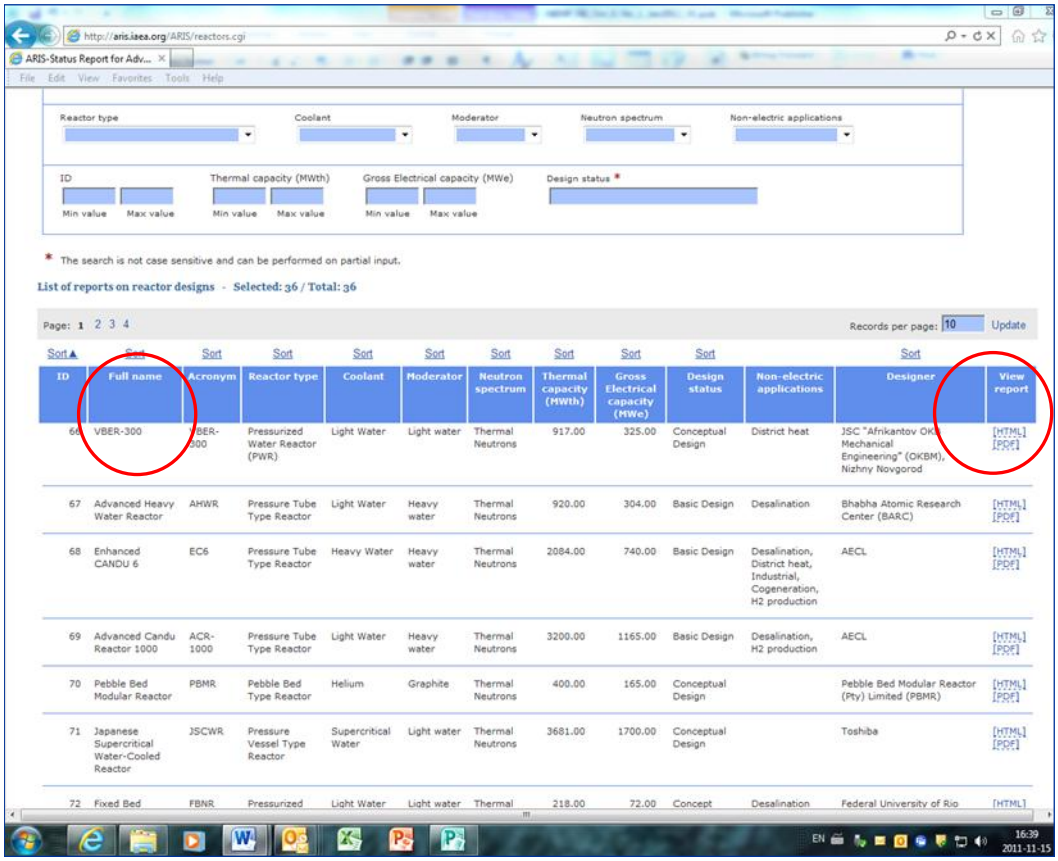
Each design description is updated according to progress of the design status, licensing status or construction and commissioning. At present, 36 design descriptions are included in ARIS for PWRs, BWRs, integral water cooled reactors, SWCRs, HWRs, GCRs and FRs. All descriptions are listed at http://aris.iaea.org/ARIS/reactors.cgi.

For designs not listed, design organizations can contact the following responsible IAEA Technical Officers:

LWRs: M.Harper@iaea.org; **HWRs:** J.H.Choi@iaea.org; **GCRs:** B.M.Tobyeka@iaea.org; **FRs:** S.Monti@iaea.org; **SMRs:** M.Subki@iaea.org.

ARIS also has the capability to sort according to different parameters including reactor type, coolant, moderator, spectrum, thermal and electrical, design status, non-electrical applications, and design organization.

Current trends in design and technology development:
This information was recently added to the ARIS database. It includes the current status of nuclear power; advances in safety technology; proven technical approaches for achieving



economic competitiveness; new technical approaches for reducing plant costs; and approaches to achieve sustainable nuclear energy and a high degree of proliferation resistance.

Global activities on developments of advanced nuclear plants with LWRs, HWRs, GCRs and FRs, and activities of GIF and INPRO are also summarized, as well as alternative applications of nuclear energy such as district heating, seawater desalination, transportation and heat for industrial processes.

Readers are invited to check out the ARIS website and send their feedback via: http://aris.iaea.org/ARIS/feedback.cgi

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Nuclear Power Publications

Thirty Years of RDS-2: Nuclear Power Reactors in the World

This year we are celebrating thirty years of publishing of the Reference Data Series No. 2 (RDS-2), 'Nuclear Power Reactors in the World'. This very popular, pocket- sized book is published every year to present the status and developments in the nuclear industry.

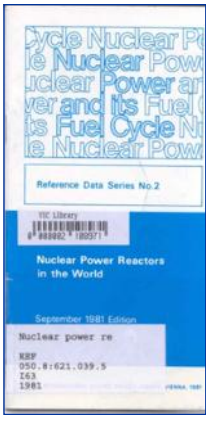
In 1981, when computerization of the power reactor data had been completed and the PRIS database launched, the format and scope of the previously published annual report was significantly changed. The first edition of 'Nuclear Power Reactors in the World was issued September 1981, as the beginning of the Reference Data Series No. 2 (RDS-2).

In spite of several modifications in the table format and content, the structure and graphic design of its cover has been very stable for much of the past 30 years. The main revisions of the publications were done in 2000 and 2008. To emphasize the significant milestone of RDS-2, the thirty-first edition which was published in June 2011, introducing a new cover design.

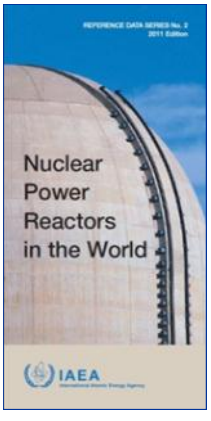
"Now RDS-2 represents very comprehensive overview of nuclear power reactors worldwide", said IAEA's Jiri Mandula, who has been responsible for preparing the publication. It includes specifications and performance history data of operating reactors, as well as reactors under construction, being planned, or reactors being decommissioned. "This is one of the most accessed publications currently available on the IAEA publications website. PRIS data are collected by the Agency through the designated national correspondents of Member States" explained Mr Mandula.

Publishing of RDS-2 started thirty years ago but the history of power reactor annual publications is even longer. The first issue of a comprehensive list of nuclear reactors was issued in 1969 with the title: 'Power and Research Reactors in Member States'. It included an overview of both power and research reactors. Since 1975 the power reactors were presented in the stand alone annual publication 'Power Reactors in Member States'.

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



RDS-2: 1981



RDS-2: 2011

The Nuclear Energy Series

The IAEA Nuclear Energy Series (NES) was started in 2006, in order to organize the various technical reports and other documents that were being produced in the Nuclear Energy Department. Before the NES, reports were consecutively numbered, there was mixing between subjects, there was neither a formal structure nor a revision process. "The Nuclear Energy Series now organizes reports by subject, by the level of advice, and continually improves quality through regular revision and consultation", explains Karen Edge, Coordinator of the NE Series.

The NES is meant to provide advice and technical examples to Member States either planning or implementing nuclear activities, primarily in the nuclear power arena. Advice is based on best practices in Member States, and is built on their expertise through various technical working groups and the Standing Advisory Group on Nuclear Energy (SAGNE), which are involved in both writing and review of publications. Collaboration with other IAEA Departments including Nuclear Sciences and Applications and Nuclear Safety and Security is ongoing and routine.

There are currently 65 publications in the series, with another 88 in process. A few have been translated into Arabic, French and Russian and are available on-line. Several hundred supporting documents, dating from the 1970s through the present, are also available. "It is difficult to establish an exact count", said Ms Edge. "But Nuclear Energy Series documents have, to date, received more than 950 000 'hits' on the IAEA Publications website, and will continue to be an important resource for Member States in the future".

To view all books published in the Nuclear Energy Series, go to http://www-pub.iaea.org/books/IAEABooks/Series/134/Nuclear_Energy_Series or check out the structure and levels of reports at http://www.iaea.org/OurWork/ST/NE/NESeries/ClickableMap/.

Contact: Karen Edge, K.Edge@iaea.org

Evaluation of Human Resource Needs for a New Nuclear Power Plant – Armenian Case Study

This new IAEA-TECDOC-1656, produced cooperatively by NPTDS and NKM, draws on the experience of an IAEA Technical Cooperation project using Armenia as an example, to look at the tasks linked to the management of human resources that will be required by a country planning a new nuclear power plant. This includes standard processes associated with preparatory and construction work, customer actions at various stages leading up to commissioning, and means, conditions and requirements for the training of specialists.

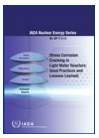
The publication is available at http://www-pub.iaea.org/books/IAEABooks/8549/Evaluation-of-Human-Resource-Needs-for-a-New-Nuclear-Power-Plant-Armenian-Case-Study

Contact: Vladimir Kuznetsov, V.Kuznetsov@iaea.org

Recently Published

Nuclear Energy General Objectives

(NG-O, STI/PUB/1523)



Stress Corrosion Cracking in Light Water Reactors: Good Practices and Lessons Learned

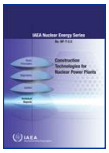
(NP-T-3.13, STI/PUB/1522)

Stakeholder Involvement Throughout the Life Cycle of Nuclear Facilities

(NG-T-1.4, STI/PUB/1520)

Introduction to the Use of the INPRO Methodology in a Nuclear Energy System Assessment

(NP-T-1.12, STI/PUB/1478), Arabic and Russian Editions



Construction Technologies for Nuclear Power Plants

(NP-T-2.5, STI/PUB/1526)

Core Knowledge of Instrumentation and Control Systems in Nuclear Power Plants

(NP-T-3.12, STI/PUB/1495)

INIR: Integrated Nuclear Infrastructure Review Missions – Guidance on Preparing and Conducting INIR Missions

(INIR-Rev. 1)

Coming Soon…

Invitation and Evaluation of Bids for Nuclear Power Plants (NG-T-3.9)

Management System Standards: Comparison between IAEA GS-R-3 and ASME NQA-1-2008 and NQA-1a-2009 Addenda (Safety Reports Series No. 70)

Management System Standards: Comparison between IAEA GS-R-3 and ISO 9001: 2008 (Safety Reports Series No. 69)

Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: Steam Generators (IAEA TECDOC-1668)

INPRO Collaborative Project: Proliferation Resistance: Acquisition/Diversion Pathway Analysis (PRADA) (IAEA-TECDOC Series)

Inside the Division of Nuclear Power

First NENP Sports Day

On a beautiful September Sunday some forty staff, family and friends met on the outskirts of Vienna to enjoy a team building activity in the form of the first 'NENP Hiking and Kite Flying Family Day'.

NENP hikers 'near heaven'

After a 5 km hike through vineyards and up hills, with spectacular views of the city of Vienna, the group reached its destination — 'Near Heaven' *(Am Himmel),* a wide open space which was perfect for a kite flying competition. Creativity was shown in abundance as home-made kites of all colours and forms flew through the air. In the end, the most original kites and the best kite flyers received awards from NENP Director JK Park. A joint meal in a nearby restaurant offered more opportunities for networking and getting to know colleagues outside the normal working environment. Due to its success, another NENP family day is planned for 2012.

New on the Team

Fanny Bazile, Senior Nuclear Engineer, Integrated Nuclear Infrastructure Group (INIG)

Fanny Bazile is a cost-free expert from France; at INIG she is in charge of questions related to energy planning, national position on nuclear power and stakeholder involvement in newcomer countries. She was previously Forecast and Communication Director in the French CEA's Nuclear Energy Division. She has a graduate degree in philosophy and public law.

Mark Harper, Team Leader, Water Reactor Technology Development, Nuclear Power Technology Development Section (NPTDS)

Mark Harper is in charge of the Water Reactor Technology Development project at NPTDS. Prior to joining the IAEA, he was a professor and lecturer at the US Naval Academy in Anapolis, Maryland, USA. He holds a PhD in nuclear engineering from the University of Maryland.

Jaana Isotalo, Training Specialist, Nuclear Power Engineering Section (NPES)

Jaana Isotalo is responsible for coordinating projects and activities related to training and education including advanced training methods and their application. She was Head of General Training for ten years at TVO in Finland. She holds a Master's degree in Education Science and also studied nuclear science.

Arif Nesimi (Ness) Kilic, Nuclear Engineer, NPES

The primary responsibility area of Ness Kilic is nuclear power plant operations. Previously, he worked at the Palo Verde Nuclear Generating Station in Arizona, USA, as Reactor, NSSS and BOP Mechanical Design and Safety Analysis Engineer. He holds a doctorate degree in nuclear and energy engineering from the University of Arizona.

Thomas Koshy, Section Head, NPTDS

Thomas Koshy brings 33 years of experience in the nuclear power industry to this position. Previously, he was Branch Chief for Mechanical and Electrical Engineering at the US Nuclear Regulatory Commission. He holds a M.Sc. in Engineering and Technical Management from Johns Hopkins University, USA, and a B.S.E.E.

Stefano Monti, Team Leader, Fast Reactor Technology Development, NPTDS

Before joining the IAEA, Stefano Monti was Head of the Reactor and Fuel Cycle Safety and Security Methods Section at the Italian National Agency for New Technologies, Energy and the Sustainable Economic Development (ENEA). He holds a PhD in Nuclear Engineering from the University of Bologna, Italy.

Pill Hwan Park, Senior Nuclear Engineer, INPRO

Pill Hwan Park is a cost free expert from the Republic of Korea; at INPRO he is responsible for several INPRO Collaborative Projects. He was Director General of Changwon National University, Ministry of Education, Science and Technology, Republic of Korea. He holds an MSc in nuclear policy from Manchester University, UK.

Masahiro Yagi, Senior Nuclear Engineer, INIG

Masahiro Yagi is a cost-free expert from Japan. At INIG he is responsible for industrial involvement in newcomer countries and is Technical Officer for the TC Regional Asia Programme as well as for several national TC projects. He was Director for Nuclear Emergency Response at the Japanese regulatory body. He is a PhD candidate in non-proliferation policy at the University of Tokyo, Japan.

My Hometown

Ballycastle, Northern Ireland

By Brian Molloy

Ballycastle or, to give it its original Irish name *Baile an Caislenn* (meaning the 'place of the castle'), is first recorded as a local name in 1565 in a letter to Queen Elizabeth from a local Irish 'king'. The oldest surviving remains are that of Bonamargie Friary built in the 1400s, where many of the Earls of Antrim are interred in its vault. The parish of Ramoan (*Rathmudhain*), in which Ballycastle is situated, was founded by the ministry of St. Patrick in the 5th century. Today, Ballycastle is a small town of around 5 000 people nestled on the 'Causeway' coast in the north-east corner of Northern Ireland, within sight of the west coast of Scotland.

Like much of Ireland, it is a place of myths and legends, and not a little history. Twenty kilometers to the west is the 'Giant's Causeway', an area of about 40 000 interlocking basalt columns. They are the result of an ancient volcanic eruption which disappears into the sea, giving the impression of a causeway heading toward Scotland, often referred to as the Eighth Wonder of the World. Legend has it that it was built by the Giants of Ireland and Scotland, Fionn Mac Cool and Fingal respectively (there are similar rock formations on the Isle of Staffa off the coast of Scotland,) but was destroyed by them after a fight.

The Giant's Causeway, North Antrim, Ireland

Moving on to slightly more tangible but still legendary affairs, nearby is the 'Olde Bushmills' distillery, the oldest (1608) licenced whiskey (note the Irish spelling) distillery in the world. It is still distilling a mean glass of *Uisce beatha,* literally 'water of life' in Irish, and the origin of the modern word 'whiskey'.

Another Irish whiskey, this time Jamesons was, in a roundabout way, responsible for one of Ballycastle's more 'technical' claims to fame. In the summer of 1898, Guglielmo Marconi, whose mother Annie was one of the Jameson whiskey family, conducted some of his first 'wireless transmission' experiments between Ballycastle and the nearby Rathlin Island. He went on to transmit between Ireland and America in 1899, and won the Nobel Prize for Physics in 1909.

Ballycastle from 'The Strand' beach

The Author C.S. Lewis holidayed in Ballycastle for many years including the period he was writing his now famous 'Chronicles of Narnia'. The Irish patriot and revolutionary, Sir Roger Casement, lived there in his youth.

What makes Ballycastle really special for me are the people who live there and the rugged beauty of the coast. People say the 'Emerald Isle' is so green because it rains all the time. However, when I think of growing up there, I think of endless summer days spent cycling, swimming in the sea, fishing in the rivers, playing golf and tennis and generally doing things most boys love to do.

Brian Molloy is Technical Head for Human Resources in the Nuclear Power Engineering Section.

Multan, Pakistan

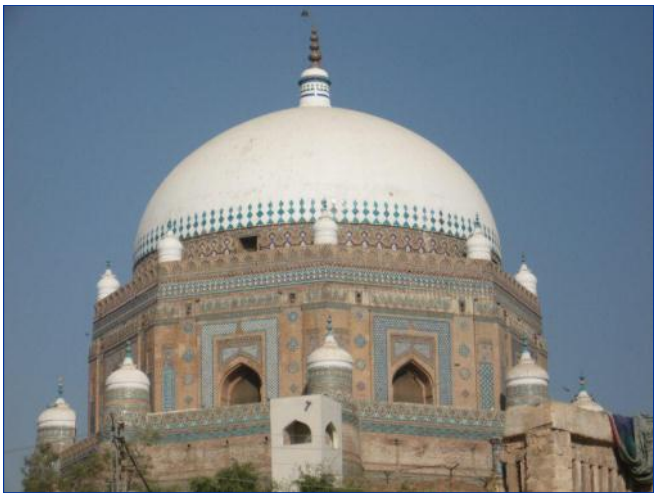
By Kamran Qureshi

Multan is a lively city, situated in the Punjab Province in Pakistan. It is the sixth largest city in the country with a population of 1.3 million people. It had several names in the past. Its present name is derived from the Sanskrit word "Mulasthana" (The Place of Origin). Multan is known as the 'City of Saints' because of hundreds of shrines of saints who propagated Islam in the Asian subcontinent with the message of peace, love and religious harmony. The shrines have very rich, geometrical pattern, calligraphy, and glazed tile work. The shrine of Saint Shah Rukn-e Alam is considered to have the largest dome in Asia.

Mutan is a truly historical city with one of the oldest civilizations of the Asian subcontinent. At the time of the Mahabharta war, Multan was the capital of the Trigarta Kingdom. It is believed that Multan was the city of Malli which Alexander the Great stormed and where he was struck by a poisonous arrow which eventually led to his death. Muhammed Bin Qasim conquered Multan from the local ruler Chach of Alor

in 711 AD. Following this conquest, the town was under Muslim rule. The British were here from 1848 until Pakistan became independent in 1947.

The inhabitants of Multan are called Multanis and the majority speaks 'Saraiki'. Today, Multan combines both old and new Pakistani culture. The city has many historical, cultural and recreational places of interest. The Multan Fort, built on a hill that separates it from the city through the old bed of the river Ravi, offers a great panoramic view. Today, six large gates in different parts of the city remind us that they were part of an ancient city wall.



Mausoleum of Shah Rukn-e-Alam

Multan is famous for its traditional handicrafts and art works. Local shoes called 'Multani Khussa', blue pottery, embroidery, hand woven carpets, camel skin lamps and camel bone work are attractive handicrafts and well known all over the world. The old part of the city is full of narrow streets and colourful bazaars with tiny shops where craftsmen can be seen turning out masterpieces in copper, brass, silver, gold and textiles in traditional fashion. Walking through these streets is a rich and sensory experience that speaks of an extraordinary history.

'Multani Khussa'

The very hot weather conditions of Multan make it an ideal place for growing the juiciest, most delicious mangoes in the world. Multani Sohan Halwa is a famous sweet exported to many countries.

I consider myself very fortunate that Multan is my home town. Wherever I may live in the future, in my heart, Multan will always remain my home.

Kamran Qureshi is a cost free expert from Pakistan in the INPRO Group.

The 'Valley of the Sun', USA

By Arif Nesimi (Ness) Kilic

I have recently joined the IAEA after working at the Palo Verde Nuclear Generating Station (NGS) which is located 100 km west of Phoenix, Arizona, USA.

The Phoenix metropolitan area, also known as the Valley of the Sun, is adjacent to the north edge of the Sonoran Desert, and with a population of more than 4 million, the 14th largest metropolitan area of the USA. Although the hot summers with temperatures of 45–50°C can be brutal, it is a great spot, attracting the 'snow-birds', a term used for people who reside in the northern US but love to spend their winters in Arizona.

Besides being close to major attractions such as the Grand Canyon, Saguaro National Forest and Old Tucson, the winters of Phoenix offer additional fun at the ski resorts in the Mogollon Rim, only a 3–4 hour drive away.

Sonoran Desert, Arizona, USA

Famous old-western steak houses, historic Spanish missions and pueblos, native American villages and ghost towns of the copper and gold eras are things to see in and around Phoenix.

And let's not forget the second best sunset in the world — although Phoenicians argue that sunset in the Sonoran Desert is better than that of Sudan.

Arif Nesimi Kilic is a nuclear engineer responsible for the area of nuclear power plant operation in the Nuclear Power Engineering Section.

Upcoming Events January–May 2012

Date	Title	Location	Contact
23–27 Jan	Technical Meeting on Grading of the Applications of Management System Requirements	IAEA, Vienna	J.Boogaard@iaea.org
24–27 Jan	Technical Meeting/Workshop on Topical Issues on Infrastructure Development – Managing the Development of a National Infrastructure for Nuclear Power Plants	IAEA, Vienna	M.Aoki@iaea.org
27–29 Feb	Technical Meeting on Innovative Fast Reactor Designs with Enhanced Negative Reactivity Feedback Effects	IAEA, Vienna	S.Monti@iaea.org
29 Feb–2 Mar	Technical Meeting to Identify Innovative Fast Neutron Systems Development Gaps	IAEA, Vienna	S.Monti@iaea.org
5–9 Mar	6th GIF–INPRO Interface Meeting	IAEA, Vienna	R.Beatty@iaea.org
5–16 Mar	Workshop on Environmental Degradation of Components in Nuclear Power Reactors	Trieste, Italy	B.M.Tyobeka@iaea.org
19–23 Mar	Technical Meeting on Impact of Fukushima Event on Current and Future Fast Reactor Designs	Dresden, Germany	S.Monti@iaea.org
20–23 Mar	Technical Meeting on Environmental Issues in New Nuclear Power Programmes	IAEA, Vienna	M.Aoki@iaea.org
27–30 Mar	Third Workshop of ICSP on Integral PWR Design Natural Circulation Flow Stability and Thermo–hydraulic Coupling of Containment and Primary System during Accidents	Daejeon, Rep. of Korea	J.H.Choi@iaea.org
28–30 Mar	Technical Meeting on the Status of the International Knowledge Base on Irradiated Nuclear Graphite Properties	IAEA, Vienna	B.M.Tyobeka@iaea.org
16–19 Apr	First Research Coordinated Meeting on Qualification, Condition Monitoring, and Management of Aging of Low Voltage Cables in Nuclear Power Plants	IAEA, Vienna	K-S.Kang@iaea.org
16–20 Apr	Fourth Research Coordinated Meeting on Benchmark Analysis of Sodium Natural Circulation in the Upper Plenum of the MONJU Reactor Vessel	Tsuruga, Japan	S.Monti@iaea.org
17–20 Apr	Technical Meeting on Establishing, Developing and Maintaining Capacity Building in Member States (Nuclear Safety Action Plan)	Austria Centre, Vienna	B.Molloy@iaea.org Z.Pasztory@iaea.org S.Mallick@iaea.org
23–27 Apr	INPRO Dialogue Forum on Drivers and Impediments for Regional Cooperation on the Way to Sustainable Nuclear Energy Systems	IAEA, Vienna	V.Kuznetsov@iaea.org
24–27 Apr	Technical Working Group on Nuclear Power Infrastructure	IAEA, Vienna	M.Aoki@iaea.org
24–26 Apr	Fourth Research Coordination Meeting on Development of Advanced Methodologies for the Assessment of Passive Safety System Performance in Advanced Reactors	IAEA, Vienna	H.Subki@iaea.org
1–4 May	Fourth Research Coordination Meeting on Benchmarking Severe Accident Computer Codes for HWR Applications	Ottawa, Canada	J.H.Choi@iaea.org
14–18 May	Third International Conference on Nuclear Power Plant Life Management	Salt Lake City, USA	K-S.Kang@iaea.org

Impressum

Nuclear Power Newsletter
Vol. 9, No. 1, January 2012

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, January 2012

10–06151