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Nuclear Power Newsletter

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Contents

Division of Nuclear Power
Department of Nuclear Energy, IAEA
PO Box 100, Vienna International Centre
1400 Vienna, Austria
Tel : +43 1 2600 25718
Fax: +43 1 2600 –7
Email: E.Dyck@iaea.org

IAEA Ministerial Conference on Nuclear Safety

IAEA Director General Yukiya Amano and Conference President Antonio Guerreiro

In the wake of the 11 March 2011 nuclear accident at TEPCO's Fukushima Daiichi Nuclear Power Station in Japan, the IAEA Director General, Mr Yukiya Amano, convened an **IAEA Ministerial Conference on Nuclear Safety** in Vienna from **20 to 24 June 2011**. The main objective of the Conference was to identify the lessons learned from the accident and strengthen nuclear safety throughout the world.

Read more on p 7–9

Briefing GC Delegates on Nuclear Power Issues

The side events on nuclear power issues, to be held during the 55th IAEA General Conference (19–23 September 2011) will include:

- **Highlights of INPRO – Adding Value for Member States**
  Wednesday, 21 September, 09:15 – 10:50 h, M4 (M0E140)
- **Developments in the Introduction of Nuclear Power**
  Wednesday, 21 September, 11:00 – 13:00 h, IAEA Library (F0146)
- **Nuclear Industry Cooperation Forum**
  Wednesday, 21 September, 15:15 – 17:45 h, M4 (M0E140)

The articles on **pages 2–6** provide background information on these events.

Highlights of INPRO Projects - Adding Value for Member States

GC Side Event, Wednesday, 21 September 2011, 9:15-10:50 h, M Building, Room M4

In the side event organized by the International Project on Nuclear Reactors and Fuel Cycles (INPRO), Member State representatives will highlight several projects that address the safe and secure expansion of nuclear energy on a global, regional and national level. A vision for INPRO's development over the next five years will be presented.

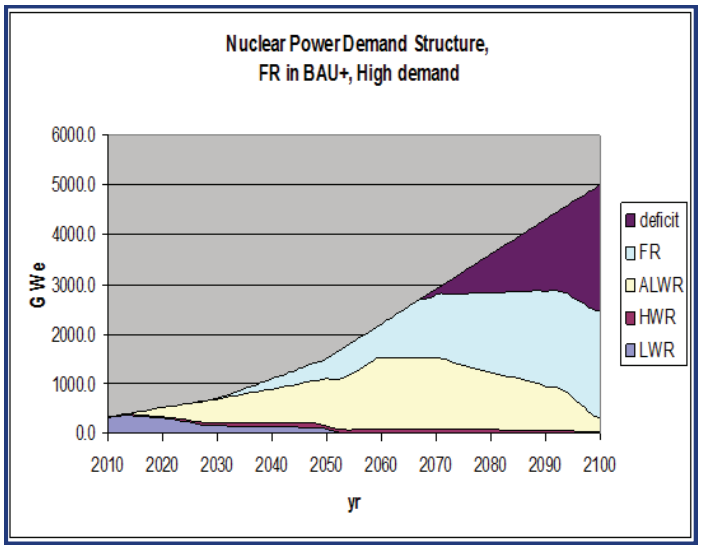
Global Architecture of Innovative Nuclear Systems based on Thermal and FRs including Closed Fuel Cycles (GAINS)

The INPRO Collaborative Project GAINS was launched to develop a new model on global nuclear energy development in the 21st century and validate the results of its application through sample analyses. A high energy scenario (1500 GW(e) by 2050, 5000 GW(e) by 2100) and a low energy scenario (1000 GW(e) by 2050, 2500 GW(e) by 2100) were selected for the project. Options for the future global nuclear architecture were examined using homogeneous and heterogeneous models of the 'nuclear' world; for the latter, three groups of nuclear power producing countries were identified which can operate separately from, or synergistically with each other to create the architecture of a global nuclear energy system.

The reference database for GAINS scenario studies includes reactors and associated fuel cycles with different technical maturities, ranging from operating systems generating most of the current available nuclear electricity to systems being developed or construction to be deployed in the near to medium term, and to very innovative systems currently in various stages of research and development.

To estimate the impact of innovations, four types of global nuclear energy system were defined and then analysed:

- 'Business as usual' (BAU), i.e. expansion of the current nuclear energy system, based on PWR (94%) and HWR (6%) operated in a once-through fuel cycle in all GAINS groups;
- BAU plus advanced PWR (BAU+);
- BAU+ including FRs and fuel recycling in G1 (BAU+FR);
- Perturbation scenarios including: (i) construction of fast spectrum reactors or thermal spectrum HWRs using the thorium fuel cycle for reduction of natural uranium requirements; (ii) reduction of minor actinides (MA) using accelerator driven systems (ADS) or molten salt reactors (MSR) and other perturbation scenarios.



Key indicators and evaluation parameters calculated for each nuclear energy system form the main basis for comparing the different options and results, which focus on the issue of spent nuclear fuel, plutonium inventory and economic and investment risks.

Belgium, Canada, China, the Czech Republic, France, India, Italy, Japan, the Republic of Korea, Spain, the Russian Federation, Slovakia, Ukraine, USA, the European Commission (EC), and Argentina as an observer are participants in GAINS. Within the IAEA, the Division of Nuclear Fuel Cycle and Waste Technology (NEFW) and the Planning and Economic Studies Section (PESS) are contributing to this project.

Nuclear Energy System Assessment (NESA)

A NESA using the INPRO methodology will assist energy planners in Member States in making informed decisions on the choice of the most appropriate nuclear energy system and in assessing whether their strategic deployment plan is sustainable. The IAEA offers Member States support in performing a NESA.

A full scope NESA evaluates (i) all nuclear facilities in a given nuclear energy system, including front end facilities and back end waste management facilities, and related institutional measures such as legal framework, regulatory bodies, etc., (ii) the complete lifecycle of the facility ('cradle to grave'), i.e. design, construction,

operation, decommissioning and waste disposal; (iii) all assessment areas defined in the INPRO methodology.

Given its comprehensive nature, a NESA with the INPRO methodology can benefit (i) nuclear technology developers, to identify possible gaps in R&D and the associated actions needed to fill those gaps; (ii) experienced nuclear technology users, to assist with strategic planning and decision making concerning the continued operation and expansion of a nuclear energy system; (iii) prospective first time nuclear technology users, to familiarize them with issues that need to be considered when deciding on whether to embark on a nuclear power programme and to support their long term strategic planning.

EXPERIENCE OF BELARUS: Belarus is undertaking a NESA using the INPRO methodology. The assessed nuclear energy system consists of the first two nuclear power plants expected to come into service in Belarus in 2016 and 2018, respectively, and associated waste management facilities. Consistent with the holistic approach of the INPRO methodology, all nuclear fuel cycle facilities located outside the country are also evaluated with support from the Russian Federation, which is acting as a 'strategic partner' in the Belarus study. At the INPRO side event, a representative from Belarus will share the country's experience in assessing its nuclear energy system with the INPRO methodology.

Proliferation Resistance: Acquisition/Diversion Pathway Analysis (PRADA)

The overall objective of this INPRO Collaborative Project was to provide guidance on enhancing proliferation resistance of innovative nuclear energy systems and contribute to further developing and strengthening the assessment area of 'proliferation resistance' of the INPRO methodology. As a test of the methodology, the PRADA project focused on identifying and analyzing high level pathways for the acquisition or diversion of fissile material for a nuclear weapons programme. For the case study, the DUPIC fuel cycle (direct use of PWR spent fuel in CANDU reactors) with an assumed specific diversion scenario for further detailed analyses was used. The study also made recommendations for assessing the multiplicity and robustness of barriers against proliferation, including institutional, material and technical barriers and also barriers resulting from the implementation of international safeguards.

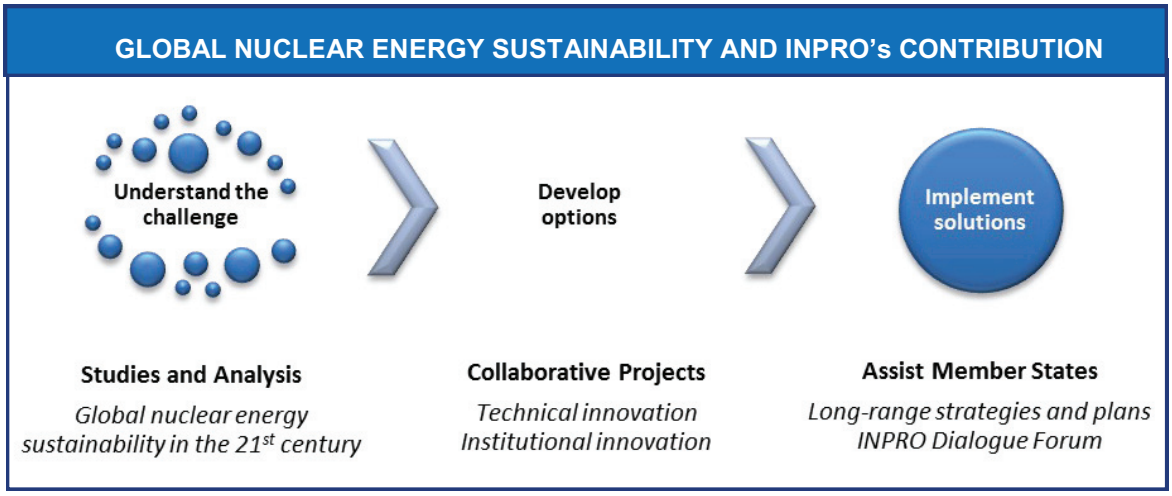
The Collaborative Project PRADA was concluded at the end of 2010. Led by the Republic of Korea, the project involved the participation of Canada, China, the USA and the EC while Japan and the Russian Federation were observers. Within the IAEA, the PRADA project established close cooperation with the Department of Safeguards.

INPRO 2017 Development Vision

In its *Medium Term Strategy* for 2012–2017, the IAEA envisages a focus on areas where it can make a unique impact. INPRO's approach is a holistic and global view of nuclear energy systems together with the pursuit of innovations in nuclear energy, enabling it — as stated in the *Medium Term Strategy* — to "facilitate collaboration among interested Member States in the joint development of evolutionary and innovative nuclear energy systems".

A vision and plan for INPRO's development to 2017 is being formulated by the governing body of the project, the INPRO Steering Committee. It focuses on (a) added value of INPRO to Member States, (b) programme development, (c) collaboration of INPRO with Member States, and (d) implementing INPRO activities in the IAEA.

Contact: R.Beatty@iaea.org
www.iaea.org/INPRO



Developments in the Introduction of Nuclear Power

GC Side Event, Wednesday, 21 September, 11:00 – 13:00 h, IAEA Library (F0146)

Interest in nuclear power remains high, although the accident at the Fukushima Daiichi Nuclear Power Station has had an impact on the future of nuclear power. There were 38 countries without nuclear power that, before the accident, had strongly indicated their intentions to proceed with nuclear power programmes, including those with active construction or reactors on order. Since the accident, a few countries have cancelled or revised their plans but most have not, while many are waiting for lessons learned from that accident. In general, it appears that several countries that have already made a decision will continue with their plans to develop a nuclear power programme.

Progress by Nuclear Newcomers

Before the Fukushima accident, much progress was displayed by the nuclear power 'newcomer' countries. Among those who have advanced their nuclear power programmes, two countries have ordered new nuclear power plants, and several countries are close to awarding the contract to procure a nuclear power plant under a government-to-government agreement. There is a tendency for countries embarking on nuclear power programmes to seek out and decide on the vendor country, even before inviting tenders for the nuclear power plant contract. Such early partnerships have some advantages: they can have bilateral assistance from an early stage, but it does narrow the available options of different nuclear technologies.

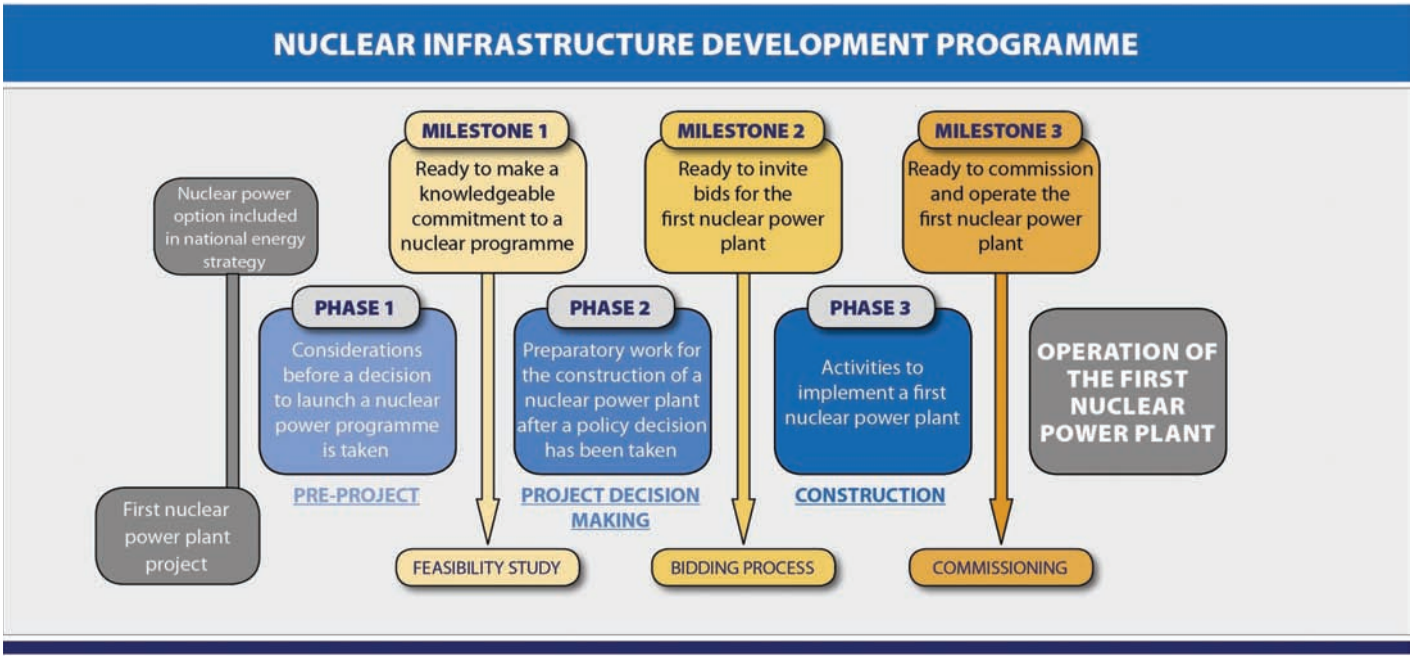
Several Member States have decided on or plan to have non-traditional ownership and contracting approaches for their first nuclear power plants, such as 'build-operate-own'.

The IAEA is now preparing a report on the issues that includes the benefits and challenges associated with these approaches. A Technical Meeting was held on that subject in March 2011, in order to exchange information among Member States on current practices and needs related to alternative contracting and ownership for nuclear power plants.

The IAEA Milestones Approach

At the same time, many countries interested in nuclear power are still in Phase 1 of the IAEA 'Milestones' approach (documented in the IAEA Nuclear Energy Series publication NG-G-3.1: *Milestones in the Development of a National Infrastructure for Nuclear Power*), preparing for a knowledgeable national plan, involving all stakeholders and taking into consideration all the key elements for the successful introduction of nuclear power.

Several States are now closing in on Milestone 1, 'Knowledgeable Decision', and have their own experience in addressing the many issues, such as developing a national position to introduce nuclear power, preparing for human resource development and establishing the necessary legislative and regulatory frameworks. The IAEA continues with the implementation of its assistance activities in this area, which cover a wide range



of technical topics, such as human resource development and support for the development of competent regulatory systems; they also include the development of guidance and other documents, the establishment of forums to share lessons learned and best practices, and the provision of technical assistance in the form of capacity building and review services.

The IAEA takes a phased, holistic approach to infrastructure development. The Nuclear Power Support Group (NPSG) of the IAEA helps coordinate overall guidance, while the implementation of technical activities across all relevant areas of the IAEA's programme is coordinated through the Integrated Nuclear Infrastructure Group (INIG), established in July 2010.

Technical Working Group on Nuclear Power Infrastructure

To further enhance the IAEA activities for nuclear power newcomer countries, the Technical Working Group on Nuclear Power Infrastructure (TWG-NPI) was established and held their first two meetings in November 2010 and in May 2011.

The TWG-NPI recommended that the IAEA focus its assistance appropriate to the level and extent of the nuclear power infrastructure development phase in the Member State (as defined in the IAEA Milestones approach), for better tailoring of the required and needed IAEA technical assistance programme. Such assistance should be defined based on the completed self-evaluation survey, the Integrated Nuclear Infrastructure Review Mission (INIR) and follow-up reports of INIR missions, and an integrated work plan developed by the Member States with IAEA/INIG support.

Soft Coordination

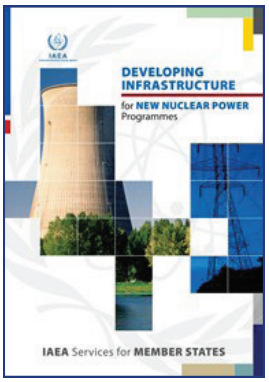
Recognizing experienced countries' willingness to support the infrastructure development in newcomer countries, and limited resources in the IAEA for newcomer support, 'soft coordination' is becoming a preferred approach.

'Soft coordination' refers to the IAEA's efforts to promote the productive interaction among the infrastructure assistance groups of the IAEA and similar bilateral assistance between newcomer and vendor countries — while respecting the independence of different assistance initiatives.

Second Meeting of the Technical Working Group on Nuclear Power Infrastructure, IAEA, 23-26 May 2011.

Guidance Publications

Several series of IAEA publications, such as the IAEA Safety Standards Series, the IAEA Nuclear Energy Series and technical documents (IAEA-TECDOCs) can be helpful for Member States in establishing the necessary infrastructure for a nuclear power programme.



A new brochure on *Developing Infrastructure for New Nuclear Power Programmes* summarizes the services which the IAEA offers to Member States considering the introduction of nuclear power.

A comprehensive **Nuclear Infrastructure Bibliography** currently with over 160 publications is available at **www-pub.iaea.org/MTCD/publications/nibibliography1.asp** including, e.g.

- *Evaluation of the Status of National Nuclear Infrastructure Development* (NE-Series NG-T-3.2)
- *Managing Human Resources in the Field of Nuclear Energy* (NE-Series NG-G-2.1)
- *Issues to Improve the Prospects of Financing Nuclear Power Plants* (NE-Series NG-T-4.1)
- *Responsibilities and Capabilities of a Nuclear Energy Programme Implementing Organization* (NE Series NG-T-3.6)
- *Initiating Nuclear Power Programmes: Responsibilities and Capabilities of Owners and Operators* (NE Series No. NG-T-3.1)

The side event on the **Developments in the Introduction of Nuclear Power** offers a great opportunity for a wide range of Member State delegations to hear about the latest developments in some of the countries with fast moving nuclear power programmes.

Contact: A.Starz@iaea.org
www.iaea.org/NuclearPower/Infrastructure

Nuclear Industry Cooperation Forum

GC Side Event, Wednesday, 21 September, 15:15 – 17:45 h, M Building, Room M4

The severe nuclear accident in Japan prompted an immediate reaction from Member States, both from countries with operating nuclear power programmes and potential newcomers. The IAEA has played a vital role in the international response to enhance safety and improve performance by sharing operating experience and management strategies to support Member States.

Recommendation of Ministerial Conference

The Ministerial Conference on Nuclear Safety, convened by the IAEA on 20–24 June 2011, recommended to the IAEA, amongst others, to facilitate the sharing of information, including specific lessons learned as operators conduct safety reviews in response to insights they gained from the events in Japan.

Recommendation of SAGNE

Also, the Standing Advisory Group of Nuclear Energy (SAGNE) in its Recommendation No. 17 on 'Operational Incidents in Nuclear Facilities' advised that the IAEA devote further effort to improving managerial focus towards a more transparent and timely reporting and follow-up of actions, based on lessons learned and recommendations resulting from operational incidents in nuclear facilities.

Operators have the primary responsibility for nuclear safety on a daily basis. They must conduct robust reviews of their programmes in the aftermath of a nuclear event and implement necessary changes to enhance the facilities' capability to withstand and respond to multiple external hazards.

First Meeting of the Nuclear Industry Cooperation Forum

In response to the above recommendations, the IAEA is planning to establish a new forum — the **Nuclear Industry Cooperation Forum (NICF)** — for senior leaders and managers from the nuclear industry. The objective of the forum is to offer a platform for identifying and sharing recent experiences, relevant factors and approaches influencing safety and performance improvements and long term strategies, taking into consideration the accident at the Fukushima Daiichi Nuclear Power Station, to the extent possible.

The side event at the General Conference offers a good opportunity to serve as the first meeting of the Forum. Stress tests or integrated safety test results will be presented by senior managers from utilities or technical service organizations (TSO) in Member States. Nuclear industries need to learn, on a continuous basis, about a nuclear power plant's response, the role of operators at the plant and on-site and off-site emergency responders under extreme conditions.

Invited senior managers will present 'road maps' to guide an effective global effort of addressing the lessons learned. Such road maps can include several elements, such as (1) national response, (2) current and future cooperation with the IAEA, and (3) cooperation among other countries or international organizations.

Contact: K-S.Kang@iaea.org

www.iaea.org/NuclearPower/Engineering/

Photo credit: Korea Wolsong Nuclear Power Plants

IAEA Ministerial Conference on Nuclear Safety

20-24 June 2011, Austria Centre, Vienna

In the wake of the 11 March 2011 nuclear accident at TEPCO's Fukushima Daiichi Nuclear Power Station in Japan, which was caused by the Great East Japan Earthquake and Tsunami, the IAEA Director General, Mr. Yukiya Amano, convened an **IAEA Ministerial Conference on Nuclear Safety** in Vienna from 20 to 24 June 2011. The main objective of the Conference was to identify the lessons learned from the accident and strengthen nuclear safety throughout the world.

The Conference provided an opportunity to undertake a thorough preliminary assessment of the accident and discuss broader issues relating to nuclear safety including emergency preparedness and response.

The specific objectives of the Conference were to:

(i) make a preliminary assessment of the accident at TEPCO's Fukushima Daiichi Nuclear Power Station;

(ii) assess national and international emergency preparedness and response levels in light of the accident, with a view to strengthening them;

(iii) discuss safety implications and identify those areas of the global nuclear safety framework which may be reviewed with a view to strengthening them through launching a process to that effect;

(iv) identify lessons learned and possible future actions.

These issues were discussed at the ministerial and senior technical level in plenary sessions and in greater depth in three working sessions.

Opening Session

In opening the Ministerial Conference, Mr. Amano laid out his vision for the future of global nuclear safety, including the IAEA's role. He made a number of concrete proposals which could contribute to establishing a realistic and enhanced post-Fukushima nuclear safety framework. He focused on five main areas:

First, to strengthen IAEA Safety Standards and to ensure that they are universally applied; the Director General noted that the Safety Standards are an internationally agreed benchmark for what constitutes a high level of safety. He pointed out that he was "asking the IAEA's Commission on Safety Standards to review the relevant standards and report within 12 months, with recommendations for strengthening them".

Second, to systematically and regularly review the safety of all nuclear power plants; the Director General noted that "these assessments should be conducted nationally by Member States, but additional review by the IAEA is essential to add credibility and transparency and make the process more effective".

Third, to enhance the effectiveness of national nuclear regulatory bodies and ensure their independence, as they play a crucial role in ensuring nuclear safety. "All countries should ensure that they are as effective as possible, genuinely independent, adequately funded and staffed by well-trained personnel", emphasized Mr. Amano.

Fourth, to strengthen the global emergency preparedness and response system; the Director General made practical proposals and noted that "mechanisms for responding to and managing a nuclear incident need to be enhanced, both within countries and at the regional and international levels". He emphasized the need for a strengthened role of the IAEA as coordinator of the Joint Radiation Emergency Management Plan of International Organizations.

IAEA Director General Yukiya Amano speaking at the Opening Session of the Conference on 20 June 2011.

Fifth, to expand the IAEA's role in receiving and disseminating information – in the case of Fukushima, the IAEA served as a useful point of reference. "However, our role in the case of an accident is largely limited to distributing information validated by the country concerned, to all Member States", Mr Amano stressed. He proposed to expand this role to analysis and development of possible scenarios on how a crisis might develop and the associated radiological impact. The Director General asked the Advisory Committee of the International Nuclear and Radiological Event Scale (INES) to consider ways in which the scale might be improved.

These five proposals enjoyed broad support by Member State representatives attending the Conference, many of whom requested that they constitute the core of an Action Plan to be developed.

Ministerial Declaration

The Conference unanimously adopted a **Ministerial Declaration** that outlined a number of measures to improve nuclear safety and expressed the firm commitment of Member States to ensure that these measures are implemented. The Ministers also asked the Director General to prepare a draft Action Plan covering all the relevant aspects relating to nuclear safety, emergency preparedness and response, and radiation protection of people and the environment, as well as the international legal framework, and submit it to the IAEA Board of Governors and the IAEA General Conference in 2011.

For his part, the Director General stated that the five-day Conference "achieved its main goal, which was to pave the way for an enhanced post-Fukushima global nuclear safety framework".

Working Sessions

WORKING SESSION ONE on the ***Preliminary Assessment of the Accident at TEPCO's Fukushima Daiichi Nuclear Power Station and Actions for Safety Improvements*** aimed at facilitating a forum for discussions on preliminary expert assessment of the accident and possible future actions for continuous improvement of safety of nuclear installations. The session discussed substantive safety issues arising from the Fukushima accident. Although the full scope of all the lessons that need to be learned cannot yet be known, efforts will continue non-stop to achieve full understanding while ensuring that safety vulnerabilities which are now apparent can be addressed promptly.

Working Session One: Chairperson Mike Weightman, Chief Inspector of Nuclear Installations, Office for Nuclear Regulations, UK, (left) and Scientific Secretary Pal Vincze, IAEA Division of Nuclear Power.

WORKING SESSION TWO on ***Emergency Preparedness and Response*** discussed national, regional and international actions in response to the Fukushima accident, existing national arrangements, an international emergency preparedness and response framework and the central role of the IAEA in inter-agency coordination. Participants discussed the need for expansion and strengthening of IAEA's role in emergency preparedness and response, including enabling the Agency to provide analyses of the progress of the accident and the radiological impacts and share such analyses with Member States. The IAEA's strengthened role in coordinating the international emergency response was also discussed and called for.

WORKING SESSION THREE on the ***Global Nuclear Safety Framework*** recognized that the Standards should be continuously reviewed, strengthened and applied as widely and effectively as possible under the

Ms Alumanda Dela Rosa, Director, Philippine Nuclear Research Institute, presented the summary of Working Session Two.

auspices of respective national regulatory frameworks. This is very important to ensure that the highest and most robust levels of nuclear safety are in place worldwide, based on IAEA Safety Standards. The session recognised that the IAEA Safety Standards serve as the common reference around the globe.

Many Member States have already initiated safety assessments in the light of the Fukushima accident. It was also noted that it would be beneficial in the interest of global safety that internationally harmonized safety review methodologies be developed and implemented, both by countries with existing nuclear power programmes and those embarking on a nuclear power programme. The IAEA could play a leading role in the development of these methodologies on a coordinated basis.

Member States were strongly encouraged to report the results of safety reviews and their responses to lessons learned at the Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS) to be held in 2012.

Richard Meserve, Chairman, International Nuclear Safety Group (INSAG), presented the summary of Working Session Three.

Comprehensive information about
the IAEA Ministerial Conference on Nuclear Safety
held on 20-24 June 2011 in Vienna, Austria,
is available at the Conference website:

www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=42466

Conference highlights and photos at:
www.iaea.org/conferences/ministerial-safety/

Exhibition on Nuclear Energy at the 55th IAEA General Conference

19 to 23 September 2011

Nuclear Energy Exhibit 2010

Delegates and visitors to the 55th Meeting of the IAEA General Conference will find this year's exhibition on nuclear energy on the **first floor of the M Building, in front of the Plenary entrance.**

The exhibition will highlight select services of the IAEA Department of Nuclear Energy available to Member States to assist them on their path to sustainable nuclear energy. A set of 3–5 minute presentations on related topics of interest will take place at the exhibit during the breaks.

Please visit our booth to learn more about how the IAEA can assist your country in developing and maintaining a safe, sustainable nuclear power programme.

Nuclear Power Technology Developments

Technical Working Groups on Advanced Technologies for LWRs and HWRs

The 16th Meeting of the Technical Working Group on Advanced Technologies for Light Water Reactors (TWG-LWR) and the 12th Meeting of Technical Working Group on Advanced Technologies for Heavy Water Reactors (TWG-HWR) were held jointly at IAEA Headquarters in Vienna on 26–28 July 2011.

The two TWGs include groups of experts who provide advice and support for programme implementation and represent a global network of excellence and expertise in the area of advanced technologies for LWRs and HWRs, respectively. Twenty Member States and three international organizations are represented in the TWG-LWR, and seven Member States in TWG-HWR.

Participants of the two TWGs met for a joint session at the IAEA on 26–28 July 2011.

In a joint session, highlights of international organizations and national programmes on water cooled reactor technology development were presented and discussed, thus providing a global forum for information exchange.

The Fukushima nuclear accident was discussed in a special session, based on an update by the Japanese representative; also, the participants were briefed on the outcome of the IAEA Ministerial Conference on Nuclear Safety. Both sessions resulted in a number of proposals for future IAEA activities.

The members of the TWGs confirmed the synergy of the joint sessions and decided to hold the next TWG meetings jointly in June 2012.

More information on the meetings of the TWGs is available at the following web page:

www.iaea.org/NuclearPower/Technology/Meetings/2011-Jul-26-28-TWG-LWR-HWR.html

Contact: J.H.Choi@iaea.org / K.Yamada@iaea.org

Training Courses on Nuclear Reactor Technology

Recently, two training courses, held in cooperation with national and international institutions trained nuclear engineers from Member States on specific aspects of nuclear reactor technology.

Joint ICTP-IAEA Course on Science and Technology of Supercritical Water Cooled Reactors

The Abdus Salam International Centre for Theoretical Physics (ICTP) in co-operation with the IAEA, organized a Course on Supercritical Water Cooled Reactors (SCWR) at the ICTP in Trieste, Italy, from 27 June–1 July 2011.

The training course provided a group of international participants with a comprehensive and up-to-date review of SCWR science and technology. The one week course consisted of 28 lectures addressing:

- SCWR concepts under development
- Neutronics and core designs
- Thermodynamics of systems at supercritical pressure
- Thermal-hydraulics of supercritical fluid
- Safety requirements and safety systems
- Materials requirements and candidate materials
- Water chemistry.

Twenty-two participants from 18 Member States attended the joint ICTP/IAEA Course on Supercritical Water Cooled Reactors in Trieste, Italy, in June 2011.

The participants ranged from graduate students to university professors and from engineers to regulators. The lectures and the following team discussions enabled the participants to gain a deeper understanding of issues related to SCWR and fostered close collaboration among team members.

The SCWR is an innovative water cooled reactor concept which uses supercritical pressure water as reactor coolant. This makes it possible to achieve high thermal efficiency and simplify reactor systems, resulting in improved plant economics. Increasing operating pressure and steam temperature is a natural evolution from conventional water cooled reactors as seen in fossil power technology. About 20 Member States have been involved in research and development of the new concept.

Contact: K.Yamada@iaea.org

www.iaea.org/NuclearPower/Technology

Course on Natural Circulation in Nuclear Power Plants

Passive safety systems and natural circulation are receiving significant attention from those involved in the nuclear industry, especially after the Fukushima accident. One issue the IAEA fosters international cooperation in is examining natural circulation for removal of core heat under normal operation and accident conditions, and to provide cooling of the containment vessels.

The Course on Natural Circulation Phenomena and Passive Safety Systems in Advanced Water Cooled Reactors utilizes information, results and expertise shared within the framework of the IAEA Coordinated Research Project on 'Natural Circulation Phenomena, Modelling and Reliability of Passive Systems that Utilize Natural Circulation'. The course has been organized, almost annually since 2004, at the ICTP in Trieste, Italy, and in several other places.

This year, Harbin Engineering University at Harbin, China, hosted the course from 11–15 July 2011. More than 25 participants were able to benefit from instructions on:

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

An international group of participants attended the training course on natural circulation in nuclear power plants at Harbin Engineering University in China in July 2011.

The next course on Natural Circulation Phenomena and Passive Safety Systems in Advanced Water Cooled Reactors is scheduled for 23–27 July 2012. It will be hosted by Oregon State University in Corvallis, Oregon, USA.

Contact: J.H.Choi@iaea.org

www.iaea.org/NuclearPower/Technology

New Publications

Operating Experience with Nuclear Power Stations in Member States in 2010

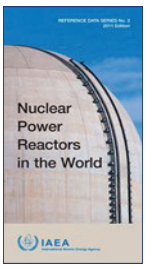
2011 Edition (CD-ROM); STI/PUB/1518

This report is the 42nd edition in the IAEA's series of annual reports on operating experience with nuclear power stations in Member States.

Available at: **www-pub.iaea.org/MTCD/Publications/PDF/OPEX_2010_CD_web/Start.pdf**

Nuclear Power Reactors in the World

2011 Edition, IAEA-RDS-2/31



This is the thirty-first edition of Reference Data Series No.2; it presents the most recent reactor data available to the IAEA and summarizes information as of the end of 2010.

Available at: **www-pub.iaea.org/MTCD/Publications/PDF/RDS2_web.pdf**

Upcoming Events 2011

Date	Title	Venue	Country	Contact
3–6 October	Technical Meeting/Workshop on Non-electric Applications of Nuclear Energy	Rež	Czech Republic	I.Khamis@iaea.org
3–6 October	Technical Meeting on Options to Enhance Energy Supply Security with NPPs based on SMRs	Vienna	Austria	M.Subki@iaea.org
3–14 October	Workshop on Enhancing Nuclear Engineering Education through the Use of IAEA PC-based Simulators	Milan	Italy	S.Jo@iaea.org
10–14 October	International Workshop on Public Information and Understanding to Introduce New Nuclear Power Plant	Seoul	Republic of Korea	K-S.Kang@iaea.org M.Maeoka@iaea.org
10–14 October	INPRO Dialogue Forum: Common User Considerations for Small and Medium-sized Nuclear Power Reactors	Vienna	Austria	P.Villalibre@iaea.org M.Subki@iaea.org
17–21 October	Technical Meeting on Maintenance Optimization and Outage Management in Nuclear Power Plants	Vienna	Austria	R.Shouler@iaea.org
17–20 October	Regional Workshop on Self-Evaluation Methodology and Action Plan Development for Nuclear Power Programmes	Vienna	Austria	D. Kovacic@iaea.org
2–4 November	18th Meeting of the INPRO Steering Committee	Vienna	Austria	R.Beatty@iaea.org P.Gowin@iaea.org
7–18 November	Training Course on Management and Safety Infrastructure for Introducing and Expanding Nuclear Power Programmes	Argonne	USA	V.Nkong-Njock@iaea.org
16–18 November	Workshop on the Prediction of Axial and Radial Creep in HWR Pressure Tubes	Vienna	Austria	J.H.Choi@iaea.org
22–25 November	Technical Meeting on Recruitment, Selection, Training and Qualification of Personnel for New Nuclear Power Plants	Vienna	Austria	B.Molloy@iaea.org
28–30 November	Technical Meeting on Innovative Fast Reactor Designs with Enhanced Negative Reactivity Feedback Features	Vienna	Austria	S.Monti@iaea.org
5–7 December	Technical Working Group on Nuclear Power Infrastructure	Vienna	Austria	M.Aoki@iaea.org
5–8 December	Technical Meeting on the Management of New Nuclear Power Plant Projects	Bratislava	Slovakia	J.Boogaard@iaea.org

Impressum

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