Safety of Nuclear Installations

Objective

To continuously improve the safety of nuclear installations during site evaluation, design, construction and operation through the availability of set safety standards and their application. To support Member States in developing appropriate safety infrastructure. To assist adherence to, and implementation of, the Convention on Nuclear Safety and the Code of Conduct on the Safety of Research Reactors, and to strengthen international cooperation.

Nuclear Safety Infrastructure

The Agency continued to support Member States in enhancing their governmental, legal and regulatory frameworks, which were evaluated through Integrated Regulatory Review Service (IRRS) missions. Four IRRS missions were conducted in 2012 — in Finland, Greece, Slovakia and Sweden. In addition, an IRRS scoping mission was conducted in Kazakhstan. The IRRS mission guidelines were reviewed through a series of consultancy meetings targeting methods to improve mission efficiency, consistent with the IAEA Action Plan on Nuclear Safety. Improvements were also made to the SARIS (Self-Assessment of Regulatory Infrastructure for Safety) methodology and software; this self-assessment is required of the host country prior to an IRRS mission.

Countries embarking on nuclear power have benefited from IAEA Safety Standards Series No. SSG-16, *Establishing the Safety Infrastructure for a Nuclear Power Programme*. Over 150 training courses, workshops and advisory missions were conducted to support national activities in countries considering or deciding to introduce nuclear power. These included Bangladesh, Belarus, Egypt, Indonesia, Jordan, Lithuania, Malaysia, Nigeria, the Philippines, Poland, Thailand, Turkey, the United Arab Emirates and Vietnam. Additionally, workshops on self-assessment of safety infrastructure were conducted for the Arab Network of Nuclear Regulators and the Asian Nuclear Safety Network, and at the national level (for example, in Egypt, Poland, Lithuania and the Philippines). Moreover, a technical meeting attended by 40 Member States in December highlighted the use of the Integrated Review of Infrastructure for Safety methodology and software, which are tailored to assess the progress made in developing safety infrastructure of embarking countries.

The Agency updated its guidance on infrastructure self-assessment, specifically the questionnaires for the Systematic Assessment of Regulatory Competence Needs service, and developed a safety report on the competences of human resources for regulatory bodies. Infrastructure development and capacity building for Member States were facilitated, mainly through international networks and forums such as the International Regulatory Network and the Regulatory Cooperation Forum, respectively (Fig. 1).

FIG 1. The Regulatory Cooperation Forum assists countries.

Convention on Nuclear Safety

The objectives of the 2nd Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS), facilitated by the Agency, were to review the lessons learned from the accident at the Fukushima Daiichi nuclear power plant and to evaluate the effectiveness of the provisions of the Convention. The Contracting Parties recognized that these objectives must be accomplished in addition to

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meeting the ongoing safety obligations for currently operating facilities.

During the meeting, CNS guidance documents were revised to enhance the effectiveness of the review process and to make national reports more comprehensive. Each Contracting Party will incorporate the revisions in their national reports to the 6th Review Meeting, scheduled for 2014. Moreover, Contracting Parties agreed to establish an "effectiveness and transparency" working group, open to all Contracting Parties, with the task of reporting to the next review meeting on a list of actions to strengthen the CNS and on proposals to amend it, where necessary. The CNS working group will take account of the conclusions of this Extraordinary Meeting, including the initial proposals to amend the Convention submitted by Switzerland and by the Russian Federation.

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Safety Assessment of Nuclear Installations

A technical meeting in July, attended by 16 Member States, investigated the application of Level 3 probabilistic safety assessment techniques to estimate potential off-site consequences of a severe nuclear accident. The participants identified emergent technical areas for further development (for example, long term accident scenarios, evaluation of land contamination and impact of filtered containment venting) and recommended an update of the existing guidance.

Collaboration among safety assessment experts is expected to be greatly enhanced through the Global Safety Assessment Network (GSAN), which provides registered users a means of sharing a wide range of information — webinars, streamed videos and presentations on nuclear safety. This conclusion was reached by 12 Member States at a technical meeting in December, which covered features of the GSAN platform and the safety assessment practices, experiences and needs of Member States.

Following a request from the Russian Federation and China to use the Generic Reactor Safety Review (GRSR) module of the Design and Safety Assessment Review Service for new reactor designs, the Agency established a programme of work in 2012 to review the reactor designs of these two Member States, and possibly extend the review to six designs in total. Japan made initial enquiries late in 2012 about updating an existing GRSR of one of its designs to take account of the latest Agency Safety Requirements for design.

Member States embarking on a nuclear power programme have been requesting safety assessment techniques to further enhance their capability to produce and review preliminary safety reports. In response, the Agency organized a 'Zwentendorf Plant Walkdown' workshop, which for the first time used this never commissioned nuclear power plant in Austria for training and demonstration purposes (Fig. 2). The workshop provided future safety analysts and regulators from Member States embarking on a nuclear power programme with hands-on training.

FIG. 2. Participants train using a boiling water reactor fuel assembly at the 'Zwentendorf Plant Walkdown' workshop.

Site Safety and Design against Internal and External Hazards

Prior to site selection and the subsequent construction of a nuclear power plant, newcomer Member States need assistance in systemically evaluating their resource needs, national capability and workforce for the development of a site licence application. The Agency provided such capacity building services to Indonesia, Turkey and Vietnam. As a result, Turkey provided the Agency with a list of services that can be provided through the Agency's

Site and External Events Design (SEED) service to support it in meeting its national objectives.

The SEED service, which added a new module for environmental impact assessment in 2012, is helpful not only for Member States requesting capacity building services, but also for specific hazard assessments. SEED review services were conducted in Hungary, Japan, Kazakhstan, Lebanon, Nigeria, Romania, South Africa, Turkey and Vietnam. The increasing demand from States with developed nuclear programmes demonstrated not only the service's universal appeal but also the legal commitment by all Contracting Parties to the CNS to ensure site safety for both new and existing nuclear power plants.

Multi-unit sites are exposed to more complex sets of interactions with multiple hazards. At a workshop held in Mumbai, India, in October, the results of the Agency's extrabudgetary programme to share knowledge and experience in this area were reviewed and development began on a framework addressing multi-site issues.

In July and August, the Agency undertook a mission to collect data on the possible effects of the earthquake and tsunami that struck Japan in March 2011 on structures, systems and components (SSCs) at the Onagawa nuclear power plant (Fig. 3). The findings of the mission will be added to the Agency's seismic experience database for use by Member States in developing earthquake preparedness and response plans.

FIG. 3. Experts collect data about the possible effects on SSCs at the Onagawa nuclear power plant in Japan as a result of the 2011 earthquake and tsunami.

Operational Safety and Experience Feedback

The Agency's Operational Safety Review Team (OSART) service, which comprises an internationally based team of experts reviewing operational safety performance, conducted eight missions and four follow-up missions in 2012 (Fig. 4). Three additional missions, including an expert mission to evaluate the station blackout event at the Kori nuclear power plant in the Republic of Korea and two pilot missions using a new OSART methodology, were conducted. Six of the eight OSART missions included a module for assessing severe accident management, which extends design, operational, technical and emergency preparedness and response measures to better manage accidents that occur beyond the scope of a reactor's design basis. An evaluation of this OSART module in the six missions found wide variation in the implementation scope and sufficiency of the Agency's severe accident management guidelines. Areas for improvement were identified and good practices were highlighted. Additionally, the Agency conducted a technical meeting in June in Vienna on 'Managing the Unexpected', which attracted experts and scientists from 22 Member States to discuss systemic improvements to the risk models in place.

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In the area of long term operation and ageing, the Agency carried out three missions as part of the Safety Aspects of Long Term Operation of Water Moderated Reactors Peer Review Service (SALTO) at nuclear power plants in Belgium, the Republic of Korea and the Netherlands.

The gap between awareness of a strong safety culture's fundamental components and identifying practical measures for its improvement was highlighted by the publication *Safety Culture in Pre-operational Phases of Nuclear Power Plant Projects* (Safety Reports Series No. 74). At a technical meeting in Cape Town, South Africa, the 144 participants used this publication as the basis for a discussion of the multinational components of safety culture and the complexity of 'new build' projects involving hundreds of vendors. A training course on

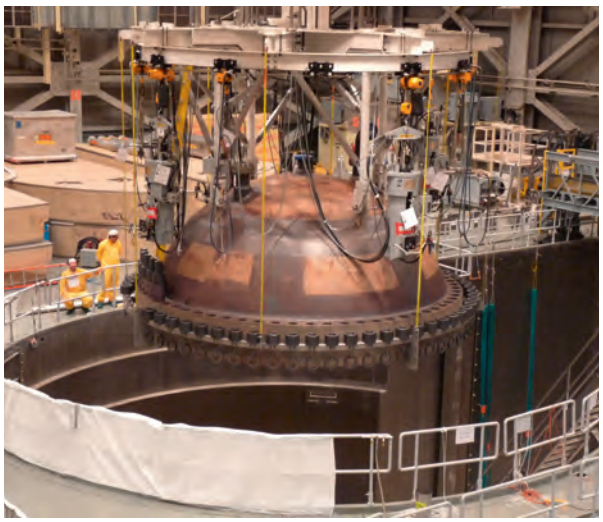

FIG. 4. A reactor vessel head being lifted at the Laguna Verde nuclear power plant in Mexico. An OSART mission visited this plant.

performing a safety culture self-assessment, held at a nuclear waste facility in Dessel, Belgium, and an on-line questionnaire whose results were analysed in collaboration with St. Mary's University in Canada, also addressed the issue of safety culture.

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Safety of Research Reactor and Fuel Cycle Facilities

Agency support of efforts to enhance research reactor safety included two regional meetings in Algiers, Algeria, and Warsaw, Poland, on the application of the Code of Conduct on the Safety of Research Reactors. To improve networking, the Agency supported the first meetings of the Regional Advisory Safety Committees for Research Reactors in Africa and in Europe.

In addition, the Agency conducted two technical meetings, one on the safety of experiments and the other on the implications of the Fukushima Daiichi accident; two regional workshops on ageing management (in Accra, Ghana, and Bangkok, Thailand); one regional workshop on the development of human resources (ARASIA); and two regional workshops on the safe operation of research reactors (Africa and ARASIA). Six workshops were also conducted on regulatory supervision, use of a graded approach, human factors, training programmes, assessment of safety documents and the safety of reactors in extended shutdown. In total, more than 240 participants from 58 Member States operating or planning research reactors participated in these activities.

The Agency published three Safety Guides on research reactors covering: utilization and modification, use of a graded approach, and safety assessment and preparation of the safety analysis report. Additionally, a publication was issued on considerations and milestones for a new research reactor, which also provides guidance on the safety enhancement of research reactors.

Safety missions were undertaken to research reactors in Congo, Egypt, Ghana, Jordan, Kazakhstan, Malaysia, Slovenia, Thailand, Tunisia and Uzbekistan, which provided recommendations for safety improvements concerning safety analysis and documents, ageing, utilization, modifications, radiological safety and emergency planning.

To enhance the safety of fuel cycle facilities, the Agency finalized the development of Safety Requirements on research and development activities and reprocessing facilities, as well as a Safety Guide on criticality. These efforts included a meeting of the national coordinators of the Fuel Incident Notification and Analysis System, and workshops on the application of the Agency's safety standards and on the licensing process for such facilities.