
Safety of Nuclear Installations

Objective

To support Member States in improving the safety of nuclear installations during site evaluation, design, construction and operation through the development of safety standards and providing for their application. To support Member States in establishing and strengthening the safety infrastructure including through safety reviews and advisory services. To assist adherence to, and facilitate implementation of, the CNS and the Code of Conduct on the Safety of Research Reactors. To support Member States in capacity building through education and training, encouraging the exchange of information and operating experience, as well as international cooperation including the coordination of research and development activities.

Regulatory Infrastructure for Safety

The Agency published two Safety Guides on regulatory infrastructure for safety in 2018: *Organization, Management and Staffing of the Regulatory Body for Safety* (IAEA Safety Standards Series No. GSG-12) and *Functions and Processes of the Regulatory Body for Safety* (IAEA Safety Standards Series No. GSG-13).

Throughout the year, it assisted Member States with operating nuclear power plants in strengthening their national regulatory infrastructure for nuclear and radiation safety through the Integrated Regulatory Review Service (IRRS). The Agency conducted an IRRS mission to Spain and two follow-up IRRS missions – to Hungary and to the Netherlands. In November, the Agency held a workshop in Luxembourg where participants exchanged information, experiences and lessons learned from IRRS missions conducted since 2014. They also discussed developments and expectations for the IRRS programme and explored longer term improvements in the planning and implementation of IRRS missions. The Agency also organized a regional workshop, in Luxembourg in November, where participants discussed specific aspects related to IRRS missions conducted to Member States that are part of the European Union (Fig. 1).

The Agency conducted 49 expert missions, workshops and training activities that provided guidance and information on establishing an effective safety infrastructure in line with the recommendations set out in *Establishing the Safety Infrastructure for a Nuclear Power Programme* (IAEA Safety Standards Series No. SSG-16). It also conducted two Hands-on Regulatory Inspector Training Workshops for Member States embarking on a nuclear power programme. The workshops were held at the Zwentendorf nuclear power plant in Austria in May (Fig. 2), with 13 participants from 12 Member States, and in October, with 17 participants from 15 Member States.

The Small Modular Reactor Regulators' Forum established three working groups – on licensing; design and safety analysis; and manufacturing, commissioning and operations. The Agency facilitated two Forum meetings in Vienna, in March and October. The Forum

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FIG. 1. Participants in the Regional Workshop on Lessons Learned from Integrated Regulatory Review Service (IRRS) Missions Conducted in the European Union, held in Luxembourg in November.

published a report summarizing the work carried out over the past three years. The report focuses on defence in depth, the graded approach and emergency planning zones applied to small modular reactors and is available on the Agency's web site.

Convention on Nuclear Safety

The Agency held a meeting in Vienna in late January and early February at which the Officers of the Seventh Review Meeting of the Contracting Parties to the Convention on Nuclear Safety provided feedback on their experience in reporting on the principles of the Vienna Declaration on Nuclear Safety. The group of Officers prepared a report that was considered at the Organizational Meeting for the Eighth Review Meeting, which was held in Vienna in October. At the meeting, the Convention on Nuclear Safety Contracting Parties also established Country Groups and elected the President, Vice-Presidents and the Country Group Officers of the Eighth Review Meeting.

Design Safety and Safety Assessment

The Agency supported Member States in sharing information and experience through the Technical Meeting to Share Experience on Implementing Safety Improvements at Existing Nuclear Power Plants; the Technical Meeting on Current Approaches in Member States to the Analysis of Design Extension Conditions for New Nuclear Power Plants; and the Technical Meeting on the Development of a Methodology for Aggregation of Various Risk Contributors for Nuclear Facilities. Three Agency workshops held in 2018 addressed the application of the new safety requirements for nuclear power plant design; severe accident analysis; and the development of severe accident management guidelines.

The Agency conducted three Technical Safety Review (TSR) services: one on periodic safety review, in the Czech Republic; one on design safety, in Bangladesh; and one on safety requirements, in Saudi Arabia. It also streamlined the TSR services guidelines by providing a common approach across the services' technical areas.

The Agency finalized a study on how the safety requirements established in *Safety of Nuclear Power Plants: Design* (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1)) are to be



FIG. 2. Participants in the Hands-on Regulatory Inspector Training Workshop for Member States embarking on a nuclear power programme at the Zwentendorf nuclear power plant.

applied to small and medium sized or modular reactors intended for near term deployment. It also completed a case study on multi-unit probabilistic safety assessment (MUPSA) that provided feedback on the applicability of the MUPSA methodology previously developed. The lessons from the case study, reflecting the experience from the practical use of the methodology, were used to improve the application of the MUPSA methodology.

Safety and Protection against External Hazards

The Agency conducted two Site and External Events Design (SEED) review missions in November — to the Islamic Republic of Iran and to Kenya. Also in the framework of the SEED service, it conducted five expert missions — to Armenia, Bolivia, Jordan, the Sudan and Turkey — and held nine capacity building workshops — in Egypt, Kazakhstan, Malaysia, Pakistan, the Philippines, Romania, Sri Lanka, Tunisia and Turkey.

The Agency held a Technical Meeting on the Design and Reassessment of Nuclear Installations for Protection against External Hazards where it shared information on the progress of activities for protection of nuclear installations against extreme external events. The meeting's 58 participants from 37 Member States discussed plans for future activities in this area.

The Agency organized two workshops in cooperation with the Government of France in 2018. In May, it conducted the Second Workshop on Best Practices in Physics-Based Fault Rupture Models for Seismic Hazard Assessment of Nuclear Installations: Issues and Challenges towards Full Seismic Risk Analysis, attended by 126 professionals from 29 Member States. In December, it held a Workshop on Testing and Updating Probabilistic Seismic Hazard Analysis on the Basis of Observations, with 81 participants from 20 Member States.

The Agency issued three publications on protection against external hazards during the year: *Safety Aspects of Nuclear Power Plants in Human Induced External Events: Assessment of Structures* (Safety Reports Series No. 87); *Consideration of External Hazards in Probabilistic Safety Assessment for Single Unit and Multi-unit Nuclear Power Plants* (Safety Reports Series No. 92); and *Best Practices in Physics Based Fault Rupture Models for Seismic Hazard Assessment of Nuclear Installations* (IAEA-TECDOC-1833).

Operational Safety of Nuclear Power Plants

In June, the Agency issued a new Safety Guide entitled *Operating Experience Feedback for Nuclear Installations* (IAEA Safety Standards Series No. SSG-50), which supersedes IAEA Safety Standards Series No. NS-G-2.11. The publication provides recommendations for establishing, implementing, assessing and continuously improving an operating experience programme for nuclear installations and regulatory bodies.

In November, the Agency issued *Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-48), which supersedes IAEA Safety Standards Series No. NS-G-2.12. This new Safety Guide provides recommendations to operating organizations and regulatory bodies for implementing and improving ageing management and for developing a programme for safe long term operation of nuclear power plants.

The Agency conducted six OSART missions — one each to the Islamic Republic of Iran, the Russian Federation (Corporate OSART), Spain (Fig. 3) and the United Kingdom, as well as two to Finland, one of which was held at a nuclear power plant in the pre-operational phase prior to initial fuel load. It also conducted two follow-up OSART missions — to Canada and Slovenia. The Agency compiled an OSART missions highlight report summarizing the most significant findings of missions and follow-up visits undertaken from 2013 to 2015. The report describes the main trends and good practices identified, and provides an assessment of overall OSART mission outcomes.

The Memorandum of Understanding between the Agency and the World Association of Nuclear Operators (WANO) was extended, to further enhance cooperation and to optimize the use of OSART missions and WANO follow-up peer review visits to nuclear power plants.

The Agency supported the efforts of operating organizations to enhance their safety culture capabilities. In April, it conducted a workshop on Safety Culture Assessment Support at Kola nuclear power plant in the Russian Federation. In September, two workshops on the Safety Culture Continuous Improvement Process (SCCIP) Implementation Support Programme were conducted at Rosenergoatom in Moscow and at Kalinin nuclear power plant in Udomlya. It also carried out an SCCIP follow-up support mission to Laguna Verde nuclear power plant in Veracruz, Mexico, in August; a mission to Accra focusing on human factors, leadership for safety and safety culture in October; a safety culture self-assessment mission to Fennovoima in Helsinki in November; and an expert mission to Chashma nuclear power plant in Islamabad focusing on safety culture and safety culture self-assessment methodologies for senior management of nuclear power plants in December. The Agency also carried out two Independent Safety Culture Assessment peer review missions — to Norway in February and to South Africa in August.

The Agency held two national workshops on regulatory oversight of safety culture — in Ljubljana in January and in Islamabad in November. It also held one regional workshop on self-assessment of safety culture for nuclear regulatory bodies in Hanoi in October.

The Agency supported Member States in the area of leadership for safety through a workshop on leadership and safety culture for senior managers, held in Vienna in September; a workshop on a systemic approach to safety, held in Vienna in October; and instructor training on safety leadership for member countries of the Asian Nuclear Safety Network (ANSN), held in Fukui prefecture, Japan, in April. The Agency also held national workshops in this area in Ghana, the Islamic Republic of Iran and Poland. It evaluated and enhanced the pilot International School of Nuclear and Radiological Leadership for Safety. Two Schools were held in November — one in India and one in Mexico.

In cooperation with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), the Agency issued *Nuclear Power Plant Operating Experience*, covering the period 2012–2014. The publication highlights lessons based on a review of event reports received from participating Member States through

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FIG. 3. Members of the OSART team conducting the 200th OSART review, in Almaraz, Spain.

the International Reporting System for Operating Experience (IRS). The Agency, with the OECD/NEA, began expanding the IRS database to incorporate the construction experience database (ConEX).

The Agency supported Member States in their efforts to continuously improve operational safety performance through learning from operating experience, holding two technical meetings in Vienna, one in September in cooperation with WANO Moscow Centre, and one in October in cooperation with the OECD/NEA. It also organized seven workshops to enhance Member State capacities to prevent events through root cause investigations, effective corrective action programmes and the use of operating experience – one each in Argentina, Austria, Belarus, the Czech Republic and Slovenia, and two in the Russian Federation. An expert mission to Ukraine supported efforts to enhance operating experience programmes at Ukrainian nuclear power plants.

The Agency conducted four Pre-SALTO missions, to Argentina, Brazil, Bulgaria and Ukraine; two SALTO missions, to Armenia and Sweden; and two expert missions, to Pakistan and South Africa. All of the missions reviewed ageing management and plant preparations for long term operation. The Agency conducted 12 workshops on ageing management and long term operation, in Argentina, Armenia, Bulgaria, China, the Islamic Republic of Iran, Mexico (two), Pakistan, Romania, South Africa, Spain and the United Kingdom. It prepared a SALTO mission highlight report summarizing the most significant findings of missions conducted from July 2015 to June 2018. The report describes main trends and good practices, and provides an overall assessment of SALTO mission results. The Agency held eight working group meetings, a steering committee meeting and a workshop in the framework of the International Generic Ageing Lessons Learned programme to share lessons learned regarding ageing management and long term operation.

Safety of Research Reactor and Fuel Cycle Facilities

The Agency conducted two Integrated Safety Assessment of Research Reactors (INSARR) missions, to the Democratic Republic of the Congo and to Ghana, and a follow-up INSARR mission to Jordan. The Agency also conducted safety expert missions to research reactors

in Egypt, Jordan and Uzbekistan, and supported new research reactor projects in the Plurinational State of Bolivia, Nigeria, Saudi Arabia, Thailand and Viet Nam.

The Agency published the *Guidelines for Self-assessment of Research Reactor Safety* (IAEA Services Series No. 35) to assist research reactor operating organizations in preparing for future INSARR missions.

In July, it held a regional meeting on the application of the Code of Conduct on the Safety of Research Reactors for the Africa region in Rabat. The meeting's 15 participants from ten Member States exchanged information on the safety status of their research reactors and on their experience in applying the provisions of the Code.

In December, the Agency issued *Regulatory Inspection of Research Reactors – Training Material* (Training Course Series (CD-ROM) No. 66). The information included is intended to assist Member States in establishing and implementing regulatory inspection programmes for research reactors and in improving the competencies of regulatory staff in charge of regulatory inspection of research reactors.

The Agency supported Member States in sharing information and experience through a Technical Meeting on Criticality Safety in Nuclear Fuel Cycle Facilities, held in Vienna in April, and a Technical Meeting on the Use of a Graded Approach in the Application of the Safety Requirements for Nuclear Fuel Cycle Facilities, held in Vienna in July. In September, the Agency hosted the biannual Technical Meeting for the National Coordinators of the Joint IAEA–OECD/NEA Fuel Incident Notification and Analysis System (FINAS) at its Headquarters in Vienna.