



Nuclear Safety Review 2024



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

GC(68)/INF/2

NUCLEAR SAFETY REVIEW 2024

GC(68)/INF/2

Nuclear Safety Review 2024
IAEA/NSR/2024
Printed in the IAEA in Austria
August 2024

Foreword

The *Nuclear Safety Review 2024* includes the global trends and the Agency's activities undertaken in 2023 and thereby demonstrates the progress made regarding the priorities for 2023. It also presents priorities for 2024 and beyond, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety, and emergency and preparedness response. The majority of priorities remain unchanged from the previous year due to their long term nature but some have evolved to take into account changing global trends and in response to activities performed.

A draft version of the *Nuclear Safety Review 2024* was submitted to the March 2024 session of the Board of Governors in document GOV/2024/3. The final version of the *Nuclear Safety Review 2024* was prepared in light of the discussions held during the Board of Governors and also of the comments received from the Member States.


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Nuclear Safety Review 2024

Executive Overview

1. The *Nuclear Safety Review 2024* reflects the global trends in 2023. It shows that the nuclear community continued to make steady progress in improving nuclear safety throughout the world. It also presents planned Agency activities for 2024 and priorities, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety, and emergency preparedness and response (EPR). Appendix A indicates the activities that were undertaken by the Agency in 2023 to meet the priorities identified in the Nuclear Safety Review 2023. The Agency's safety standards activities in 2023 are provided in Appendix B.



**Nuclear Safety
Priorities**

- Continuing to strengthen the Agency's safety standards to ensure that they constitute an integrated, comprehensive and consistent set of up-to-date, user-friendly and fit-for purpose standards of high quality and that they continue to be seen as the global reference for protecting people and the environment from the harmful effects of ionizing radiation;
- Continuing to support Member States in the application of the Agency's safety standards;
- Continuing to support Member States in strengthening their capacity building efforts, including through self-assessments, developing capacity building strategic plans, facilitating exchange of knowledge and networking, and promoting gender parity and safety leadership, in nuclear, radiation, transport and waste safety and EPR;
- Enabling the safe deployment of innovative technologies, including small modular reactors, fusion facilities and floating NPPs, in Member States by developing further the related safety standards and other documents, supporting capacity building and information sharing, progressing the harmonization of regulatory approaches through the NHSI, and holding the first International Conference on Small Modular Reactors and their Applications;
- Continuing to enhance the safety of operating NPPs and research reactors and to support Member States in long term operation and ageing management by effectively conducting OSART, INSARR and SALTO review missions for NPPs and research reactors and holding the International Conference on Enhancing the Operational Safety of Nuclear Power Plants and the International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future;
- Assisting Member States in strengthening their regulatory effectiveness through capacity building initiatives such as Regulatory Infrastructure Development Project, Schools for Drafting Regulations, peer reviews and advisory missions, RAIS+, and education and training in radiation, waste and transport safety and national strategy development in these areas, including through the continuation of the PGEC and RPO training programmes, and through holding the International Conference on Enhancing Nuclear Safety and Security Through Technical and Scientific Support Organizations (TSOs): Challenges and Opportunities in a Rapidly Changing World;

2. The Executive Overview provides a summary of significant nuclear safety issues and trends covered in this period of reporting.

3. The work on the Agency's safety standards addresses both the revision of existing standards and the establishment of a number of new standards. Two General Safety Guides and 15 Specific Safety Guides were published in 2023. The Agency is preparing a new long term structure and plan for safety standards in a comprehensive manner and ensuring coordination with relevant international organizations.

4. Broader analysis of peer review and advisory service mission reports shows that these continue to include recommendations relating to leadership, management for safety, occupational radiation protection, medical exposure, coordination and cooperation between regulatory authorities, human and financial resources and safety culture.

5. Member States continue to express a need for further Agency support in developing communication strategies and plans.



**Nuclear Safety
Priorities**

- Building capacity for the safe transport of radioactive material, in particular with regard to the safety of TNPPs, developing guidance on transport packaging, supporting the work of the Denial of Shipment Working Group, ensuring the effective application of the Code of Conduct on the Safety and Security of Radioactive Sources and its guidance, and supporting Member States in the safe transport and sustainable management of sources and disused sources;
- Assisting Member States in developing and implementing national policies and strategies for radioactive waste and spent fuel management; addressing clearance levels; taking an integrated approach to waste management and the safety case; decommissioning uranium production facilities; addressing regulatory supervision and safety aspects of the remediation of legacy sites; and leveraging international experience and cooperation and training in radiological and environmental impact assessments;
- Developing and implementing integrated regional and national EPR plans with Member States, and providing training and exercises to strengthen emergency response arrangements;
- Developing response strategies and guidelines to address emerging challenges such as the increased use of small modular reactors and other innovative nuclear reactor designs. This includes preparing for incidents and emergencies specific to these new technologies, as well as promoting harmonized safety standards relating to EPR;
- Continuing monitoring and assessment activities at Fukushima Daiichi NPS related to the ongoing discharges of ALPS treated water, including ensuring the continuous presence of Agency experts at the site, conducting safety review missions, conducting sampling and analysis for both ALPS treated water and environmental samples to corroborate the relevant monitoring programmes, and ensuring the timely online publishing of data and information;
- Continuing to monitor, assess and report on the nuclear safety and security situation in Ukraine, and to provide assistance to Ukraine's nuclear facilities and activities involving radioactive sources, including support and assistance missions and delivery of equipment, as requested by Ukraine; and
- Supporting the Director General's 'Rays of Hope' initiative to develop and strengthen national radiation safety infrastructure through the improvement of procurement process, legislative frameworks and capabilities.

6. Many Member States that are considering embarking on a nuclear power programme or on a first research reactor project face difficulties in allocating resources for regulatory capacity building. The Integrated Regulatory Review Service and other peer review and advisory services undertaken in embarking countries continue to identify the need to strengthen regulatory body independence, build regulatory capacity and competence, and establish safety regulations and licensing processes as part of effective legislative and regulatory oversight programmes. In addition, regulatory bodies in several Member States face the challenge of rapidly shrinking experienced human resources or discontinued programmes due to lack of resources and require attention in ensuring continuity of knowledge and capacity building.



General Safety

The Agency will:

- Strengthen its safety standards and assist with their application;
- Promote adherence to Conventions under its auspices and support their implementation;
- Assist Member States in strengthening their regulatory effectiveness;
- Assist Member States in strengthening leadership and management for safety;
- Assist Member States in strengthening their processes for communicating radiation risks;
- Assist Member States in their capacity building programmes; and
- Assist Member States' efforts in the field of research and development for safety.

7. There is continued Member State interest in building and further developing their national systems for EPR, in areas such as hazard assessment, protection strategy, emergency planning, medical emergency preparedness and response and communication with the public in the event of a nuclear or radiological emergency. Member States continue to seek Agency support in improving the preparation, conduct and evaluation of national emergency exercises.

8. In 2023, there were two new Contracting Parties to the Convention on Nuclear Safety (CNS); by the end of the year, there were 93 Contracting Parties to the CNS¹. Meanwhile, there was one new Contracting Party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention); by the end of the year, there were 89 Parties to the Joint Convention².

9. In 2023, there was one new State Party to the Convention on Early Notification of a Nuclear Accident (Early Notification Convention), bringing the total number of States Parties to 133. There was also one new State Party to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention), bringing the total number of States Parties to 128. By the end of 2023, 41 States Parties to the Assistance Convention had registered National Assistance Capabilities in the Agency's Response and Assistance Network, of which six³ registered or updated their National Assistance Capabilities in 2023.



Strengthening Emergency Preparedness and Response

The Agency will:

- Further develop and support the implementation of the operational arrangements for notification, reporting and assistance;
- Assist Member States in the implementation of IAEA Safety Standards Series No. GSR Part 7 and develop associated Safety Guides; and
- Continue to implement an active exercise programme at the international level to test EPR and support national EPR exercise programmes.

10. There is continued Member State interest in the identification and characterization of areas contaminated by past activities or events and in planning for remediation and post-remediation management of sites. Member States continue to request Agency assistance in remediation activities

¹ One Member State (Iraq) deposited its instrument of accession to the CNS in November 2023 and has become a Contracting Party thereof in February 2024, leading thus to an increase in the number of Contracting Parties from 93 to 94.

² One Member State (Iraq) deposited its instrument of accession to the Joint Convention in November 2023 and has become a Contracting Party thereof in February 2024, leading thus to an increase in the number of Contracting Parties from 89 to 90.

³ Belarus, Canada, Denmark, Finland, Italy and Switzerland.

and, where remediation is justified and is planned to be implemented, are seeking Agency support in establishing open communication with interested parties.

11. International attention continues to be paid to the handling and discharge of Advanced Liquid Processing System (ALPS) treated water at Fukushima Daiichi nuclear power station (NPS) following the commencement of discharges into the sea by the Tokyo Electric Power Company.

12. There is growing need to analyse and evaluate the implications of the release of radionuclides into the environment, in particular in relation to uranium mining and processing and industrial activities involving naturally occurring radioactive material. There is increasing interest among Member States in methodologies for the prospective and retrospective assessment of doses to the members of the public in relation to the authorization and establishment of discharge limits for facilities and activities as well as assessment of doses from residual radioactive materials of past unregulated practices or abnormal situations.

13. The application of a graded approach remains challenging for Member States dealing with regulatory control of existing exposure situations, in particular in the context of international trade of commodities and criteria for the exemption of surface-contaminated non-food commodities in line with the requirements of *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards* (IAEA Safety Standards Series No. GSR Part 3).

14. Access to and use of diagnostic imaging procedures involving ionizing radiation are continuing to increase, leading to higher cumulative individual exposures in Member States and creating a need for greater awareness of the importance of justifying medical exposures and optimizing the radiation protection of patients. Interventional radiology procedures are rapidly becoming more frequent around the world, posing many additional challenges in terms of the radiation protection of patients and medical staff. The number of radiotherapy treatment courses delivered per year is also continuing to increase globally. Radiation protection and safety continue to be of particular concern when this technology is introduced in countries and regions that have previously had only limited access to such applications.

15. The intensive use of radioactive sources in medicine, agriculture, industry and research has led to a growing number of disused radioactive sources that require safe and secure management and disposal. Some Member States require further guidance on the application of the Code of Conduct on the Safety and Security of Radioactive Sources with regard to ensuring financial provisions for the safe management and secure protection of disused sources. The number of Member States committed to acting in a harmonized manner with the supplementary Guidance on the Import and Export of Radioactive Sources is 134, and the number of States that have committed themselves to implementing the supplementary Guidance on the Management of Disused Radioactive Sources increased from 52 in 2022 to 64 in 2023.

16. There has been an increase in Member States' needs for capacity building in the release from regulatory control of material and waste with low activity concentrations, generated during the operation and decommissioning of nuclear facilities and the remediation of contaminated sites. Requests continue to be made for Agency support for safe interim (storage) and long term (disposal) management solutions for radioactive waste. The Agency's Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) continues to be in demand.



Strengthening Radiation, Transport and Waste Safety

The Agency will:

- Assist Member States in the management of radioactive sources;
- Promote the application of the Code of Conduct on the Safety and Security of Radioactive Sources and the supplementary Guidance on the Import and Export of Radioactive Sources and Guidance on the Management of Disused Radioactive Sources;
- Assist Member States in developing and implementing national policies and strategies for the safe management of radioactive waste and spent fuel, including disposal, and the development of decommissioning strategies and plans;
- Promote and facilitate the sharing of experience regarding the remediation of contaminated areas and;
- Conduct technical reviews, upon request, of Member State activities.

17. In 2023, the Agency commemorated the 40th anniversary of the Operational Safety Review Team (OSART), having delivered 222 missions and 162 follow-up missions. OSART mission reports continue to identify recommendations and suggestions regarding setting, communicating and implementing management expectations, strengthening the conduct of safe operations, optimizing maintenance activities, and strengthening accident management and on-site EPR.

18. Safety Aspects of Long Term Operation (SALTO) missions continue to identify the need to improve the preparedness of NPPs for long term operation, specifically in the areas of safety assessments, including ageing management, knowledge management and competence management. Member States are increasingly using periodic safety reviews to justify the long term operation of NPPs and have expressed interest in sharing current challenges, good practices and examples of corrective actions and resulting safety improvements.

19. Member States are continuing to request Site and External Events Design (SEED) missions, as well as other related capacity building services, in particular countries embarking on the deployment of small and medium sized or modular reactors (SMRs).

20. Member States are continuing to revise severe accident management guidance for existing NPPs to include safety upgrades and non-permanent equipment, and to address combined hazards and multi-unit considerations. There is strong interest in sharing experience of the development of accident management programmes for advanced, evolutionary and innovative reactors.

21. The application of Agency safety standards to innovative NPP designs, including SMRs, continues to be a matter of great interest for Member States. The construction and deployment of transportable nuclear power plants (TNPPs) is also of increasing interest to Member States.


22. More than 80 different SMR designs are at various stages of development and some SMR concepts are close to deployment. Several Member States are considering requesting Technical Safety Review services for SMR designs.

23. The Agency continued implementing the Nuclear Harmonization and Standardization Initiative (NHSI) to support the effective global deployment of safe and secure advanced nuclear reactors through the harmonization of safety and regulatory approaches (regulatory track) as well as in the standardization of industrial approaches (industrial track) for SMRs. The regulatory track has continued to work towards helping regulators work together in conducting regulatory reviews of new reactors. Furthermore, some Member States expressed interest in addressing safety–security–safeguards by design for nuclear installations— in particular for SMRs — at the early stage of the design process, without prejudice to Member States’ legal commitments, the Agency’s Statute or the relevant General Conference resolutions.

24. Most Member States with operating research reactors are applying the provisions of the Code of Conduct on the Safety of Research Reactors. Several Member States are planning or implementing


modification and refurbishment projects to address the ageing of research reactor structures, systems and components.

25. Analysis of reports provided to the Fuel Incident Notification and Analysis System in 2023 continued to indicate the importance of establishing effective ageing management programmes, continuing to train personnel, and ensuring the effective use of operating procedures.

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|  <p>Strengthening Safety in Nuclear Installations</p> | <p>The Agency will:</p> <ul style="list-style-type: none">• Assist Member States in implementing programmes for ageing management and long term operation;• Facilitate the exchange of operating experience;• Provide assistance to Member States to support their preparation for the implementation of safety upgrades;• Assist Member State activities related to SMRs;• Strengthen the application of the Code of Conduct on the Safety of Research Reactors; and• Assist Member States in the development of safety infrastructure for new nuclear power and research reactor programmes. |
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26. Member States continue to attach importance to having in place effective and coherent nuclear liability mechanisms at the national and international levels. Member States continue to request Agency assistance in their efforts to adhere to and implement the international nuclear liability conventions.

27. Member States encourage the Secretariat to continue the identification of interfaces between nuclear safety and nuclear security and the further development of guidance on how to effectively address them.

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|  <p>Improving Management of the Safety and Security Interface And Strengthening Civil Liability for Nuclear Damage</p> | <p>The Agency will:</p> <ul style="list-style-type: none">• Ensure that safety standards and nuclear security guidance take into account the implications for both safety and security whenever appropriate, recognizing that the activities that address nuclear safety and security are different; and• Continue to facilitate the establishment of a global nuclear liability regime and assist Member States in their efforts to adhere to and implement the international nuclear liability instruments, taking into account the recommendations adopted by INLEX in 2012. |
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28. There is continued international concern about the nuclear safety and security situation in Ukraine, in particular with regard to Zaporizhzhya Nuclear Power Plant (ZNPP). The Agency continues to monitor and assess the nuclear safety and security situation in Ukraine against the seven indispensable pillars for ensuring nuclear safety and security during an armed conflict ('Seven Pillars'), to report on the situation regularly and to provide technical support and assistance to Ukraine. During the reporting period, the Agency monitored the observance of the Director General's five concrete principles to help ensure nuclear safety and security at ZNPP, established during the Director General's statement to the United Nations Security Council on 30 May 2023.

29. The Agency's priorities for 2024 regarding strengthening nuclear, radiation, transport and waste safety, and EPR are as follows:

- Continuing to strengthen the Agency's safety standards to ensure that they constitute an integrated, comprehensive and consistent set of up-to-date, user-friendly and fit-for purpose standards of high quality and that they continue to be seen as the global reference for protecting people and the environment from the harmful effects of ionizing radiation;
- Continuing to support Member States in the application of the Agency's safety standards;
- Continuing to support Member States in strengthening their capacity building efforts, including through self-assessments, developing capacity building strategic plans, facilitating exchange of knowledge and networking, and promoting gender parity and safety leadership, in nuclear, radiation, transport and waste safety and EPR;
- Enabling the safe deployment of innovative technologies, including small modular reactors, fusion facilities and floating NPPs, in Member States by developing further the related safety standards and other documents, supporting capacity building and information sharing, progressing the harmonization of regulatory approaches through the NHSI, and holding the first International Conference on Small Modular Reactors and their Applications;
- Continuing to enhance the safety of operating NPPs and research reactors and to support Member States in long term operation and ageing management by effectively conducting OSART, INSARR and SALTO review missions for NPPs and research reactors and holding the International Conference on Enhancing the Operational Safety of Nuclear Power Plants and the International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future;
- Assisting Member States in strengthening their regulatory effectiveness through capacity building initiatives such as Regulatory Infrastructure Development Project, Schools for Drafting Regulations, peer reviews and advisory missions, RAIS+, and education and training in radiation, waste and transport safety and national strategy development in these areas, including through the continuation of the PGEC and RPO training programmes, and through holding the International Conference on Enhancing Nuclear Safety and Security Through Technical and Scientific Support Organizations (TSOs): Challenges and Opportunities in a Rapidly Changing World;
- Building capacity for the safe transport of radioactive material, in particular with regard to the safety of TNPPs, developing guidance on transport packaging, supporting the work of the Denial of Shipment Working Group, ensuring the effective application of the Code of Conduct on the Safety and Security of Radioactive Sources and its guidance, and supporting Member States in the safe transport and sustainable management of sources and disused sources;
- Assisting Member States in developing and implementing national policies and strategies for radioactive waste and spent fuel management; addressing clearance levels; taking an integrated approach to waste management and the safety case; decommissioning uranium production facilities; addressing regulatory supervision and safety aspects of the remediation of legacy sites; and leveraging international experience and cooperation and training in radiological and environmental impact assessments;
- Developing and implementing integrated regional and national EPR plans with Member States, and providing training and exercises to strengthen emergency response arrangements;

- Developing response strategies and guidelines to address emerging challenges such as the increased use of small modular reactors and other innovative nuclear reactor designs. This includes preparing for incidents and emergencies specific to these new technologies, as well as promoting harmonized safety standards relating to EPR;
- Continuing monitoring and assessment activities at Fukushima Daiichi NPS related to the ongoing discharges of ALPS treated water, including ensuring the continuous presence of Agency experts at the site, conducting safety review missions, conducting sampling and analysis for both ALPS treated water and environmental samples to corroborate the relevant monitoring programmes, and ensuring the timely online publishing of data and information;
- Continuing to monitor, assess and report on the nuclear safety and security situation in Ukraine, and to provide assistance to Ukraine's nuclear facilities and activities involving radioactive sources, including support and assistance missions and delivery of equipment, as requested by Ukraine; and
- Supporting the Director General's 'Rays of Hope' initiative to develop and strengthen national radiation safety infrastructure through the improvement of procurement process, legislative frameworks and capabilities.

Abbreviations

| | |
|---------------|--|
| ALPS | Advanced Liquid Processing System |
| ARTEMIS | Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation |
| CANDU reactor | Canadian deuterium–uranium reactor |
| CGULS | Coordination Group for Uranium Legacy Sites |
| CNS | Convention on Nuclear Safety |
| ConvEx-1 | Level 1 Convention Exercise |
| ConvEx-2 | Level 2 Convention Exercise |
| ConvEx-3 | Level 3 Convention Exercise |
| CRP | coordinated research project |
| CSC | Convention on Supplementary Compensation for Nuclear Damage |
| CSS | Commission on Safety Standards |
| DSRSs | disused sealed radioactive sources |
| EENS | External Events Notification System |
| EPR | emergency preparedness and response |
| EPREV | Emergency Preparedness Review |
| EPRIMS | Emergency Preparedness and Response Information Management System |
| FINAS | Fuel Incident Notification and Analysis System |
| FNPPs | Floating Nuclear Power Plants |
| FORO | Ibero-American Forum of Radiological and Nuclear Regulatory Agencies |
| GIF | Generation IV International Forum |
| iNET-EPR | International Network for Education and Training for Emergency Preparedness and Response |
| INLEX | International Expert Group on Nuclear Liability |
| INSARR | Integrated Safety Assessment of Research Reactors |
| IRMIS | International Radiation Monitoring Information System |
| IRRS | Integrated Regulatory Review Service |
| LTO | long term operation |
| MEREIA | Methods for Radiological and Environmental Impact Assessment |
| NHSI | Nuclear Harmonization and Standardization Initiative |

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| NORM | naturally occurring radioactive material |
| NPP | nuclear power plant |
| NPS | nuclear power station |
| NSS-OUI | Nuclear Safety and Security Online User Interface |
| OECD/NEA | Nuclear Energy Agency of the Organisation for Economic Co-operation and Development |
| OEWG | Open-Ended Working Group |
| ORPAS | Occupational Radiation Protection Appraisal Service |
| OSART | Operational Safety Review Team |
| PGEC | Postgraduate Educational Course |
| PSR | periodic safety review |
| PSA | probabilistic safety analysis |
| RAIS+ | Regulatory Authority Information System |
| RASIMS | Radiation Safety Information Management System |
| RCF | Regulatory Cooperation Forum |
| RISS | Advisory Mission on Regulatory Infrastructure for Radiation Safety and Nuclear Security |
| RPO | radiation protection officer |
| SALTO | Safety Aspects of Long Term Operation |
| SEED | Site and External Events Design |
| SMR | small and medium sized or modular reactor |
| TECDOC | IAEA Technical Document |
| TNPP | transportable nuclear power plant |
| TSO | technical and scientific support organization |
| TSR | Technical Safety Review |
| TSR-DS | Technical Safety Review–Design Safety |
| TSR-PSA | Technical Safety Review–Probabilistic Safety Assessment |
| UNSC | United Nations Security Council |
| ZNPP | Zaporizhzhya Nuclear Power Plant |

Analytical Overview

A. General Safety Areas

A.1. Agency Safety Standards and Peer Review and Advisory Services

Trends

1. The work on the Agency’s safety standards addresses both the revision of existing standards and the establishment of a number of new standards, under the long term plan established in 2008 and the medium term plan approved by the Commission on Safety Standards (CSS) in May 2023. The Secretariat, together with the CSS and the Safety Standards Committees, is also preparing a new long term structure and plan, addressing the set of safety standards in a comprehensive manner and ensuring coordination with relevant international organizations.



2. The Agency’s peer review and advisory services continue to be provided to Member States upon request, and the number of Member State requests for these services remains high (see Figure 1).

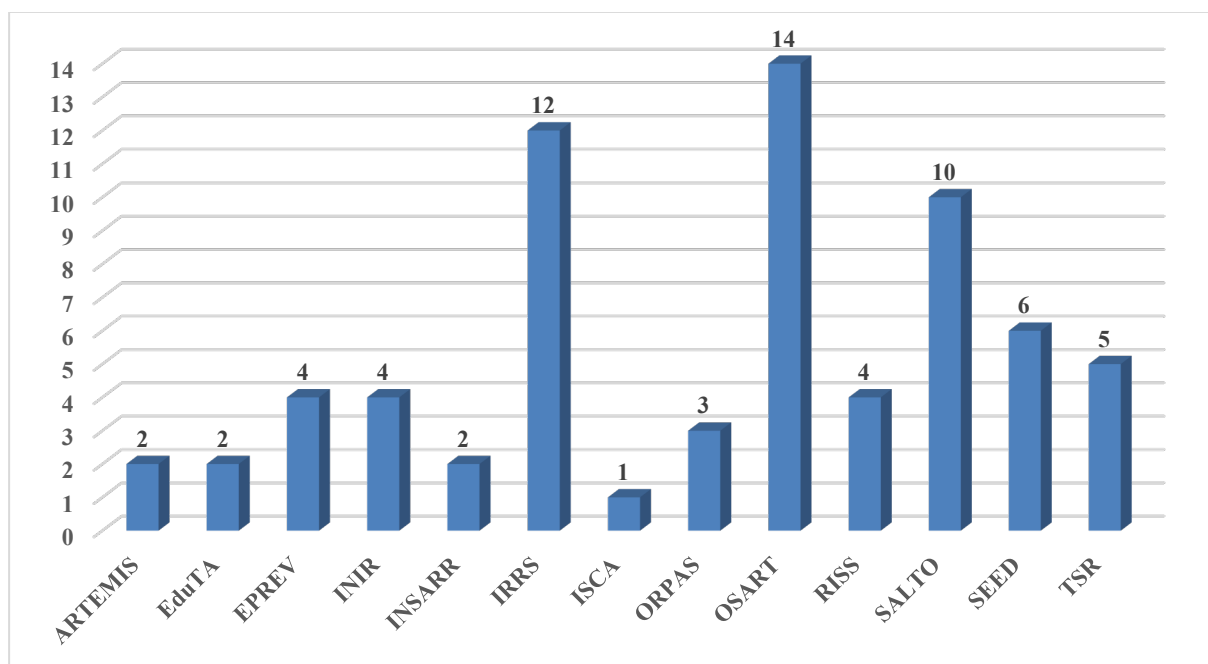


Fig. 1. Number of Member State requests for Agency peer review and advisory services to be conducted over the next two years.

Related activities

3. *The Agency will continue strengthening its safety standards using lessons from international conferences and other relevant sources. The Agency will assist with the promotion and application of its safety standards by, inter alia, strengthening its peer review and advisory services and related self-assessment tools, as well as awareness and training. The Agency is planning to undertake the following related activities:*

- Continue supporting Member States in raising awareness of Agency safety standards at the national level through training and the use of e-learning resources on the IAEA Safety Requirements, as well as improving access to online resources and translating the safety standards into Arabic, Chinese, French, Russian and Spanish;
- Support the work of the Safety Standards Committees and the CSS through the launch and operation of a new IT platform;
- Continue encouraging Member States to request Integrated Regulatory Review Service (IRRS) missions, including IRRS follow-up missions, according to the recommended ten-year cycle, and continue delivering such missions upon request, integrating lessons learned and recommendations from Member States;
- Continue organizing Occupational Radiation Protection Appraisal Service (ORPAS) missions upon request to strengthen Member States' legislative and regulatory infrastructure and the practical implementation of occupational radiation protection programmes;
- Continue encouraging Member States to request Technical Safety Review (TSR) services concerning the safety of conceptual reactor designs for small and medium sized or modular reactors (SMRs), in order to increase confidence in the safety of their designs and the adequacy of their safety assessments and to identify the path to making practicable improvements to nuclear safety; and
- Continue encouraging Member States to request Agency peer review and advisory services to strengthen their regulatory infrastructure and performance in relation to nuclear and radiation safety.

A.2. International Safety Conventions

Trends

4. The Convention on Nuclear Safety (CNS) was adopted on 17 June 1994 and entered into force on 24 October 1996. As of 31 December 2023, there were 93 Contracting Parties to the CNS, an increase of 2 compared to the end of 2022 (see Figure 2).

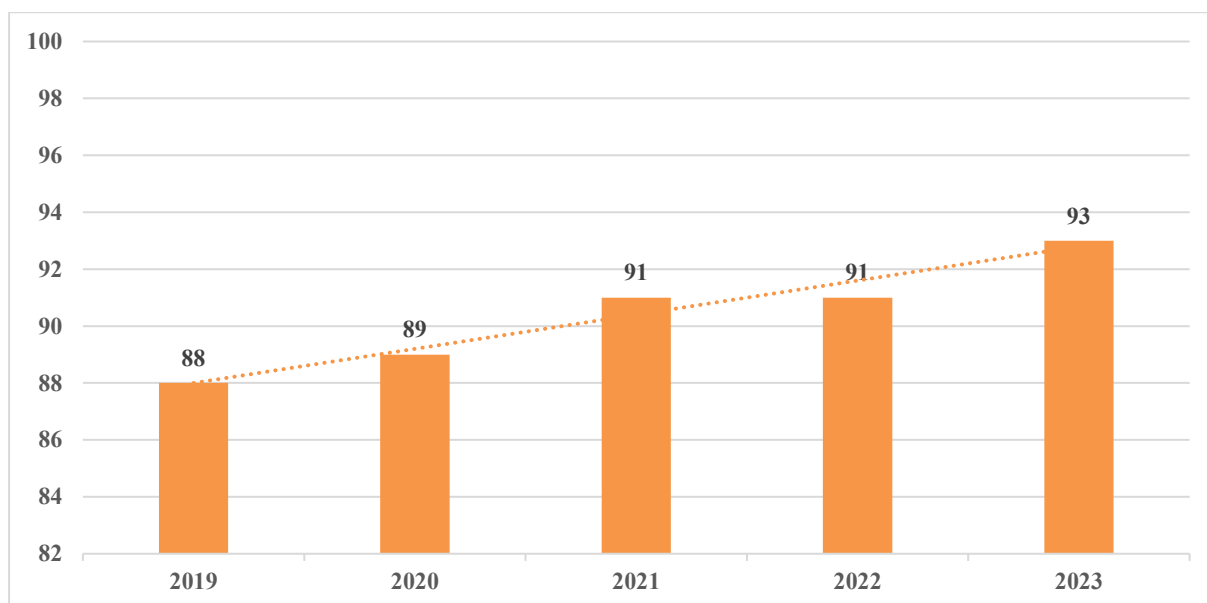


Fig. 2. Number of Contracting Parties to the CNS between 2019 and 2023.

5. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) was adopted on 5 September 1997 and entered into force on 18 June 2001. As of 31 December 2023, there were 89 Contracting Parties to the Joint Convention, an increase of 1 compared to the end of 2022 (see Figure 3).

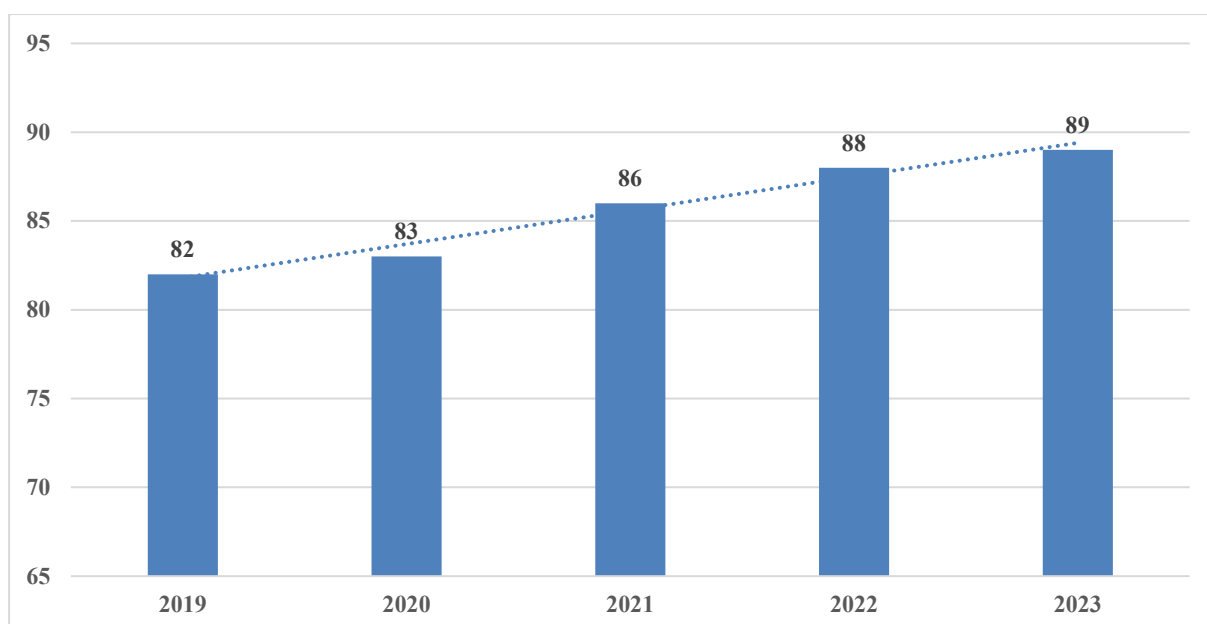


Fig. 3. Number of Contracting Parties to the Joint Convention between 2019 and 2023.

6. The Convention on Early Notification of a Nuclear Accident (Early Notification Convention) was adopted on 26 September 1986 and entered into force on 27 October 1986. As of 31 December 2023, there were 133 States Parties to the Early Notification Convention, an increase of 1 compared to the end of 2022.

7. The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) was adopted on 26 September 1986 and entered into force on 26 February 1987. As of 31 December 2023, there were 128 States Parties to the Assistance Convention, an increase of 1 compared to the end of 2022.

Related Activities

8. *The Agency will promote universal adherence to the CNS, Joint Convention, Early Notification Convention and Assistance Convention, and support their effective implementation, inter alia through the organization of workshops at the regional level and through bilateral activities with the Member States. The Agency is planning to undertake the following related activities:*

- Hold the second Working Group Meeting of the Contracting Parties to the Convention on Nuclear Safety;
- Hold the Organizational Meeting for the Tenth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety;
- Continue providing educational workshops for Contracting Parties to ensure effective implementation of the CNS;
- Organize interregional and regional workshops to promote the adherence of Member States to the Joint Convention; and
- Organize the 12th Meeting of the Representatives of Competent Authorities Identified under the Early Notification Convention and the Assistance Convention.

A.3. Regulatory Effectiveness in Nuclear, Radiation, Transport and Waste Safety, and in Emergency Preparedness and Response

Trends

9. Information provided in the Agency's Radiation Safety Information Management System (RASIMS) indicates that 80% of Member States whose information in the system has been evaluated have a regulatory infrastructure for radiation safety with a 'satisfactory' or 'good' level of compliance with Agency safety standards. This percentage is unchanged from 2022.

10. Member States have shown significant interest in the Agency's recently updated Regulatory Authority Information System (RAIS+), which can be used by Member States to manage their regulatory control programmes in accordance with Agency safety standards and nuclear security guidance and which promotes a consistent approach to the control of radiation sources.

11. The 9 IRRS missions conducted in 2023 highlighted the continued commitment of the Member States concerned to strengthening national legal, governmental and regulatory infrastructure for safety. The Agency's analysis of IRRS missions conducted from 2018 to 2022 shows that many regulatory bodies experience issues relating to maintaining regulations for occupational and medical exposure; coordination and cooperation between regulatory authorities; long term human resource planning; financial resources; management systems; and the implementation of a graded approach to regulatory processes, including authorization and inspection.

12. The Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) continues being one means to support Member States in the assessment of their radioactive waste and spent fuel management, decommissioning and remediation programmes. In addition to the nine ARTEMIS missions conducted in 2023, one mission reviewed for the first time siting plans for deep geological disposal of radioactive waste.

13. The Transport Safety Standards Committee reviewed the draft revision of the 2018 edition of the *Regulations for the Safe Transport of Radioactive Material* (IAEA Safety Standards Series No. SSR-6 (Rev. 1)). Following approval by the Safety Standards Committees and clearance by the Nuclear

Security Guidance Committee, the draft regulations were circulated for the purpose of consultation with Member States.

14. Member States continued to actively use regional knowledge networks to enhance their regulatory competencies and effectiveness through the sharing of information and experience, as well as identifying best practices in their respective regions. In 2023, the nuclear regulator networks for Asia, the Arab countries, Africa and Europe collectively conducted a total of 19 workshops and seminars, either jointly or individually.

15. Member State demand for the various Schools for Drafting Regulations on safety remains high.



Regulatory Effectiveness in Nuclear, Radiation, Transport and Waste Safety, and in Emergency Preparedness and Response

There is ...

- Continued commitment to strengthening national legal and governmental infrastructure;
- Continued interest among many Member States in updating national EPR frameworks, including EPR regulations, and harmonizing national arrangements; and
- Continued interest in IRRS, ORPAS and ARTEMIS missions.

There are ...

- Issues in relation to long term human resource plans, the management system and the implementation of the graded approach within regulatory processes.

Need for ...

- Training for radiation protection officers (RPOs) and qualified experts, and extension of the monitoring scope of technical service providers to strengthen occupational radiation protection;
- Review of regulations for the transport of radioactive material; and
- Enhancement of nuclear safety and security through technical and scientific support organizations.

Related Activities

16. The Agency will assist Member States in strengthening their regulatory effectiveness by identifying lessons from international conferences, peer reviews, advisory missions, knowledge networks and relevant meetings and workshops. The Agency is planning to undertake the following related activities:

- Promote RAIS+ and assist Member States in implementing and optimizing their use of RAIS+ through remote assistance, expert missions and regional workshops;
- Continue to address Member State comments on the draft revised 2018 edition of the Regulations for the Safe Transport of Radioactive Material (IAEA Safety Standards Series No. SSR-6 (Rev. 1)), and seek approval of the draft publication by the Safety Standards Committees and clearance by the Nuclear Security Guidance Committee;
- Continue to assist RASIMS national coordinators in completing their profiles and assessing their needs in order to strengthen their national infrastructure for radiation safety;
- Hold a CANDU Senior Regulators' Meeting;
- Support the regional regulator networks in identifying mutual challenges and developing strategies to address these issues collaboratively through coordination meetings and workshops;
- Organize the International Conference on Enhancing Nuclear Safety and Security Through Technical and Scientific Support Organizations (TSOs); and

- Organize a School for Drafting Regulations focusing on waste safety for European countries.

A.4. Leadership and Management for Safety, Safety Culture and Communication on Safety

Trends

17. Member State interest in the Agency's regional networks and thematic networks under the Global Nuclear Safety and Security Network remains high.

18. Some Member States have highlighted the role of women in leadership in the area of nuclear safety and have expressed the need to raise awareness of the contribution of women through the Global Nuclear Safety and Security Communication Network.

19. Agency peer review and advisory service mission reports continue to include recommendations relating to leadership, management for safety and safety culture.

20. The number of requests from Member States for assistance in conducting safety culture self-assessments for regulatory bodies remains high. The number of requests for the International School on Nuclear and Radiological Leadership for Safety also remains high.

21. Thematic working groups and Technical Meetings have highlighted the need for the Secretariat to further support Member States in developing communication strategies and plans, including in the areas of disseminating information, enhancing transparency and ensuring communication effectiveness in nuclear and radiation safety.



Leadership and Management for Safety, Safety Culture and Communication on Safety

- Review and advisory service mission reports continue to include recommendations relating to leadership and management for safety, occupational radiation protection and safety culture; and
- Member States continue to request assistance in developing their programmes on leadership and management for safety.

Need for ...

- The Secretariat to further support Member States in developing communication strategies and plans; and
- Safety culture self assessments for regulatory bodies.

Related Activities

22. *The Agency will assist Member States in strengthening leadership and management for the safety of nuclear and radiation facilities and activities. The Agency will assist Member States in their efforts to foster and sustain a strong safety culture. The Agency will also assist Member States in strengthening their processes for communicating radiation risks to the public in planned and existing exposure situations and during an emergency. The Agency is planning to undertake the following related activities:*

- Continue advocating to the Member States on the importance of nuclear safety and security cultures;
- Hold two Regional Schools of Nuclear and Radiological Leadership for Safety, as well as a train the trainers course;

- Continue to implement safety culture self-assessment and management system reviews for regulatory bodies; and
- Hold a Training Course on Leadership, Management and Culture for Safety and a workshop on the Safety Culture Continuous Improvement Process.

A.5. Capacity Building in Nuclear, Radiation, Transport and Waste Safety, and in Emergency Preparedness and Response

Trends

23. Member States continue to express a need for Agency support as they develop and strengthen their national provisions for education, training, qualification and competence in radiation protection, in order to achieve closer alignment with Agency safety standards.

24. Member States have provided information on the current status of their national provisions in order to identify areas where these should be strengthened. They have also evaluated education and training needs at the national level, in particular for personnel with responsibilities for radiation protection and safety (radiation protection officers (RPOs) and qualified experts). Member States continue to request guidance on the competencies of the RPO and the qualified expert and the learning path to achieve such competencies, and assistance in training RPOs.

25. The Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radiation Sources continued to be an effective programme through which Member States could train personnel with regulatory or advisory functions in radiation safety. In 2023, regional training centres in Indonesia and Kenya hosted the PGEC for the first time, for the benefit of other Member States at the regional level.

26. Member State interest in online and web-based training on radiation protection — including radiation protection in medical uses of ionizing radiation, occupational radiation protection, public protection and radon, transport and waste safety — has remained high. Member States are also continuing to show increasing interest in accessing e-learning resources on Agency safety standards and their practical application, and in participating in knowledge management networks where they can share their experience in the application of the safety standards in national and international projects.

27. Reports provided by Member States to the Steering Committee on Regulatory Capacity Building show the timely implementation of the strategic approach to capacity building in nuclear safety. The work programme of the Steering Committee and the activities of the Secretariat remain on track.

28. There is a continued increase in the number of requests for support for education and training activities related to site evaluation and operational safety performance of nuclear installations, in particular SMRs, design safety and safety assessment, protection against external events, design extension conditions, severe accident management, long term operation (LTO) and safety culture. Such requests arrive from Member States with existing nuclear installations as well as from those considering embarking on nuclear power programmes. There was also an increase in the number of requests for support for training on safety assessment computational tools, probabilistic safety assessment, severe accident management guidelines, drafting of regulations, inspector training, and senior manager leadership and safety culture from Member States embarking on new nuclear power programmes.

29. Many Member States considering embarking on a nuclear power programme or on a first research reactor project are facing difficulties in allocating resources for regulatory capacity building. In many of these Member States, the programme or project schedules allow only limited time for the regulatory body to establish its resources and competence to perform its regulatory functions effectively. In addition, regulatory bodies in several Member States face the challenge of rapidly shrinking or

discontinued programmes. Ensuring continuity of knowledge in the context of rapidly decreasing staff, including in capacity building areas (human resources staff, training managers, knowledge management specialists), requires additional attention.

30. Member State interest in emergency preparedness and response (EPR) capacity building activities has continued to grow. The International Network for Education and Training for Emergency Preparedness and Response membership grew to 208 in 2023, up from 206 in 2022. Member State interest in implementing the international master's degree programme in EPR is also on the rise, with two countries indicating interest in offering the degree at their own universities.



Capacity Building in Nuclear, Radiation, Transport and Waste Safety, and in Emergency Preparedness and Response

There is ...

- An increase in the number of requests for support for education and training activities related to site evaluation and operational safety of nuclear installations, design safety, protection against external events, design extension conditions, severe accident management, LTO and safety culture from Member States with existing nuclear installations and those considering embarking on nuclear power programmes;
- An increase in the number of requests for support for training on safety assessment computational tools, probabilistic safety assessment, severe accident management guidelines, drafting of regulations, inspector training, and senior manager leadership and safety culture from Member States embarking on new nuclear power programmes; and
- A growing interest in online and web-based training on radiation protection.

Need for ...

- Developing or strengthening national and organizational knowledge management programmes and capacity building for nuclear safety among regulatory bodies, operators, as well as technical and scientific support organizations; and
- Agency support in strengthening national provisions for education, training, qualification and competence in radiation protection, achieving a closer alignment with Agency safety standards.

Related Activities

31. The Agency will assist Member States in their capacity building programmes, in nuclear, radiation, transport and waste safety as well as EPR, and will assist Member States in developing their expertise in the relevant technical areas. The Agency is planning to undertake the following related activities:

- Support Member States in establishing sustainable education and training programmes in radiation, transport and waste safety, as well as national strategies in this area;
- Continue to provide the PGEC in Radiation Protection and the Safety of Radiation Sources in collaboration with regional training centres, and organize train the trainer events for trainers of RPOs;
- Organize a hands-on training course to develop the competency of regulatory bodies in performing inspections of nuclear power plants (NPPs);
- Organize a Technical Meeting on the development of regulatory enforcement process and procedures;
- Hold an international Workshop on National Strategies on Capacity Building for Safety;
- Hold a Technical Meeting of the Steering Committee on Regulatory Capacity Building;

- Continue delivering EPR capacity building activities in areas such as hazard assessment, protection strategy, emergency planning, medical emergency preparedness and response, and communication with the public in the event of a nuclear or radiological emergency; and
- Establish an overarching Strategic Approach in capacity building for Nuclear, Radiation, Transport, Waste Safety and Emergency Preparedness and Response along with enhanced internal processes for the Secretariat to ensure the effectiveness and efficiency of its activities in support of capacity building in Member States.
- Continue to support Regulators and TSOs, especially in embarking countries, through Technical and Scientific Support Organization Forum (TSOF) initiatives such as the Technical and Scientific Support Organizations Self Capability Assessment (TOSCA) tool.

A.6. Research and Development for Safety

Trends

32. Recent research and development work undertaken in Member States is largely focused on enhancing knowledge related to the severe accident phenomena and accident progression. In addition, efforts in Member States have been dedicated to the analysis of plant event sequences that could potentially lead to an early or large radioactive release and justification of their practical elimination.

33. There is continued interest in Member States in the application of rapid characterization techniques for radiological contamination monitoring over large sites.

Related Activities

34. The Agency will assist Member State efforts in the field of research and development for safety where the need for further work has been identified, and will facilitate the exchange of results. The Agency is planning to undertake the following related activities:

- Continue to conduct research and development activities in support of the safety of advanced/innovative reactors;
- Continue to conduct research on the resilience of new and existing nuclear infrastructures to climate-related extreme scenarios.

B. Strengthening Radiation, Transport and Waste Safety

B.1. Radiation Protection of Patients, Workers and the Public

Trends

35. There is continued interest and awareness among Member States, including through Agency activities regarding naturally occurring radioactive material (NORM) in workplaces, concerning the need to protect workers and properly manage residues containing NORM in industrial operations and processes in workplaces, and to apply a graded approach to optimize the use of regulatory and operator resources for these tasks in line with *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards* (IAEA Safety Standards Series No. GSR Part 3). Member States have also requested assistance in drafting regulations related to radiation safety in industries involving NORM from an all-hazards perspective.

36. In response to feedback from Member States, a new draft Safety Guide is under development, covering how to consistently apply the relevant GSR Part 3 requirements in existing exposure situations. The application of a graded approach remains challenging for Member States dealing with regulatory control of existing exposure situations, for example in the context of international trade of commodities and the development and application of criteria for the exemption of surface-contaminated non-food commodities.

37. High rates of participation in Agency activities and feedback from Member States both indicate a growing awareness among Member States of the effects of exposure due to radon in homes and workplaces and the need for the Agency to provide continued assistance in this field.

38. The Agency has issued a Safety Report *Exposure due to Radionuclides in Food other than during a Nuclear or Radiological Emergency Part 1: Technical Material* (Safety Reports Series No. 114) and *Exposure due to Radionuclides in Food other than during a Nuclear or Radiological Emergency: Considerations in Implementing Requirement 51 of IAEA General Safety Requirements Part 3* (IAEA-TECDOC-2011) providing practical guidance on how to manage exposures due to radionuclides in food and drinking water in non-emergency situations. Member State requests to promote discussion and potential application of the recently released guidance confirm that this continues to be a subject of significant concern.

39. Member States continue to request assistance in establishing regulatory systems for the application of non-medical human imaging, the use of consumer products and the management of non-food commodities containing radionuclides.

40. The magnitude of recurrent radiological imaging of patients and the associated higher cumulated individual exposures have been shown to be more extensive than previously assumed. Interventional radiology procedures are rapidly becoming more frequent around the world, posing many additional challenges in terms of the radiation protection of patients and medical staff, including the risk of tissue reactions such as skin injuries for patients and eye lens opacities for staff. The number of radiotherapy treatment courses delivered per year globally is also continuing to increase. Radiation protection and safety continue to be of particular concern when this technology is introduced in countries and regions that have previously had only limited access to such applications.



Radiation Protection of Patients, Workers and the Public

- Magnitude of recurrent radiological imaging and the associated higher exposure are more extensive than previously known;
- Application of graded approach to regulating existing exposure situations remains a challenge; and
- Growing awareness among Member States of the health effects of exposure to radon in homes and workplaces.

Need for ...

- Revised guidance regarding the application of regulatory flexibility in exemption and clearance;
- Protection of workers and proper management of residues in industrial processes involving NORM; and
- Guidance on radiation safety in international trade of commodities.

Related Activities

41. The Agency will assist Member States in the application of the Agency's safety standards, in particular the International Basic Safety Standards (GSR Part 3), in radiation protection of people and the environment for applications such as waste management, transport of radioactive material, and research, medical and industrial uses of radionuclides. The Agency is planning to undertake the following related activities:

- Support Member States in the establishment of regulatory systems for the safe management of NORM;
- Develop a draft Safety Report on radiation protection related to NORM in the oil and gas industries, and finalize the draft Safety Report on radiation protection related to NORM in the water treatment and utilization industries;
- Revise Safety Reports Series No. 5, *Health Surveillance of Persons Occupationally Exposed to Ionizing Radiation: Guidance for Occupational Physicians*;
- Conduct the fourth global survey on the Information System on Occupational Exposure in Medicine, Industry and Research: Industrial Radiography (ISEMIR-IR);
- Develop draft Safety Guides on radiation protection and safety in existing exposure situations and on radiation safety in the international trade of non-food commodities;
- Organize national and regional meetings and workshops on the regulatory control of existing exposure situations, radon, and non-medical imaging, among others; and
- Hold a Technical Meeting on the radiation protection of patients in the new era of medical imaging.

B.2. Control of Radiation Sources

Trends

42. The use of radiation sources in medicine, industry, agriculture and research requires appropriate regulatory oversight to ensure safe and secure management throughout their lifecycle, including national strategies for managing disused radioactive sources and establishing national programmes and regulatory requirements.

43. Member States request that the Agency continue to promote political commitment to, and implementation of, the Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct) and engage in direct outreach with policy makers. In addition, some Member States continue to request further guidance on the application of paragraph 22(b) of the Code of Conduct on ensuring financial provisions for the safe management and secure protection of radioactive sources once they have become disused, as well as on regulatory requirements for the different options in the management of disused sources.

44. In 2023, four additional Member States made a political commitment to implementing the Code of Conduct, with the total number increasing to 149. Five Member States notified the Director General of their intention to act in a harmonized manner with the supplementary Guidance on the Import and Export of Radioactive Sources, meaning that the total number of Member States that have done so increased to 134. Four additional Member States nominated points of contact for facilitating the import and export of radioactive sources, bringing the total number of Member States that have done so to 153, and 12 Member States made a political commitment to implementing the supplementary Guidance on the Management of Disused Radioactive Sources, bringing the total number that have done so to 64 (see Figure 4).

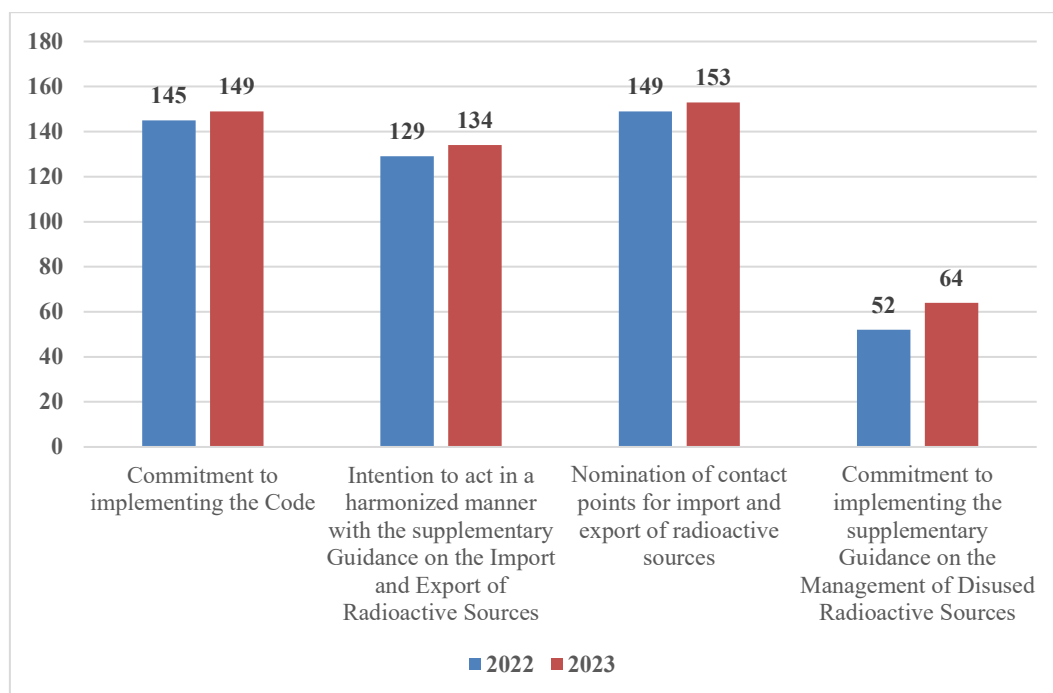



Fig. 4. Member State support for the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary guidance documents.



TRENDS

Control of Radiation Sources

- The use of radiation sources in medicine, industry, agriculture and research is increasing.

Need for ...

- Appropriate arrangements for the control of sources and the safe and secure management of disused sealed radioactive sources, including national strategies.

Related Activities

45. The Agency will assist Member States in the management of radioactive sources from cradle to grave through guidance documents, peer reviews, advisory services, training courses and workshops. The Agency will also promote the effective application of the Code of Conduct on the Safety and Security of Radioactive Sources and the supplementary Guidance on the Import and Export of Radioactive Sources and Guidance on the Management of Disused Radioactive Sources, and facilitate the sharing of experience. The Agency is planning to undertake the following related activities:

- Hold a Technical Meeting of technical and legal experts on implementation of the Guidance on the Import and Export of Radioactive Sources;
- Hold regional meetings to share experience and lessons learned in implementing the Code of Conduct and its supplementary Guidance;
- Hold two Technical Meetings with all States' points of contact for the Guidance on the Import and Export of Radioactive Sources; and

- Continue to engage in high level meetings with policy makers for States that have not yet made a political commitment to the Code of Conduct;
- Finalize a draft TECDOC on establishing financial provisions for the management of disused radioactive sources once they have become disused.

B.3. Safe Transport of Radioactive Material

Trends

46. Denials of and delays in international shipments of radioactive material continue to be a problem for Member States. A Denial of Shipment Working Group has been established for a four-year term for the period 2023–2026. The objective of this group is to analyse the issue and propose an effective and sustainable solution to this long-standing problem.

47. Some Member States are increasingly interested in the construction and deployment of TNPPs and their transport (movement), as well as in the transport of factory fuelled SMRs. The applicability of Agency safety standards on transport in these cases continues to be an important concern for Member States.

48. Member States continue to request support for the application of Agency safety standards to the classification, design assessment and approval of transport packages for fissile material. Many of these requests continue to come from States embarking on new nuclear power programmes that wish to develop an understanding of the requirements for the transport of fissile material and for approval of appropriate transport packages, using the latest techniques for package design evaluation.

| | |
|--|---|
|  <p>Safe Transport of Radioactive Material</p> | <p>There is ...</p> <ul style="list-style-type: none">• Support for the application of Agency safety standards to the classification, design assessment and approval of transport packages for fissile material; and• Interest in developing training platforms for drafting of transport regulations in Member States. <p>Need for ...</p> <ul style="list-style-type: none">• Regulatory oversight, including for domestic and international transport; and• Updated training material and training platforms for drafting of transport regulations to enhance capacity of Member States. |
|--|---|

Related Activities

49. The Agency will assist Member States in building capacity for the safe transport of radioactive material. The Agency is planning to undertake the following related activities:

- Continue supporting the work of the Denial of Shipment Working Group;
- Continue working with the Transport Safety Standards Committee's Working Group on Transportable Nuclear Power Plants, including in relation to identifying differences between the safe transport of transport packages and TNPPs within the framework of the *Regulations for the Safe Transport of Radioactive Material* (Safety Standards Series No. SSR-6 (Rev. 1));
- Hold meetings to finalize the *Safe Transport of Radioactive Material: Fifth Edition*, Training Course Series No.1;
- Hold a workshop on design assessment of radioactive material transport packages;

- Continue working on the development and maintenance of transport safety e-learning modules in English and other UN official languages; and
- Hold a workshop on the transport safety regulatory programme for uranium and other NORM produced by mining and processing.

B.4. Decommissioning, Spent Fuel Management and Waste Management

Trends

50. In addition to requesting ARTEMIS missions, some Member States are requesting peer reviews of the pre-operational safety of deep geological disposal projects.

51. As the worldwide nuclear industry ages, a significant global increase in the number of nuclear decommissioning projects has increased the need for Member State capacity to develop national decommissioning frameworks, strategies and plans and for more flexible provisions in Member States for the release of material, waste and sites from regulatory control after the completion of decommissioning. Member States are continuing to request new guidance on planning, implementing and regulating the clearance process and the release of sites from regulatory control.

52. Member States continue to seek Agency assistance in developing and implementing safe interim waste management solutions (e.g. storage) and long term waste management solutions (disposal). Disposal provides a safe and permanent long term management solution for waste. Assisting Member States in planning for and implementing national disposal programmes remains an ongoing priority for the Agency. There continues to be increasing interest in Member States in establishing sound practices for the management of radioactive waste from innovative reactors, including SMRs, that may be deployed in the future.

53. Member States continue to request Agency guidance and advice on the development of the safety case and safety assessments with which to guide the implementation of disposal for all types of radioactive waste, including near surface disposal of very low and low level radioactive waste.

54. Several Member States continue to be increasingly interested in the geological disposal of high level radioactive waste and spent fuel when considered as waste. Research, site investigations, construction, operation and licensing for geological disposal facilities are progressing in many Member States. In addition, some Member States are examining a closed nuclear fuel cycle or consider spent fuel to be a resource rather than waste. Strengthened safety in this regard requires further consideration.

55. Member States continue to request assistance in the safe long term management of disused sealed radioactive sources (DSRSs), including in the development of safe and secure centralized storage and disposal facilities such as borehole disposal facilities.

56. Member States have expressed a strong need for Agency support in establishing regulatory and safety infrastructure for the management of residues containing NORM and the management of areas contaminated with NORM residues.

57. It is evident from advisory missions that Member States would benefit from further guidance on the optimization of protection, particularly in relation to decommissioning, remediation and radioactive waste management.



Decommissioning, Spent Fuel Management and Waste Management

There is an ...

- Interest in Agency support in developing and implementing plans for near surface disposal of very low and low level radioactive waste;
- Interest in geological disposal of high level radioactive waste and spent fuel when considered as waste; and
- Increased number of nuclear decommissioning projects.

Need for ...

- Agency support in establishing regulatory and safety infrastructure for the management of residues containing NORM;
- Guidance on application of clearance procedures and on the derivation of specific clearance levels; and
- Support for the development and implementation of national policies and strategies for safety in relation to decommissioning and the management of radioactive waste and spent nuclear fuel.

Related Activities

58. The Agency will assist Member States in developing and implementing national policies and strategies for the safe management of radioactive waste and spent fuel, including disposal of waste, disused sealed radioactive sources, geological disposal of high level waste and spent fuel when considered as waste, and the development of decommissioning strategies and plans. The Agency is planning to undertake the following related activities:

- Hold a Technical Meeting on the derivation of specific clearance levels for materials suitable for recycling or reuse, or for disposal in landfills;
- Organize the Annual Meeting of the Regulatory Forum for Safety of Uranium Production and NORM, continue to implement the Forum's activities to promote the application of Agency safety standards and continue providing assistance to Member States upon request;
- Hold a Technical Meeting on topical issues relating to the decommissioning of uranium production facilities;
- Establish an international project on the safety of radioactive waste and spent fuel management, addressing how predisposal management facilities (e.g. storage facilities) and the various types of disposal facilities (near surface, geological and borehole) address the different components of the safety case and safety assessment; and
- Follow up on the conclusions derived from the International Conference on the Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation: Ensuring Safety and Enabling Sustainability, held in November 2023.

B.5. Radiation Protection of the Environment and Remediation

Trends

59. There is continued interest in the Agency's safety review of the discharges of Advanced Liquid Processing System (ALPS) treated water at Fukushima Daiichi NPS following the publication of the Agency's comprehensive report and the commencement of discharges into the sea by the Tokyo Electric Power Company (TEPCO). Member States have noted the importance of the Agency's ongoing monitoring of discharges as the independent and technical international organization and have called for continued transparency in this regard.

60. Given the ongoing concern regarding areas that have been radiologically contaminated by past practices and the need for remediation of such areas to ensure the protection of human health and the

environment, there is continued interest in the identification and characterization of these areas. Where remediation is justified and planned, Member States are continuing to seek Agency support in establishing open communication with interested parties. Member States with remediation projects in their final stages are continuing to request support and guidance from the Agency on planning and implementing long term post-remediation management, in particular where remediated sites cannot be released from regulatory control owing to the potential socioeconomic development of surrounding populated areas.

61. Observations from Agency missions continue to show that the use of a wide range of nuclear techniques and applications worldwide and activities such as uranium mining and milling and NORM industries have resulted in a growing need to analyse and evaluate the radiological implications of radionuclides being released into the environment. Member States continue to show interest in methodologies for the prospective and retrospective assessment of doses to members of the public and non-human biota in relation to the authorization and establishment of discharge limits for facilities and activities and for protecting the public from exposure to radionuclides in the environment stemming from past and potential future practices.



**Radiation Protection
of the Environment
and Remediation**

There is ...

- International attention continues to be paid to the ongoing discharge of ALPS treated water into the sea at Fukushima Daiichi NPS;
- Growing interest in the assessment of past unregulated activities and events, and the control of their impact; and
- Growing interest in identification and characterization of contaminated areas.

Need for ...

- Analysis and evaluation of the radiological implications of radionuclides being released to the environment; and
- Guidance on how to plan and implement institutional control over a remediated area where free release does not apply.

Related Activities

62. *The Agency will promote and facilitate the sharing of experience gained in dealing with the remediation of contaminated areas, including in relation to post-accident situations and uranium legacy sites. The Agency will also conduct technical reviews, upon request, of Member State activities against the relevant Agency safety standards. The Agency is planning to undertake the following related activities:*

- Continue monitoring and assessment activities at Fukushima Daiichi NPS related to the ongoing discharges of ALPS treated water, including ensuring the continuous presence of Agency experts at the site, conducting review missions, conducting sampling and analysis for both ALPS treated water and environmental samples to corroborate the relevant monitoring programmes, and ensuring the timely online publishing of data and information.
- Continue organizing the events of the International Working Forum on Regulatory Supervision of Legacy Sites and the Coordination Group for Uranium Legacy Sites to address safety aspects of the remediation of legacy sites, such as characterization, safety assessment, environmental impact assessment, regulatory supervision, monitoring and long term post-remediation management; and
- Continue implementing activities under the Methods for Radiological and Environmental Impact Assessment programme.

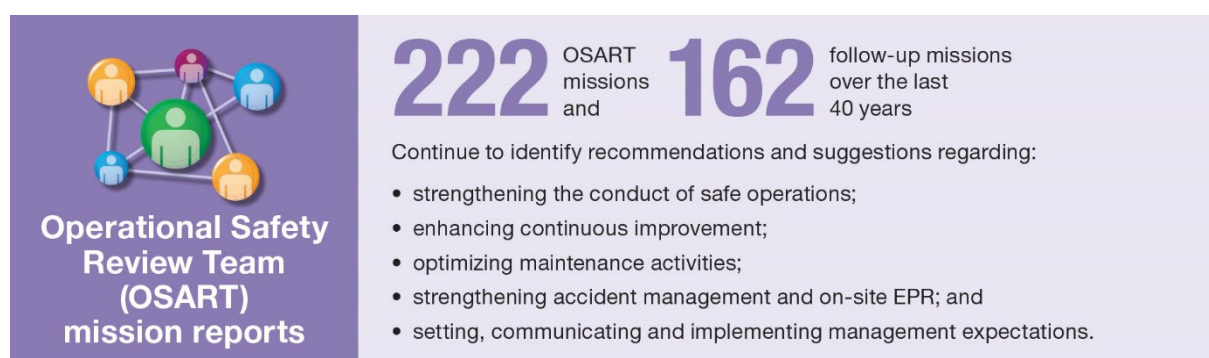
C. Strengthening Safety in Nuclear Installations

C.1. Nuclear Power Plant Safety

C.1.1. Operational Safety

Trends

63. The Agency has delivered 222 Operational Safety Review Team (OSART) missions and 162 follow-up OSART missions over the last 40 years since the mission was launched. OSART missions continue to identify recommendations and suggestions regarding setting, communicating and implementing management expectations, strengthening the conduct of safe operations, optimizing maintenance activities, and strengthening accident management and on-site EPR.



64. Analysis of data from 89 reports submitted in the International Reporting System for Operating Experience as of December 2023 indicated a continuing need to learn from events related to human performance, ensure equipment reliability, improve operation and maintenance fundamentals and improve leadership, management and oversight of processes and practices.



65. Nuclear power reactors around the world have programmes to address LTO and ageing management. In 2023, 67% of the 412 operating power reactors have been in operation for 30 years or more and 33% have been in operation for more than 40 years (see Figure 5).

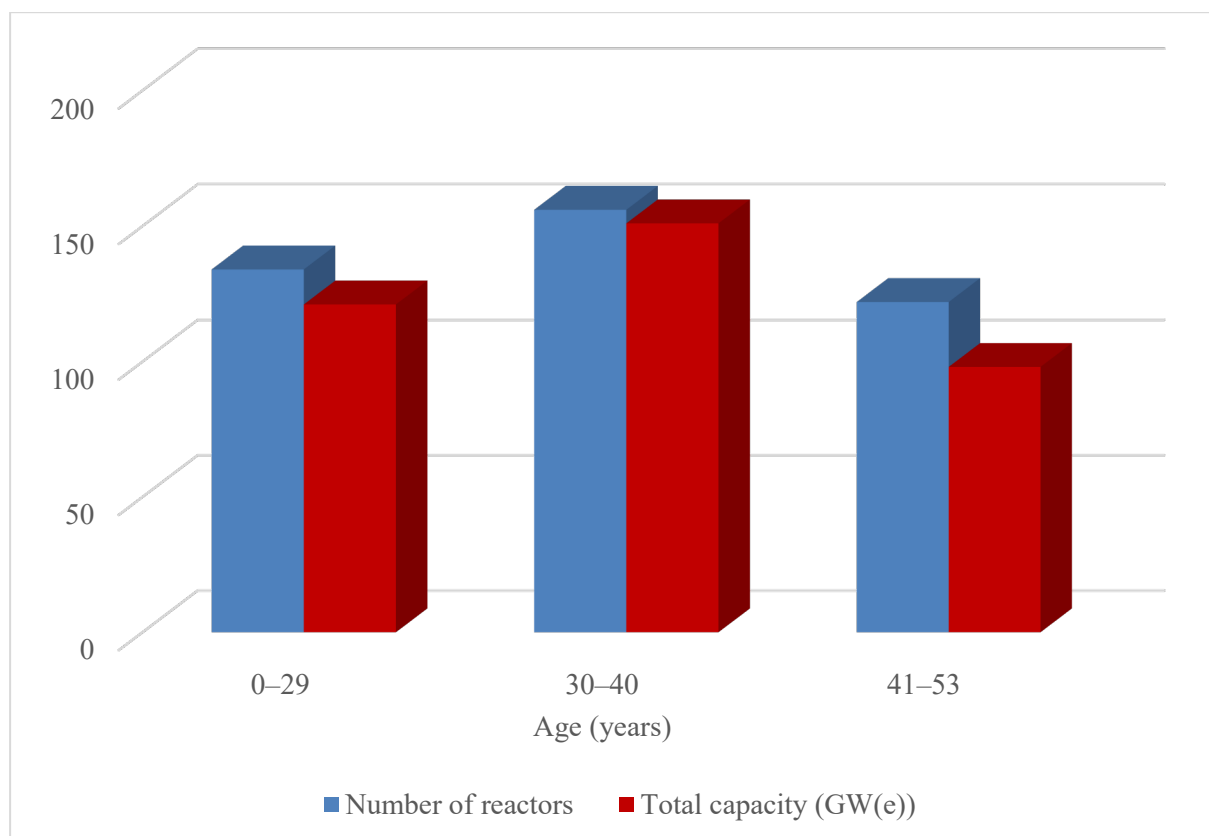


Fig. 5. Age distribution of all 412 operating power reactors in 2023 based on information from the Power Reactor Information System on 30 November 2023.

66. Safety Aspects of Long Term Operation (SALTO) missions continue to identify the need to improve the preparedness of NPPs for LTO in the area of safety assessments, including ageing management, knowledge and competence management. This will continue to be a priority for the Agency while, at the same time, the Agency supports the safety of new advanced technologies.

Related Activities

67. The Agency will assist Member States in implementing and improving programmes for ageing management and the safe LTO of nuclear installations. The Agency will facilitate the exchange of NPP operating experience and provide assistance to Member States to support their preparation for the implementation of safety upgrades at existing NPPs. The Agency is planning to undertake the following related activities:

- Organize a Technical Meeting to discuss the use of SALTO peer reviews to evaluate the ageing management of NPPs during the initial stages of commissioning or operation, and continue conducting SALTO missions to assist in the continuous improvement of NPPs' management of LTO;
- Hold a Technical Meeting on the evolution and effectiveness of the OSART service; and
- Continue sharing international operating experience of NPPs with Member States through the International Reporting System for Operating Experience.

C.1.2. Site Safety and External Hazards

Trends

68. Member States continue to request support for the application of Agency safety standards for site and design safety against external hazards. Many of the requests for such support concern the evaluation of new sites, conservatism in hazard assessments and design, and use of the latest knowledge and techniques.

69. The Agency continues to receive requests from Member States for Site and External Events Design (SEED) review missions, expert missions and capacity building and training workshops, in particular in countries embarking on SMR deployment.

70. There continues to be increased interest in the assessment of combined hazards and hazards at multi-unit sites. In September 2023, the Agency issued *Multi-unit Probabilistic Safety Assessment* (Safety Reports Series No.110). Member States continue to express interest in the development and operation of software systems and procedures that are able to provide real-time alerts concerning all types of external events jeopardizing the safety of nuclear installations.

71. Member States have expressed further interest in accessing interactive tools that can help to estimate potential risks of exceeding design bases at nuclear facilities, thereby enabling countries to mitigate associated risks effectively. The Agency has continued to develop the External Events Notification System, which delivers information on experienced or forecasted external events (e.g. earthquakes, tsunamis, volcanoes, river flooding, coastal flooding, rotational winds and wildfire), their severity, their location and an estimation of their potential effects on nuclear installations and major population centres.



There are ...

- Continued requests for assistance for the review of safety assessments of new reactor designs against Agency safety standards.

Need for ...

- Advanced safety assessment techniques in areas such as reliability of digital instrumentation and passive systems, human reliability assessment and use of safety analysis for security purposes; and
- Risk analysis in multi-unit and multi-source context or multi-model interactions.

Site and Design Safety

Related Activities

72. The Agency will assist Member States in the application of Agency safety standards relating to the evaluation of site safety of nuclear installations with respect to external hazards. The Agency is planning to undertake the following related activities:

- Hold an international workshop on recent advances in seismic hazard assessment and seismic qualification of components for nuclear installations;
- Hold the First Research Coordination Meeting of the CRP on Climate Change Challenges to the Safety of Nuclear Installations; and
- Continue providing SEED review services to assist SMR embarking countries with tailored review models.

C.1.3. Design Safety and Safety Assessment

Trends

73. Member States continue to express interest in sharing experience in the safety reassessment of existing NPPs, notably in relation to best practices for performing reasonably practicable safety improvements to prevent accidents, mitigating the consequences of an accident should one occur, and avoiding significant radioactive releases, including through the implementation of design measures to demonstrate the concept of practical elimination.

74. There continues to be growing interest in the harmonization of safety requirements and licensing approaches, and in the sharing of knowledge, with respect to the design and safety evaluation of new NPPs, including evolutionary and innovative designs. Member States continue to express interest in areas such as the reliability of digital instrumentation and control, passive systems, the use of insights from safety analysis for security purposes, and risk analysis in a multi-unit and multi-source context or for multi-module interactions.

75. Member States increasingly use periodic safety reviews (PSRs) to justify the LTO of NPPs and have expressed interest in sharing current challenges, good practices and examples of corrective actions and safety improvements related to the application of PSRs to justify LTO.

76. Member States continue to revise severe accident management guidance for existing NPPs to include safety upgrades and non-permanent equipment, and to address combined hazards and multi-unit considerations. For new NPPs, the incorporation in the design of additional safety features for design extension conditions with core melting, together with severe accident management guidance, are acknowledged as an important contributor for demonstrating the practical elimination of plant event sequences that could lead to an early or large radioactive release.

77. Member States continue to demonstrate strong interest in sharing experience of the development of accident management programmes for advanced, evolutionary and innovative reactors.

78. Member States continue to request the Agency's assistance in the review of safety assessments and to request TSR services and advisory services in order to support their current, evolutionary and innovative reactors. In particular, Member States have shown increased interest in the application of the safety standards for conceptual designs, with a focus on SMRs and non-water-cooled reactors, and recognize the importance of robust safety demonstrations to underpin claims about high levels of safety at such reactors.

79. The Agency is working with Member States in new areas of growing interest, including design safety considerations regarding fusion facilities and TNPPs and the safety implications of the use of artificial intelligence in NPPs.



Nuclear Power Plant Safety

There is ...

- A large number of NPPs over 30 years old;
- Increased interest in the assessment of combinations of hazards as well as hazards at multi-unit sites; and
- Interest in sharing experiences of the safety reassessment of existing NPPs, and performing safety improvements.

Need to ...

- Improve the preparedness of NPPs for LTO;
- Support application of Agency safety standards relating to the evaluation of siting, design, commissioning and operating requirements;
- Support safety improvements for existing NPPs; and
- Exchange experiences in the area of severe accident management.

Related Activities

80. The Agency will assist Member States in the application of Agency safety standards relating to the evaluation of design safety of nuclear installations and safety assessment and will support Member States in sharing knowledge and experience in their efforts to strengthen severe accident management guidelines. The Agency is planning to undertake the following related activities:

- Continue to organize Technical Meetings relating to the evaluation of design safety of nuclear installations and safety assessment; and
- Continue promoting and supporting capacity building and national human resource development in the areas of severe accident management and design safety of small modular reactors, among others; and
- Continue implementing TSR missions, including for design safety of small modular reactors and for evolutionary and innovative nuclear reactors.

C.2. Safety of Small Modular Reactors

Trends

81. More than 80 different SMR designs are at various stages of development and deployment. The interest of Member States in SMRs has been reflected in their growing participation in Agency activities related to SMRs, in particular in the review of the applicability of Agency safety standards to SMRs.

82. There has continued to be an increase in the number of requests from Member States, especially those embarking on SMR technologies, for workshops and expert missions on the licensing of SMRs and other safety matters relating to SMRs. Several Member States are in the process of requesting TSR services for SMR designs.

83. Member States embarking on SMR technologies continue to express the need for guidelines for the deployment of SMRs, especially for the development of suitable frameworks for a graded approach to siting and design commensurate with the magnitude of the radiation risks that SMRs pose to people and the environment.

84. Member States showed continued interest in the Nuclear Harmonization and Standardization Initiative (NHSI). Close to 30 regulatory bodies, in addition to industry representatives participated in the Regulatory Track working groups and activities including the development of documents to support Member States with enhanced international collaboration on SMR reviews, including gathering of

lessons learnt, leveraging of existing regulatory reviews, and development of a roadmap of to increase harmonization in regulatory approaches.



TRENDS

Safety of Small Modular Reactors

There is ...

- Increasing interest among Member States in SMRs; and
- Interest among embarking Member States in guidelines for the first steps of deployment of SMRs.

Need to ...

- Build capacity for design safety and safety assessment, and share good practices and regulatory approaches; and
- Review and revise Agency safety standards to ensure the safety of emerging SMR technologies.

Related Activities

85. The Agency will assist Member State activities related to SMRs, in particular their efforts to develop safety requirements, build capacity for design safety and safety assessment, and share good practices and regulatory approaches. The Agency is planning to undertake the following related activities:

- Hold the International Conference on Small Modular Reactors and their Applications;
- Hold a Technical Meeting on advanced manufacturing and qualification programmes for new materials for small modular reactors and non-water cooled reactors: safety considerations; a training course on non-water cooled reactors and small modular reactors; and a Joint IAEA–Generation IV International Forum (GIF) workshop on the safety of non-water cooled reactors;
- Continue developing guidance on the application of a graded approach for site evaluation of nuclear installations including small modular reactors;
- Continue delivering regional educational workshops on the regulation of SMRs, for embarking countries or countries expanding their nuclear programmes;
- Continue activities under the IAEA Platform on Small Modular Reactors and their Applications;
- Hold meetings for each of the three working groups of the regulatory track of the Nuclear Harmonization and Standardization Initiative (NHSI) to continue the drafting and review of their individual TECDOCs that are to be finalized in 2024; and
- Continue to provide secretarial functions for the SMR Regulators’ Forum in 2024, with two meetings, two regional workshops for embarking countries and webinars.

C.3. Research Reactor Safety

Trends

86. Feedback from Agency activities shows that most Member States with operating research reactors are applying the provisions of the Code of Conduct on the Safety of Research Reactors, including in relation to regulatory supervision, ageing management, PSRs and preparation for decommissioning.

87. Around 28 Member States are planning or implementing modification and refurbishment projects to address the ageing of research reactor structures, systems and components. They are also assessing the feasibility of, or implementing programmes for, continued safe operation of the facilities with update

of their utilization, which could require increased human and financial resources. Member States are showing increased interest in conducting the first PSR for a research reactor based on the experience gained from a similar process for NPPs. Member States have shown increased awareness, and improved their management, of the interface between safety and security when planning and implementing these projects.



There are ...

- Member States planning or implementing modification and refurbishment projects to address ageing of research reactors; and
- Increased application by Member States of the provisions of the Code of Conduct on the Safety of Research Reactors related to regulatory supervision, ageing management, and research reactors in extended shutdown.

Need to ...

- Exchange information on the safety of research reactors through the International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future;
- Strengthen application of the provisions of the Code of Conduct on the Safety of Research Reactors related to PSR, ageing management and decommissioning planning; and
- Support implementation of safety upgrades resulting from safety assessments of research reactors.

Research Reactor Safety

Related Activities

88. The Agency will provide assistance to Member States in preparing for the implementation of safety upgrades resulting from safety assessments of research reactors, managing the ageing of research facilities, enhancing regulatory supervision, and strengthening application of the Code of Conduct on the Safety of Research Reactors through application of the relevant Agency Safety Requirements. The Agency will continue to facilitate the exchange of operating experience. The Agency is planning to undertake the following related activities:

- Hold the International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future;
- Hold an International Meeting on the Code of Conduct on the Safety of Research Reactors;
- Hold a Technical Meeting on safety considerations regarding the use of advanced technologies at research reactors; and
- Enhance the efficiency and effectiveness of the Integrated Safety Assessment of Research Reactors (INSARR) review mission by disseminating mission results and training future team reviewers.

C.4. Fuel Cycle Facility Safety

Trends

89. In 2023, the total number of reports in the Fuel Incident Notification and Analysis System — a self-reporting system for sharing information on lessons learned from incidents at nuclear fuel cycle facilities — reached 309. The main lessons learned continued to relate to the importance of establishing effective ageing management programmes, ensuring the ongoing training of personnel, and using operating procedures effectively. More than 90% of the world's nuclear fuel cycle facilities are currently part of the system, which represents an increase from previous years.




The Fuel Incident Notification and Analysis System (FINAS)

90% of the world's nuclear fuel facilities are currently part of the system

90. Member States are increasingly working on developing and manufacturing new nuclear fuel types for advanced nuclear power reactors, including consideration of construction of new fuel cycle facilities.

91. The number of Member States interested in establishing systematic ageing management programmes and processes for PSRs of fuel cycle facilities, including the development of the corresponding regulatory competencies, continues to increase.



TRENDS

Fuel Cycle Facility Safety

There is ...

- Increased interest in the manufacturing of new nuclear fuel types for advanced power reactors;
- Increased interest in establishing systematic ageing management programmes and processes for PSRs of fuel cycle facilities; and
- Increased awareness among Member States of the importance of exchanging operating experience for nuclear fuel cycle facilities.

Need to ...

- Enhance regulatory supervision of fuel cycle facilities in some Member States;
- Establish effective ageing management programmes and processes for PSR in some Member States; and
- Continue the international exchange of information on safety and operating experience for nuclear fuel cycle facilities.

Related Activities

92. The Agency will provide assistance to Member States to support their efforts to enhance regulatory supervision, establish effective ageing management programmes for fuel cycle facilities, and ensure the safety of fuel manufacturing for advanced reactors. The Agency will continue to facilitate the exchange of operating experience and is planning to undertake the following related activities:

- Assist Member States in building and implementing their programmes for the regulatory supervision of nuclear fuel cycle facilities;
- Support Member States in developing ageing management programmes at nuclear fuel cycle facilities;
- Assist Member States in improving operational radiation protection programmes at nuclear fuel cycle facilities; and
- Assist Member States in developing and implementing regulatory oversight programmes for facilities producing new nuclear fuel types.

C.5. Safety Infrastructure for Embarking Countries


C.5.1. Nuclear Power Programmes

Trends

93. About 30 Member States are considering or planning a new nuclear power programme. Of those, 17 are in the decision making phase and 10 are in the post-decision making phase, some having already started construction of their first NPP. In addition, about 20 Member States are at the initial stages of considering nuclear power. Two newcomer countries have reached the operational stage in recent years. Furthermore, new NPPs or additional units are planned in about 10 Member States that are non-vendor countries and are expanding their existing nuclear power capacity after several decades of dormant construction activity.

94. The IRRS and other peer review and advisory services continue to identify the need to strengthen regulatory body independence, build regulatory capacity and competence, and establish safety regulations and licensing processes as part of effective legislative and regulatory oversight programmes.

95. It has been observed that embarking countries tend to invite an IRRS mission only at Phase 3 of a nuclear power programme, although — according to *Establishing the Safety Infrastructure for a Nuclear Power Programme* (IAEA Safety Standards Series No. SSG-16) — the regulatory body should be well established by the end of Phase 2. Therefore, in order to encourage embarking countries to consider hosting the IRRS review service at Phase 2, the Agency offers a stand-alone mission covering the relevant actions from the first two phases as an alternative to the full-scope IRRS mission, which could then be hosted at Phase 3.



TRENDS

Nuclear Power Programmes

Need to ...

- Strengthen regulatory body independence;
- Build regulatory capacity and competence; and
- Establish safety regulations and licensing processes.

Related Activities

96. *The Agency will assist Member States in developing safety infrastructure for new nuclear power programmes. The Agency is planning to undertake the following related activities:*

- Continue to assist embarking countries with the development of nuclear power programmes through the enhancement of their technical capabilities in the areas of siting and site evaluation, safety review, design safety and safety assessment, and authorization;
- Hold an International High Level Meeting on the Challenges Faced by Newcomer Countries Regarding the Establishment of an Effective Regulatory Framework and Infrastructure for Safety;
- Hold the Meeting of the Steering Committee of the Regulatory Cooperation Forum (RCF) and Support Meeting; and

- Hold a Technical Meeting on strengthening national regulatory infrastructure among RCF members.

C.5.2. Research Reactor Programmes

Trends

97. About 20 Member States are planning or implementing projects to establish their first or a new research reactor with the goal of building capacity for embarking on a nuclear power programme and/or conducting research and development to support industry and national programmes such as those for medical radioisotope production.

Related Activities

98. *The Agency will assist Member States in developing safety infrastructure for new research reactor programmes. The Agency is planning to undertake the following related activity:*

- Continue to assist Member States in the establishment of safety and regulatory infrastructure for new research reactor programmes and support capacity building activities through safety review missions, Technical Meetings and training activities.

D. Strengthening Emergency Preparedness and Response

D.1. Arrangements for Information Exchange, Communication and Assistance

Trends

99. Effective information exchange and emergency communication remain a priority for Member States. In 2023, the Agency was informed by competent authorities, or became aware through earthquake alerts or media reports, of 1825 events involving or suspected to involve nuclear or radiological facilities or activities. This number of events remains significant, in line with the trend of recent years (see Figure 6). In 2023, the Agency received ten requests for information about events from official contact points, an increase from two requests in the previous year.

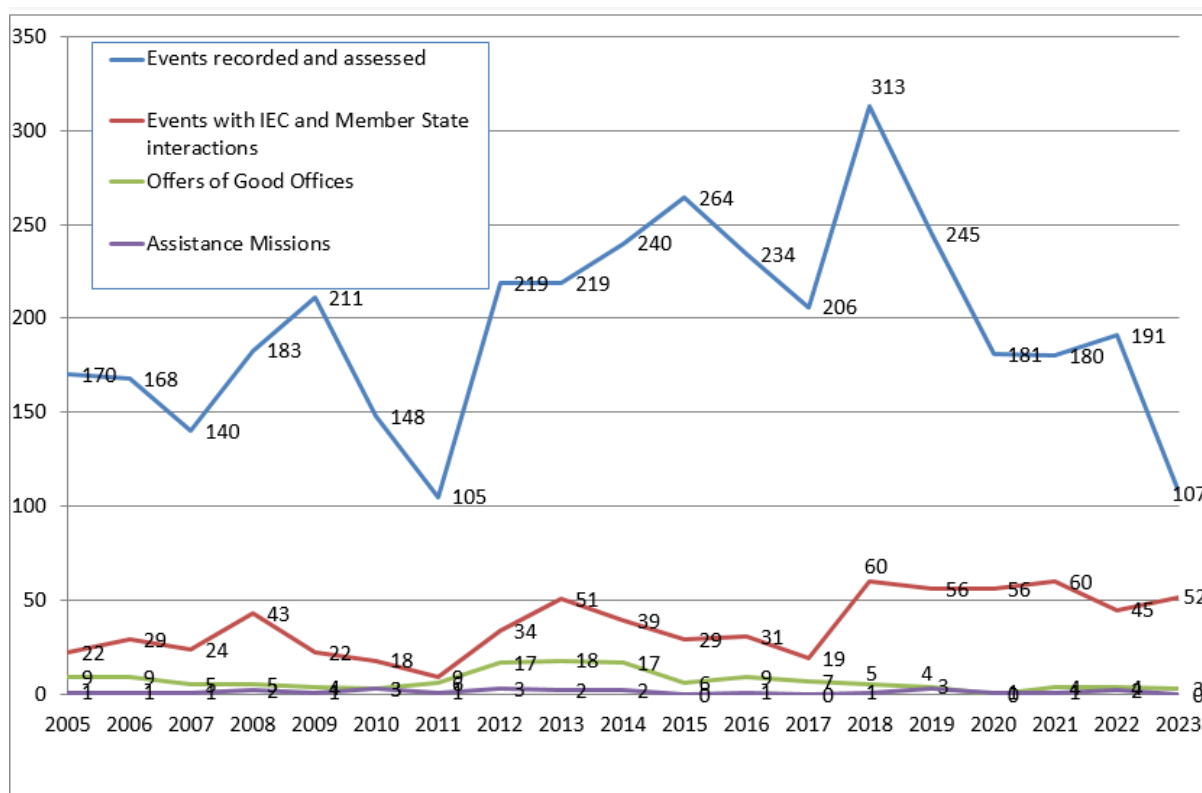


Fig. 6. Number of events involving or suspected to involve nuclear or radiological facilities or activities about which the Agency was informed by competent authorities, or of which it became aware through earthquake alerts or media reports.

100. To date, 41 of the 128 States Parties to the Assistance Convention have registered National Assistance Capabilities⁴ in the Agency’s Response and Assistance Network (RANET). New or updated registrations were received in 2023 from Belarus, Canada, Denmark, Finland, Italy and Switzerland.



RANET 2023:

- One further Member State became Party to the Assistance Convention.
- To date, 41 of the 128 States Parties to the Assistance Convention have registered National Assistance Capabilities in RANET.
- Updated registrations were received from **Belarus, Canada, Denmark, Finland, Italy** and **Switzerland**.

⁴ States Parties to the Assistance Convention are obliged to, “within the limits of their capabilities, identify and notify the Agency of experts, equipment and materials which could be made available for the provision of assistance to other States Parties in the event of a nuclear accident or radiological emergency”.

101. The number of nominated contact points for the coordination of activities related to the International Radiation Monitoring Information System (IRMIS) continues to grow. The number of Member States using IRMIS for the regular sharing of radiation monitoring data increased to 50 in 2023, with an additional 4 Member States providing radiation monitoring data routinely.

102. Member States continue to prioritize strengthening preparedness to communicate effectively with the public and the media in a nuclear or radiological emergency.

Related Activities

103. The Agency will further develop and support the implementation by Member States of the operational arrangements for notification, reporting and assistance in a nuclear or radiological incident or emergency. The Agency is planning to undertake the following related activities:

- Conduct workshops on arrangements for notification, reporting and assistance in nuclear or radiological incidents and emergencies, and webinars on specific details of the international arrangements to implement the Early Notification and Assistance Conventions;
- Provide assistance to Member States for the implementation of IRMIS through the organization of a workshop;
- Conduct a workshop on assessment and prognosis to raise awareness among Member States about the use of relevant tools; and
- Continue to assist Member States in building or strengthening their capabilities for public communication in a nuclear or radiological emergency by conducting training courses and exercises, using the social media simulator when appropriate.

D.2. Harmonization of Arrangements for Preparedness and Response

Trends

104. Member States continue to request training events on strategy development and management of preparedness and response to combined events.

105. Member States have continued high interest in using the Emergency Preparedness and Response Information Management System (EPRIMS) (see Figure 7). As of 2023, 129 Member States have appointed national EPRIMS coordinators, with a total of 497 users. The number of published modules also increased to 2093 in 2023, up from 1980 in 2022. Regular analysis of the information uploaded to EPRIMS has allowed the Agency to assess progress made in technical cooperation projects and identify global trends in national EPR arrangements based on Agency safety standards.

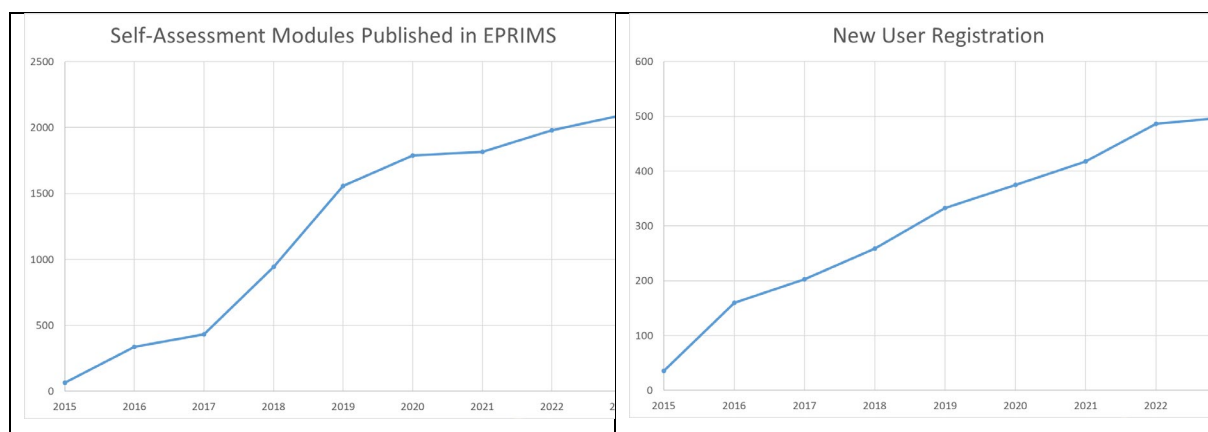


Fig. 7. Member State use of EPRIMS in 2023.

106. An analysis of Member State EPRIMS self-assessments in 2023 shows the lowest level of implementation for Requirement 18 (terminating a nuclear or radiological emergency), Requirement 5 (protection strategy for a nuclear or radiological emergency), followed by Requirement 12 (managing the medical response in a nuclear or radiological emergency), and Requirement 16 (mitigating non-radiological consequences of a nuclear or radiological emergency and of an emergency response). The requirements with the highest level of implementation continue to be those related to EPR infrastructure (see Figure 8).

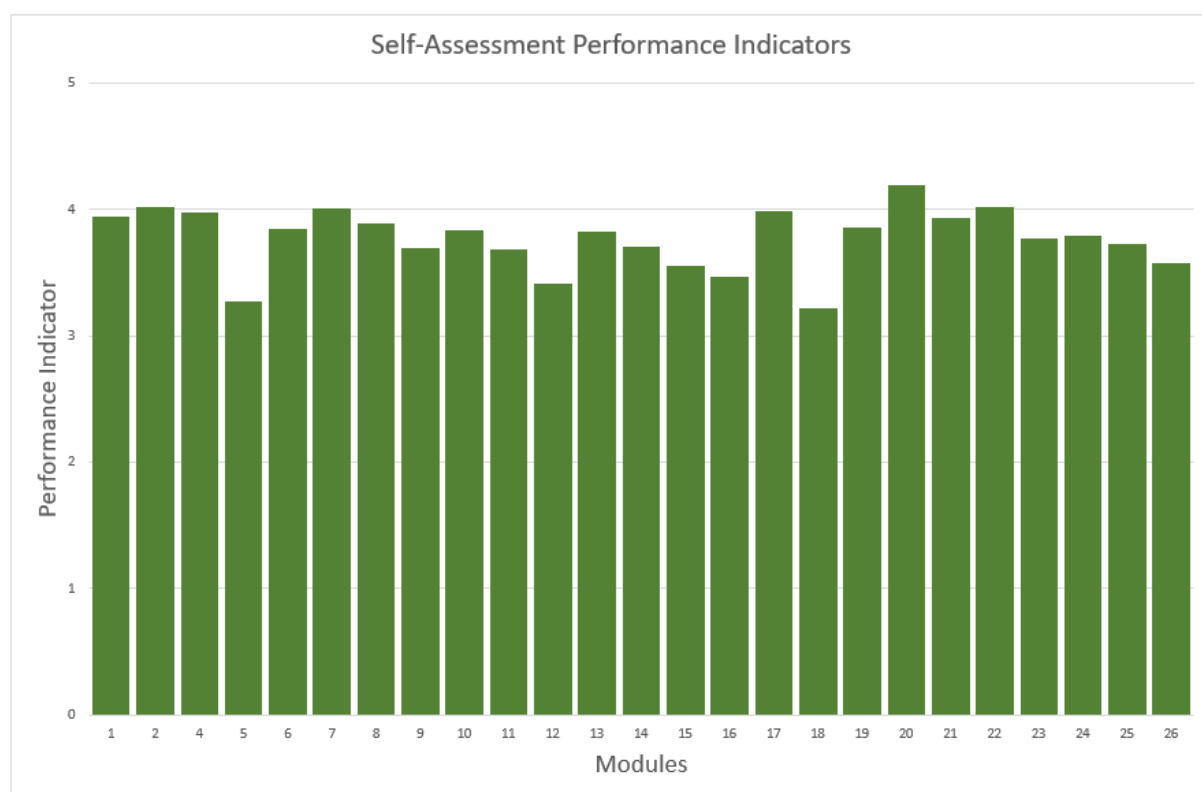


Fig. 8. GSR Part 7 requirements and their ratings according to self-assessment of countries.

107. Interest from Member States in addressing EPR arrangements for new and emerging reactor types, mainly SMRs and TNPPs, continues to grow. Member States also continue to express interest in better understanding the application of EPR concepts from Agency safety standards to new reactor types.

108. Member States, particularly those embarking on a nuclear power programme, continue to express interest in performing self-assessments in EPRIMS and hosting Emergency Preparedness Review (EPREV) missions.

Related Activities

109. The Agency will assist Member States in the application of IAEA Safety Standards Series No. GSR Part 7 and will develop associated Safety Guides as a main reference for harmonization of EPR arrangements. The Agency is planning to undertake the following related activities:

- Continue to develop EPRIMS as a tool to support Member State self-assessment against GSR Part 7, and to improve navigation, user experience and the management of data stored and plotted;
- Continue to enhance the safety standards in EPR, including through revisions of *Arrangements for Preparedness for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GS-G-2.1) and *Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSG-2); and
- Advance the development of training material for EPR arrangements for SMRs through the initiation of the development of a new EPR Series document that will provide Member States with guidance on EPR for SMRs.

D.3. Testing Readiness for Response

Trends

110. Member States continue to seek Agency support in improving the preparation, conduct and evaluation of national emergency exercises.

111. The participation of Member States in Level 2 Convention Exercises (ConvEx-2) continues to be high for the majority of exercises (see Figure 9).

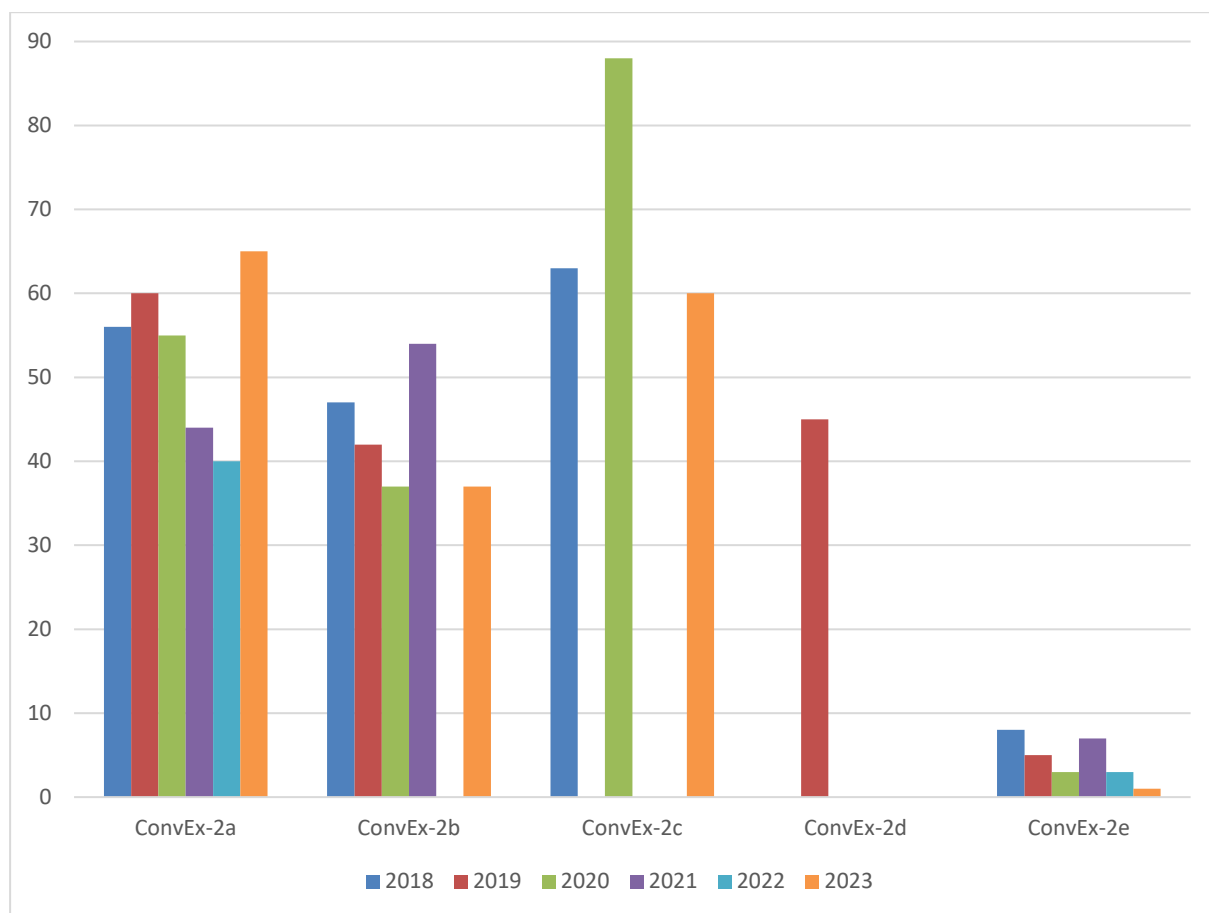


Fig. 9. Participation of Member States and international organizations in ConvEx-2.

112. The percentage of emergency contact points that confirmed a test message via the Unified System for Information Exchange in Incidents and Emergencies website during communication tests increased to 51% in 2023, in comparison with 49% in 2022.

Related Activities

113. The Agency will continue to implement an active exercise programme at the international level to test EPR and support national EPR exercise programmes. The Agency is planning to undertake the following related activities:

- Continue organize and conduct ConvEx-1, 2 and 3 exercises and share schedules in advance with Member States to support broad participation, and continue to conduct regular internal exercises to test operational arrangements; and
- Support Member State requests for Agency participation in national and/or specific exercises organized by Member States.

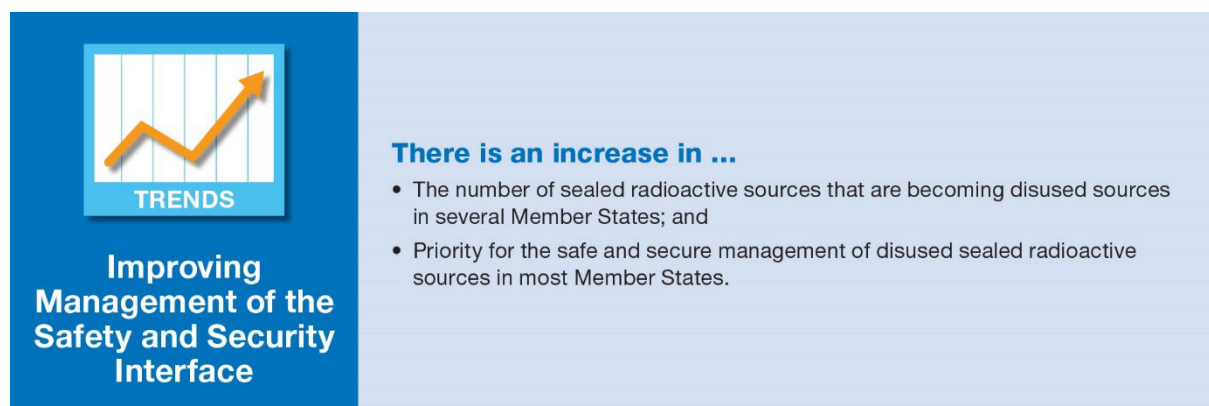
E. Improving Management of the Safety and Security Interface

Trends

114. Member States continue to encourage the Secretariat to facilitate a coordination process to address safety and security interfaces, while recognizing that the activities that address nuclear safety and nuclear security are different.

115. As is evident from the requests for consolidating or removing, and enhancing the physical protection of DSRs that the Agency receives from Member States, an increasing number of radioactive sources are becoming disused and are no longer considered an asset. Ensuring continuous safe and secure management options for DSRs remains an important priority for Member States.

116. Some Member States expressed interest in addressing safety–security–safeguards measures, in particular for SMRs, at an early stage of the design process, without prejudice to Member States’ legal commitments, the Agency’s Statute and the relevant General Conference resolutions. Some Member States also expressed interest in sharing experience in the development of technical publications and the organization of education and training activities.



There is an increase in ...

- The number of sealed radioactive sources that are becoming disused sources in several Member States; and
- Priority for the safe and secure management of disused sealed radioactive sources in most Member States.

Related Activities

117. The Agency will ensure that safety standards and nuclear security guidance take into account the implications for both nuclear safety and nuclear security whenever appropriate, recognizing that the activities that address nuclear safety and nuclear security are different. The Agency is planning to undertake the following related activities:

- Continue supporting Member States in establishing and strengthening their regulatory infrastructures under the Regulatory Infrastructure Development Project; and
- Conduct an interregional workshop on safety, security and safeguards by design in small modular reactors.

F. Strengthening Civil Liability for Nuclear Damage

Trends

118. Member States continue to attach importance to having in place effective and coherent nuclear liability mechanisms at the national and global levels to ensure prompt, adequate and non-discriminatory compensation for damage to people, property and the environment resulting from a nuclear accident or incident.

119. Member States continue to request the Agency to assist them in their efforts to adhere to the international nuclear liability conventions, taking into account the recommendations on how to facilitate the achievement of a global nuclear liability regime that were adopted by the Agency's International Expert Group on Nuclear Liability (INLEX) in 2012⁵ in response to the IAEA Action Plan on Nuclear Safety, as re-emphasized in the Group's statement in 2022 on the benefits of joining the global nuclear liability regime.⁶



Strengthening Civil Liability for Nuclear Damage

Member States continue to ...

- Attach importance to having in place effective and coherent nuclear liability mechanisms at the national and global levels; and
- Request the Agency to assist them in their efforts to adhere to the international nuclear liability conventions.

Related Activities

120. The Agency will continue to facilitate the establishment of a global nuclear liability regime and assist Member States in their efforts to adhere to and implement the international nuclear liability instruments, taking into account the recommendations adopted by INLEX in 2012. The Agency is planning to undertake the following related activities:

- Organize the annual meeting of INLEX;
- Act as the secretariat for the Contracting Parties and Signatories to the Convention on Supplementary Compensation for Nuclear Damage and support outreach activities;
- With the support of INLEX, undertake outreach activities that may be requested by Member States; and
- Continue to support Member States, upon request, in their efforts to adhere to the international nuclear liability instruments and in adopting or revising national legislation on civil liability for nuclear damage, including within the context of the Agency's legislative assistance programme.

⁵ The INLEX recommendations are available at: <https://www.iaea.org/sites/default/files/17/11/actionplan-nuclear-liability.pdf>.

⁶ The INLEX Statement is available at: <https://www.iaea.org/sites/default/files/22/10/inlex-22nd-meeting0922.pdf>.

G. Technical Support and Assistance to Ukraine

Trends

121. The Agency continued to closely monitor the situation at Ukraine's nuclear facilities as well as activities involving radioactive sources, focusing on the implications for nuclear safety and security. The Agency has continued sharing information with Member States, international organizations and the public on the nuclear safety and security situation in Ukraine. Further information on related Agency activities is provided in Section G of Appendix A.

122. The Agency further intensified and deepened its technical work in Ukraine by, inter alia, establishing a continued presence of Agency staff at a further four nuclear sites in Ukraine in January 2023 (Khmelnysky NPP, South Ukraine NPP, Rivne NPP and the Chernobyl NPP site); announcing and implementing a medical assistance programme for NPP operating staff; and announcing a programme of assistance for the Kherson Oblast to address the impact of the destruction of the Kakhovka dam with remote consultations taken to discuss the needs and the potential implementation of the IAEA Support and Assistance Mission to the Kherson Oblast (ISAMKO).

123. The armed conflict has continued to threaten nuclear safety and security in Ukraine. In 2023, the Khmelnysky, South Ukraine and Rivne NPPs continued to operate safely and securely despite the challenging circumstances imposed by the armed conflict. The situation at ZNPP continues to be particularly difficult and challenging, with six of the seven indispensable pillars for ensuring nuclear safety and security during an armed conflict being compromised fully or partially.

124. After intensive consultations and discussions with all parties, in his address at the United Nations Security Council in New York on 30 May 2023, the Director General set out five concrete principles to help ensure nuclear safety and security at ZNPP in order to prevent a nuclear accident and ensure the integrity of the plant. The Agency monitors the observance of these concrete principles through the IAEA Support and Assistance Mission to the ZNPP (ISAMZ).

- 1 There should be no attack of any kind from or against the plant, in particular targeting the reactors, spent fuel storage, other critical infrastructure, or personnel
- 2 The plant should not be used as storage or a base for heavy weapons (i.e. multiple rocket launchers, artillery systems and munitions, and tanks) or military personnel that could be used for an attack from the plant
- 3 Off-site power to the plant should not be put at risk. To that effect, all efforts should be made to ensure that off-site power remains available and secure at all times
- 4 All structures, systems and components essential to the safe and secure operation of the ZNPP should be protected from attacks or acts of sabotage
- 5 No action should be taken that undermines these principles



The five concrete principles for protecting the nuclear safety and security at the ZNPP established by the Director General Rafael Mariano Grossi at the UNSC meeting on 30 May 2023.

125. The Agency continued to deliver nuclear safety and security related equipment to Ukraine and to cooperate closely with Member States and international organizations in the interests of efficiency.

Related Activities

126. The Agency will continue to closely monitor the nuclear safety and security situation in Ukraine. The Agency will also continue to provide technical support and assistance to Ukraine in the area of nuclear safety and security and maintain the continuous presence of its experts at all Ukrainian NPPs. The Agency is planning to undertake the following related activities:

- Continue the delivery of technical support and assistance to Ukraine as needed, including, but not limited to, the conduct of expert missions and deployment of a continued presence at all nuclear sites; the delivery of nuclear safety- and security-related equipment; the delivery of medical assistance for NPP operating personnel; and the delivery of assistance for the Kherson Oblast;
- Continue sharing information on the nuclear safety and security situation in Ukraine and on the Agency's activities with Member States, international organizations and the public;
- Continue close cooperation with Member States and international organizations to ensure efficiency in the provision of technical support and assistance;
- Complete the analysis of challenges in the application of the Agency's safety standards and nuclear security guidance during an armed conflict and prepare a draft technical document using the knowledge and experience collected in Ukraine since February 2022.

Appendix A

Agency Activities in 2023

A. General Safety Areas

A.1. Agency Safety Standards and Peer Review and Advisory Services

1. Information on the Agency's safety standards activities in 2023, including all safety standards issued in 2023, is provided in Appendix B.
2. The Agency's peer review and advisory services continued to be provided upon request. The Agency conducted 55 peer review and advisory services across all safety areas in 2023 (see Figure A).

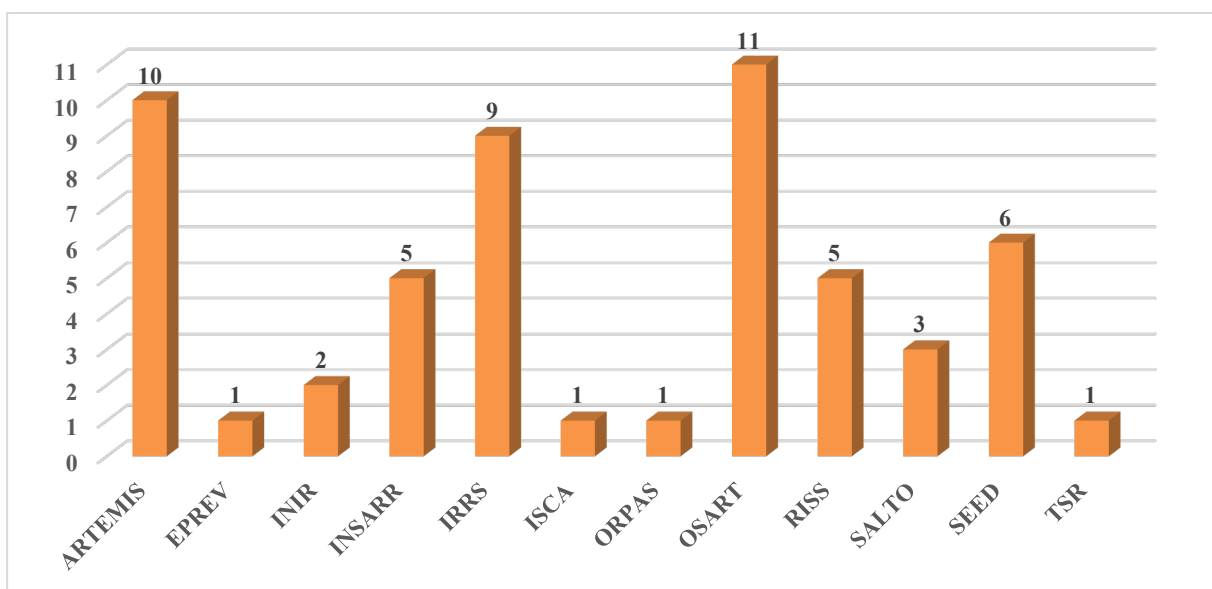


Fig. A. Number of peer review and advisory services conducted in 2023.

3. In 2023, the Agency conducted seven Integrated Regulatory Review Service (IRRS) missions and two IRRS follow-up missions. Three training courses for reviewers in IRRS missions were held, in Vienna in April 2023, in Paris in June 2023 and in Washington D.C. in October 2023. The Agency held two international workshops for IRRS missions in Vienna in October 2023 to exchange information, experience and lessons learned from the missions and to discuss recent developments and further improvements in the planning and implementation of missions.
4. The Agency held a Regional Workshop on Lessons Learned from Integrated Regulatory Review Service Missions Conducted in European Union Member States in Vienna in October 2023 to exchange information and experience, and to discuss specific issues related to the IRRS missions conducted in the European Union, including to facilitate compliance with Council Directive 2014/87/Euratom obligations. The workshop also provided an opportunity to discuss the use of the back-to-back approach for conducting IRRS and Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) missions.

5. In August 2023, the Agency commemorated the 40th anniversary of the Operational Safety Review Team (OSART). In 2023, the Agency conducted seven OSART missions and four OSART follow-up missions.
6. A Technical Safety Review–Probabilistic Safety Assessment (TSR-PSA) Mission of the Updated Probabilistic Safety Analysis (PSA) Level 1 for Units 5 and 6 of Kozloduy nuclear power plant (NPP) was conducted in Bulgaria in March 2023. In addition, in December 2023, the Agency organized a webinar on its Technical Safety Review service in the area of design safety (TSR-DS), specifically focused on reviews of conceptual designs. The Agency received four Member State requests for such missions, of which three were for full reviews of small and medium sized or modular reactor (SMR) designs, and one was for an advisory mission ('pre-TSR-DS').
7. The Agency conducted a Safety Aspects of Long Term Operation (SALTO) mission in Sweden in November 2023 and two SALTO follow-up missions, in Bulgaria in June 2023 and in Spain in September 2023.
8. The Agency conducted an Occupational Radiation Protection Appraisal Service (ORPAS) mission in Botswana in October 2023. A consultancy meeting to discuss the guidelines and the specific roles and responsibilities of ORPAS reviewers was held in Manila in October 2023.
9. The Agency held an Emergency Preparedness Review (EPREV) follow-up mission to Canada in June 2023.

A.2. International Safety Conventions

10. The Joint Eighth and Ninth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety (CNS) was held in March 2023 in Vienna, with the highest level of participation by Contracting Parties to date as 81 of the 91 Contracting Parties at that time were in attendance. In the first week, national reports were reviewed in Country Group sessions, and open-ended working group (OEWG) sessions were held to discuss proposals to improve the peer review process. In the second week, at the final plenary sessions, Contracting Parties received reports from rapporteurs on the results of the discussions on each national report and discussed the recommendations of the OEWG. Proposed amendments to the CNS guidance documents were agreed by consensus. The major common issues that emerged from the Country Group discussions included: managing extraordinary circumstances impacting the safe operation of nuclear installations; strengthening national regulatory capabilities, taking into account new and innovative technologies; fostering international collaboration; fostering international peer review missions and addressing the findings in a timely manner; addressing the possible impact of climate change on the safe operation of nuclear installations; securing reliable supply chains; strategies for ageing management in support of the operation of nuclear installations; and strengthening emergency preparedness and response (EPR) arrangements and fostering cross-border collaboration.
11. The Agency held an Educational Workshop on the Convention on Nuclear Safety in Vienna in October 2023 to provide contracting parties with assistance and information on the peer review process and obligations under the CNS.
12. The First Working Group Meeting of the Contracting Parties to the CNS was held in Vienna in November 2023 to discuss various proposals for potential changes to the CNS processes in order to enhance their effectiveness and efficiency.
13. The Agency held a Consultancy Meeting on the CNS Public and Secure Websites in Vienna in October 2023 to share experience of using these websites and to identify areas for improvement.

14. The Agency held two Regional Workshops to Promote the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, in Mexico City in April 2023 for Member States in the Latin America and the Caribbean region, and in Pretoria in December 2023 for Member States in Africa, to encourage adherence to the Joint Convention.

15. The Agency also held a Workshop to Promote the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and the Convention on Nuclear Safety in Vienna in October 2023.

A.3. Regulatory Effectiveness in Nuclear, Radiation, Transport and Waste Safety, and in Emergency Preparedness and Response

16. The Agency held the International Conference on Effective Nuclear and Radiation Regulatory Systems: Preparing for the Future in a Rapidly Changing Environment in Abu Dhabi in February 2023. The conference focused on emerging challenges, such as the safety and security of advanced reactors and new technologies; challenges related to the application of nuclear and non-nuclear technologies throughout their life cycle; ensuring regulatory agility and resilience and being prepared for the unexpected; information sharing and transparency; and international cooperation in the event of nuclear or radiological emergencies and for capacity building. A ‘call for action’ document was issued as an outcome of the conference.

17. The Agency held four Interregional Workshops for Radiation Safety Information Management System Coordinators in Vienna in March, April, October and November 2023, to assist Radiation Safety Information Management System (RASIMS) national coordinators in using the RASIMS 2.0 platform to provide information on their national radiation safety infrastructure.

18. Practical Arrangements between the Agency and the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO) on cooperation in the areas of nuclear and radiation safety, EPR and nuclear security were extended in July 2023. In September 2023 FORO launched its new web collaboration portal, known as RED, which is adaptable to all types of devices and will provide relevant information about the work of FORO to the general public and optimize interactions among its users.



**Ibero-American
Forum of
Radiological and
Nuclear Regulatory
Agencies (FORO)**

Created in: 1997

Official language: Spanish

Objectives:

- Provides a platform for its members to share information, experiences and good practices related to radiation and nuclear safety and security;
- Develops and implements innovative activities and tools to improve nuclear safety and security in key areas to strengthen regulatory bodies;
- Monitors developments and practices to identify, collect, analyse and document new and existing knowledge to share with members; and
- Establishes relationships with relevant national, regional and international organizations.

11 Members

7 Joint IAEA-FORO publications

1 risk evaluation tool called SEVRRRA

320+ experts from the Iberoamerican region have participated in FORO's projects and activities

Website: www.foroiberam.org

19. The Agency held a Regional Workshop on Technical and Scientific Support Organizations (TSOs) Providing Support to Regulatory Bodies: Challenges with their Establishment and Operation in

Dushanbe in July 2023 to exchange experience related to the establishment and operation of TSOs that support regulatory bodies' functions and to discuss the nature and scope of such support activities, the roles and responsibilities of TSOs, human resources and infrastructure.

A.4. Leadership and Management for Safety, Safety Culture and Communication on Safety

20. The Agency held a Technical Meeting on Experience in the Development of Leadership and Safety Culture Programmes in Member States in Vienna in August 2023 to bring together Member States to discuss their experience in the development of leadership and culture for safety programmes, and in the application of *Leadership and Management for Safety* (IAEA Safety Standards Series No. GSR Part 2).

21. In May 2023, the Agency held a Training Course on Leadership, Management and Culture for Safety in Vienna to provide personnel in nuclear facilities and involved in related activities with an enhanced understanding of the relevant safety requirements.

22. The Agency held two National Workshops on Leadership, Management and Culture for Safety, in Regina, Canada in June 2023 to provide foundational knowledge to the team preparing for the SMR project, and in Abuja in July 2023 to support capacity building for operating organizations and the regulatory body.

23. The Agency held a Training Workshop for Safety Culture Continuous Improvement in Vienna in June 2023 to provide personnel working in nuclear facilities and involved in related activities with insights and methods for continuously improving safety culture.

24. The Agency held a regional IAEA–Fukui Workshop on Safety Culture Self-Assessment for Regulatory Bodies in Fukui, Japan in February–March 2023 and two national workshops in Warsaw in June 2023 and in Nairobi in July 2023, to enhance regulatory bodies' understanding of the elements involved in systematically working with safety culture, and of the key success factors in implementing a safety culture improvement programme.

25. The Agency held a Regional Workshop on the Development and Implementation of Effective Integrated Management Systems for Nuclear Facilities and Activities in Jakarta in July–August 2023 to enhance participants' understanding of the elements involved in a systematic integrated management system.

26. The Agency conducted two Systematic Assessments of Regulatory Competence Needs, in Cairo in September 2023 and in Amman in November 2023, to review the regulatory bodies' management systems.

27. The Agency held a Joint IAEA – GIF Workshop on the Safety of Non-Water-Cooled Reactors in Vienna in May 2023, and in July 2023 it held a Workshop on the Application of the IAEA Safety Standards on the Design of Nuclear Power Plants, including Water Cooled Small Modular Reactors, and a Workshop on the Consideration of Hazards in Deterministic Safety Analysis in Vienna.

28. The Agency held seven International Schools on Nuclear and Radiological Leadership for Safety — in Hiratsuka, Japan, in February–March 2023, in Vienna in May and August 2023, and in Nice, France in June 2023. Additionally, three National Schools were held in Buenos Aires in July 2023, in Abu Dhabi in November 2023 and in Beijing in December 2023.

IAEA School
on Nuclear and
Radiological
Leadership
for Safety

Year of creation: 2017

21

Number of regional
and national
schools held

500+

participants
from

85+

nationalities

Main objectives:

- Develop safety leadership skills and an enhanced safety culture through experiential learning based on real-life scenarios.
- Support decision making for safety in complex situations.
- Promote networking and a better understanding of the international global framework for safety.

Target audience: The Leadership School is for early-to mid-career professionals with 5 to 10 years' experience from regulatory bodies, licensed operators or users and related organizations who have demonstrated leadership potential through professional achievements.

A.5. Capacity Building in Nuclear, Radiation, Transport and Waste Safety, and in Emergency Preparedness and Response

29. The Agency held a Workshop on Regulatory Competence Management in Vienna in May 2023 to describe the process of developing a competency framework for nuclear and radiation safety regulatory bodies and to introduce the use of an Agency assessment tool for competence management.

30. In October 2023, the Agency held a Regional Workshop on National Strategies for Education and Training in Radiation Safety in Mexico City for the Latin America region to follow up on the status of development of such strategies in accordance with *A Methodology for Establishing a National Strategy for Education and Training in Radiation, Transport and Waste Safety* (Safety Reports Series No. 93).

31. In 2023, the Agency held eight Postgraduate Educational Courses in Radiation Protection and the Safety of Radiation Sources, in Argentina, Algeria, Ghana, Greece, Indonesia, Jordan, Kenya and Morocco in a number of languages. In addition, the Agency held a Meeting of Directors of the Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources in Vienna in August 2023 to share experience and good practices in the conduct of the course.

32. Three regional training courses for trainers of radiation protection officers (RPOs) were held in Vienna in January 2023 for Member States in the Asia and the Pacific region, and in Nouakchott and Nicosia in November 2023 for Member States in the African and European regions respectively. The objective of the training courses was to train trainers on the role, duties and competence needs for RPOs at medical and industrial facilities.

33. The Agency held two Regional Schools for Drafting Regulations on Radiation Safety, for the Europe and Central Asia region in Vienna in January 2023 and for the Asia and the Pacific region in Vienna in February 2023, to assist participants with the drafting and revision of their countries' national regulations on radiation. Participants learned how to ensure the compatibility of their national regulations with the relevant Agency safety standards.

34. The Agency held a Regional Training Course on Authorization and Inspection of Radiotherapy Facilities with Linear Accelerators in Abuja in April 2023 to enhance the capacity of regulatory staff in the Africa region.

35. The Agency held a Regional Workshop on the Development and Implementation of Effective Integrated Management Systems for Nuclear Facilities and Activities in Jakarta in August 2023 to provide practical knowledge on the development and implementation of effective integrated management systems for nuclear facilities and activities.

36. The Agency held a Regional Workshop on the Management of Training Systems for Nuclear and Radiation Safety in Manila in November 2023 for Asian Nuclear Safety Network members to deliver advanced information on specific aspects of the systematic approach to training, to identify achievements, gaps and good practices with regard to this approach, and to develop country specific action plans to improve regulatory training systems.

37. In September 2023, the Agency held a National Workshop on Licensing Process for Nuclear Power Plants in Tashkent, to introduce staff of the regulatory body of Uzbekistan to the fundamentals of the licensing process for NPPs, acquaint them with licensing practices in line with the Agency safety standards and provide good practices and lessons learned from other Member States.

38. The Agency held the Annual Meeting of the International Network for Education and Training on Emergency Preparedness and Response (iNET-EPR) in Paris in October 2023 to discuss Member States' experience of capacity building activities related to EPR and to develop action plans for iNET-EPR and the related working groups.

39. The Agency held a Workshop on Monitoring during a Nuclear or Radiological Emergency in Miharu, Japan, in March 2023 to train participants to perform radiological monitoring and, on the basis of such monitoring, to make recommendations for public protective actions in response to nuclear or radiological incidents and emergencies.

40. The Agency held a Workshop on Preparedness and Response for a Nuclear or Radiological Emergency Involving the Transport of Radioactive Material in Vienna in August 2023 to train personnel on how to prepare for and respond to nuclear or radiological emergencies involving the transport of radioactive material.

41. The Agency held a Pilot Workshop on Considerations for Preparedness and Response for Nuclear and Radiological Emergencies, Triggered by Nuclear Security Events in Wiener Neustadt, Austria, in October–November 2023 to raise awareness about and train participants on emergency arrangements for dealing with a nuclear or radiological emergency triggered by a nuclear security event, to share experience and to discuss challenges in directing and coordinating the response and the means to overcome these challenges.

A.6. Research and Development for Safety

42. Following the conclusion of a coordinated research project (CRP) 'Design and Performance Assessment of Passive Engineered Safety Features in Advanced Small Modular Reactors', the Agency held two consultancy meetings in April 2023 and August 2023 to develop a TECDOC setting out the key findings of the CRP.

43. The Agency continued conducting the ongoing CRP "Developing a Phenomena Identification and Ranking Table and a Validation Matrix, and Performing a Benchmark for In-Vessel Melt Retention". In 2023, Agency made progress with the preparation of a final report of the CRP.

44. In March 2023, the Agency held a Technical Meeting on the Safety Approach for Liquid Metal Cooled Fast Reactors and the Analysis and Modelling of Severe Accidents in Vienna, where participants discussed the safety of sodium cooled and lead cooled fast reactors and provided relevant inputs for two draft TECDOCs provisionally entitled *Analysis and modelling of severe accidents for liquid metal cooled fast reactors – a report of a Technical Meeting* and *Considerations on the safety of liquid metal cooled fast reactors*.

45. The Agency held a Technical Meeting on Modernization of Instrumentation and Control of Nuclear Power Plants Designed According to Earlier Standards: Safety Considerations in Vienna in March 2023 to provide a platform for Member States to exchange information on the state-of-the art

knowledge and experience regarding the modernization of instrumentation and control systems for NPPs, with specific focus on safety considerations, including opportunities for safety improvements, and on safety challenges, including those related to licensing. At the meeting, participants also provided technical input to a draft TECDOC capturing key messages on this topic.

46. In October 2023, the Agency conducted a Technical Meeting on the Safety Implications of the Use of Artificial Intelligence in Nuclear Power Plants, and a Technical Meeting on Fusion Design Safety and Regulation, both in Vienna.

B. Strengthening Radiation, Transport and Waste Safety

B.1. Radiation Protection of Patients, Workers and the Public

47. The Agency held two Regional Workshops on the Management of Existing Radiation Exposure Situations, in Prague in March 2023 and in Victoria Falls, Zimbabwe, in April 2023, to discuss and share experience in the management of existing radiation exposure situations as described in Section 5 of *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards* (IAEA Safety Standards Series No. GSR Part 3) and to identify the main challenges and gaps and solutions to overcome them.

48. The Agency held a Technical Meeting on Radiation Safety in International Trade of Commodities in Vienna in August 2023 to discuss and share national experience in managing radiation safety in the international trade of non-food commodities and to provide technical inputs to a draft Safety Report on international trade in non-food commodities.

49. In April 2023, in Dushanbe, the Agency held a Regional Training Course on Regulatory Control of Radiation Exposure from Consumer Products – Drafting Regulations to train participants on the related Agency safety standards and on regulatory control of radiation exposure due to consumer products and commodities.

50. A Technical Meeting on Radiation Protection of Paediatric and Pregnant Patients was held by the Agency in Vienna in February–March 2023 to exchange information and identify needs for the development of guidance and tools for ensuring the radiation protection of paediatric and pregnant patients undergoing diagnostic and therapeutic medical exposures.

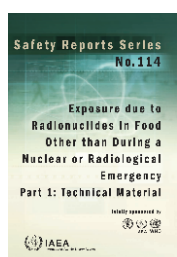
51. The Agency held a Technical Meeting on Advisory Services for Radiation Protection and Safety for Medical Exposures in Vienna in September 2023 to exchange experience and provide advice on the development of, and approach to the implementation of, such advisory services.

52. The Agency continued working on the development of new guidance on radiation protection and safety in existing exposure situations. In August 2023, the Agency published *Exposure Due to Radionuclides in Food Other Than During a Nuclear or Radiological Emergency, Part 1: Technical Material* (Safety Reports Series No. 114), jointly sponsored by the Food and Agriculture Organization of the United Nations and the World Health Organization.

B.2. Control of Radiation Sources

53. The Agency held an Interregional Workshop on the Development of National Policies and Strategies for the Management of Disused Sealed Radioactive Sources in Abuja in December 2023.

54. An International Meeting of the Points of Contact for the Purpose of Facilitating the Import and Export of Radioactive Sources in Accordance with the Guidance on the Import and Export of



Radioactive Sources was held by the Agency in Vienna in January 2023. Outcomes from the meeting highlighted the need for the Agency to continue efforts at both the regional and the international level to assist Points of Contact in their role.

55. The Agency held the Sixth Open-Ended Meeting of Technical and Legal Experts for Sharing Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources in Vienna in May–June 2023 to share information on the implementation of the Code of Conduct and its supplementary Guidance and to commemorate the 20th anniversary of the approval of the Code of Conduct.

56. The Agency also held a Regional Meeting for Sharing Experience and Lessons Learned in Implementing the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance in Jakarta in November 2023 to provide a platform for exchanging experience, lessons learned, successes and challenges in the implementation of the Code of Conduct and its supplementary Guidance.

57. The Agency held a consultancy meeting to review a draft TECDOC on establishing financial provisions for the management of disused radioactive sources in Vienna in December 2023.

B.3. Safe Transport of Radioactive Material

58. In January 2023, the Agency held the First Meeting of the Denial of Shipment Working Group in Vienna in order to define the structure and terms of reference of the Working Group and to identify a way forward to address issues related to denial of shipment of radioactive material. The Working Group agreed to aim to achieve its objectives by means of three sub-working groups on data collection and analysis, potential solutions to address denial of shipment matters, and training and outreach. The Group also agreed, inter alia, to draft a code of conduct on the facilitation of the safe and secure transport of radioactive material that should be further considered as a potential solution, among others, to address the issue. At the Second Meeting of the Denial of Shipment Working Group, held in Vienna in July 2023, discussions focused on the progress achieved and future plans of the Working Group and its three sub-working groups.

59. The Agency held an International Symposium on the Deployment of Floating Nuclear Power Plants – Benefits and Challenges in Vienna in November 2023. Further to the findings from the symposium, the Agency continues to consult with experts from Member States and international organizations to consider the potential roles of the Agency and other organizations in the development and ownership of future safety requirements for floating NPPs (FNPPs). In October–November 2023, the Agency held a meeting in Vienna to develop a TECDOC on design safety and security considerations for FNPPs. The meeting reviewed a number of Agency safety standards and guides for their applicability to FNPP facilities and discussed potential pathways for the development of future safety requirements for FNPPs.

60. The Transport Safety Standards Committee's Working Group on Transportable Nuclear Power Plants held a meeting in Vienna in April 2023, at which it reviewed the applicability of Agency safety standards to the transport of radioactive material associated with innovative reactor technologies, finalized a position paper defining various terms and containing preliminary ideas for safety requirements for TNPPs, developed a list of new and revised safety publications concerning TNPPs, and developed a proposal for the reorganization of Working Group.

61. A Follow-up Workshop on the Transport Safety Regulatory Programme for Uranium and Other Naturally Occurring Radioactive Material Produced by Mining and Milling which had been planned for 2023, has been rescheduled and is expected to be held in South Africa in February 2024. This workshop is a follow-up to a workshop that was held in Vienna in 2019.

62. The Agency held two Schools for Drafting Regulations on Transport Safety in Vienna, in November 2023 (in French) and in December 2023 (in English).

B.4. Decommissioning, Spent Fuel Management and Waste Management

63. The Agency organized the International Conference on the Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation: Ensuring Safety and Enabling Sustainability in Vienna in November 2023 to provide a forum for exchanging information, experiences, and anticipated future developments for keeping the highest levels of standards on safety and managing the interrelationships between safety and sustainability.

64. The Agency completed the International Harmonization and Safety Demonstration Project for Predisposal Radioactive Waste Management.

65. The Agency held the Seventh Technical Meeting of the International Project on Completion of Decommissioning in Trnava, Slovakia, in November 2023 to continue the collaboration and information exchange between Member States on the completion of decommissioning. In addition to the meeting, a site visit was organized to the Bohunice V1 NPP in Slovakia, which is under decommissioning, providing participants with practical information on site cleanup, final survey and site release. Relevant information will be used as inputs in the revision of the Safety Guide on release of sites from regulatory control.

66. A Workshop on the Application of the Concept of Clearance, which included in-depth practical exercises and covered the radiological basis, different clearance options, the methodology for the derivation of clearance levels, exposure scenarios to be analysed, and technical details on sampling and measurement and on the analysis of results, was held in Amman in February 2023 and was attended by participants from Iraq and Jordan.

67. Two Technical Meetings of the International Project on Decommissioning of Small Medical, Industrial and Research Facilities were held, in March 2023 in Cairo and in October 2023 in Copenhagen. The meetings advanced the development of numerous case studies, based on real examples and illustrating the decommissioning process for small facilities. Both meetings included technical visits to different types of small facilities undergoing decommissioning.

68. The Agency held the Annual Meeting of the Regulatory Forum for Safety of Uranium Production and Naturally Occurring Radioactive Materials in Vienna in July 2023 to review the progress made in activities identified as ‘high priority’ at the 2022 Annual Meeting.

B.5. Radiation Protection of the Environment and Remediation

69. In July 2023, the Agency published the *IAEA Comprehensive Report on the Safety Review of the ALPS-Treated Water at the Fukushima Daiichi Nuclear Power Station*. Furthermore, the Agency prepared the *First Interlaboratory Comparison on the Determination of Radionuclides in the Marine Environment* and the *Second Interlaboratory Comparison on the Determination of Radionuclides in ALPS Treated Water*. The Agency conducted additional environmental sampling in 2023 to support its corroboration of Japan’s environmental monitoring programme. This additional environmental sampling is the first to be conducted since discharges of the treated water began in 2023.

70. The Agency has maintained a continuous presence at Fukushima Daiichi NPS, to engage in monitoring and assessment activities during the discharges of the ALPS treated water. The Agency continued conducting review missions to Japan throughout 2023, both before and after discharges of the treated water began. In 2023, the Agency also supported enhanced transparency in relation to its ongoing safety review through the development of a dedicated live monitoring website focused on the ALPS

treated water discharges and through several high level engagements in the Asia and the Pacific region between the Director General and Member State representatives.

71. The Agency held a Joint Technical Meeting of the Uranium Mining and Remediation Exchange Group and the International Working Forum on Regulatory Supervision of Legacy Sites in San Rafael, Argentina, in October 2023 to provide a forum for experts from Member States to present, discuss and disseminate practical and new knowledge related to the operational, environmental, regulatory and societal aspects of uranium mining and remediation projects.

72. The Agency held the Annual Meeting of the Coordination Group for Uranium Legacy Sites (CGULS) in Dushanbe and Istiklol, Tajikistan, in August 2023 to exchange information on the status of current and proposed remediation activities in Central Asia, including changes to regulatory frameworks to assess and authorize remediation activities in the region.

73. In June and September 2023, the Agency provided training to Member States participating in CGULS to improve the water sampling and analysis methodology and capabilities. In addition, expert missions were organized to Kyrgyzstan, Tajikistan and Uzbekistan to advise laboratory staff on the improvement of analytical procedures and quality.

74. The Agency held a Workshop on Methods for Radiological and Environmental Impact Assessment (MEREIA) in Vienna in September 2023 to discuss the progress and results of activities being carried out under the MEREIA programme. During 2023, a series of webinars were held as part of efforts to meet the capacity and knowledge management objectives of MEREIA. A significant aspect of these activities was training young professionals in methods for radiological and environmental impact assessment.

C. Strengthening Safety in Nuclear Installations

C.1. Nuclear Power Plant Safety

C.1.1. Operational Safety

75. The Agency, together with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), held a Technical Meeting for National Coordinators of the International Reporting System for Operating Experience on Recent Events in Nuclear Power Plants in Paris in October 2023 to share lessons learned from operating experience at NPPs and to exchange information on recent safety significant events at NPPs.

76. The Agency held a training course on performance improvement using the Peer Review of Operational Safety Performance Experience (PROSPER) guidelines as a basis in Vienna in March 2023.

77. In November 2023, the Agency held the CANDU Senior Regulators' Meeting in Gyeongju-Si, Republic of Korea, to exchange lessons learned from the oversight of CANDU-type NPPs.

C.1.2. Site Safety and External Hazards

78. In May 2023, the Agency held a webinar presenting geological reconnaissance findings following the 2023 Kahramanmaraş, Türkiye earthquake sequence. The webinar presented mapped fault ruptures and their consistency with active fault maps. The upcoming Agency guidance for probabilistic fault displacement hazard analysis was also introduced at this webinar.

79. In June 2023, the Agency approved a new three-year CRP on climate change challenges to the safety of nuclear installations, focusing on hazard calculation and operational provisions and investigating the resilience of new and existing nuclear infrastructures to climate-related extreme scenarios. The study will analyse the impact of climate change on weather-related hazards by comparing national practices and evaluating available simulation tools.

80. The Agency held a Technical Meeting on Geotechnical Aspects in Site Evaluation and Design of Nuclear Installations in Vienna in July 2023 to collect information on national practices and to identify the needs and issues to be covered in the revision of *Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants* (IAEA Safety Standards Series No. NS-G-3.6).

81. The Agency held a Technical Meeting on Probabilistic Safety Assessment of Nuclear Installations in Relation to External Events and their Combinations in Vienna in November 2023 to present recent work on safety standards and technical documents related to the probabilistic safety assessment of nuclear installations, with a special emphasis on the modelling of severe external event scenarios other than seismic event scenarios. In addition, the impacts of climate change were discussed and information from Member States concerning their practices were collected and disseminated.

82. In October 2023, the External Events Notification System (EENS) was expanded to issue alerts for tornadoes, tsunamis, flooding, wildfires and volcanic eruptions, in addition to the initial configuration for earthquakes and tropical cyclones. An expert panel on climate change challenges to the safety of nuclear installations was organized at the United Nations 2023 Climate Change Conference (COP28) in Dubai, United Arab Emirates, in December 2023, with a presentation of the EENS system and of the CRP on climate change.

83. The Agency held a Technical Meeting on the Site and External Events Design (SEED) Review Service and Capacity Building Activity Output Assessment in Vienna in October 2023 to discuss and assess the progress and outputs of SEED missions and the capacity building programme on site and design safety reviews for nuclear installations. The development of a SEED service for the siting of SMRs was also discussed.

84. The Agency is developing a Handbook for Capacity Building Programmes on Nuclear Site Safety for Regulators in Embarking Countries, together with a Standard Review Plan document, a sample safety analysis report and two e-learning courses within the framework of the capacity building project for regulators.

C.1.3. Design Safety and Safety Assessment

85. In 2023, the Agency has continued developing the revision of the Specific Safety Guide *Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants* (DS528) and is also developing a draft TECDOC on experiences in design safety and safety assessment of fusion facilities.

86. The Agency held a Training Workshop on the Development of Severe Accident Management Guidelines Using the IAEA's Severe Accident Management Guideline Development Toolkit in Vienna in October–November 2023 to exchange information on, and enhance understanding of, the development of severe accident management guidelines and to share best practices for establishing such guidelines in Member States.

87. In March 2023, the Agency held a Technical Meeting on the Safety Approach for Liquid Metal Cooled Fast Reactors and the Analysis and Modelling of Severe Accidents in Vienna. Participants exchanged information on the design of liquid metal cooled fast reactors, with regard to the general approach to design safety and the consideration of severe accidents in the design and safety assessment

of sodium cooled and lead cooled innovative reactors, with an emphasis on the analysis and modelling of severe accidents.

88. The Agency held a third consultancy meeting to progress with the development of the revision of the Safety Guide *Periodic Safety Review for Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-25), in Prague in July 2023.

C.2. Safety of Small Modular Reactors

89. The Agency held a meeting of the SMR Regulators' Forum in Vienna in April 2023 to provide an opportunity for members to receive reports from, and provide guidance to, the forum's working groups. It also provided an opportunity for members to discuss strategic and administrative issues.

90. In 2023, the Agency continued implementing the Nuclear Harmonization and Standardization Initiative (NHSI). Under the regulatory track of NHSI, the Agency held the following meetings, all in Vienna: four meetings of Working Group 1 on building a framework for regulators to share information, including obstacles to sharing information and potential solutions; four meetings of Working Group 2 on developing a process for multinational pre-licensing; and four meetings of Working Group 3 on processes for leveraging other regulatory reviews and for regulators to work together during ongoing reviews.

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| <p>Nuclear Harmonization and Standardization Initiative (NHSI)</p> | <p>Objective:</p> <p>facilitate the effective global deployment of safe and secure advanced nuclear reactors. This complementary initiative seeks to advance the harmonization and standardization of SMR design, construction, regulatory and industrial approaches, and is comprised of two separate but complementary tracks: the NHSI Regulatory Track and the NHSI Industry Track.</p> <ul style="list-style-type: none"> • NHSI Regulatory Track: aims at increasing regulatory collaboration among Member States, avoid duplication of efforts, increase efficiency, and facilitate the development of common regulatory positions without compromising nuclear safety and national sovereignty. • NHSI Industry Track: focuses on developing more standardized industrial approaches for SMR development, manufacturing, construction, and operations. By establishing common standards and best practices. It also aims to help reduce licensing timelines, costs and ultimately deployment times for SMRs. <p>A NHSI Special Task Force has been established under the IAEA SMR Platform to ensure coordination with the Agency's activities in the area of SMRs.</p> |
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91. The Agency has systematically reviewed its safety standards and is implementing its plan of work to revise safety standards in support of the licensing and safe and secure deployment of emerging SMR technologies. The new editions of *Licensing Process for Nuclear Installations* (IAEA Safety Standards Series No. SSG-12), and *Safety of Nuclear Power Plants: Commissioning and Operation* (IAEA Safety Standards Series No. SSR-2/2 (Rev. 1)), which are both currently being revised, will address SMRs.

92. The Agency continued developing a new draft Safety Guide provisionally entitled *Safety Demonstration of Innovative Technology in Power Reactor Designs* (DS537), as well as two draft TECDOCs, on optimization of safety measures for protection of nuclear installations against external hazards and framework for siting of SMRs, and on siting and design aspects of SMRs in relation to external hazards: special issues in the application of safety standards. This important topic was widely addressed during a Technical Meeting on Safety Demonstration of Innovative Technology in Power Reactor Designs held in Vienna in June 2023, during which further input from Member States was compiled to enable progress with the development of the Safety Guide. This Technical Meeting provided a platform for the participants to share experiences in resolving or mitigating uncertainties associated with innovative technology while demonstrating the safety of such technology.

93. With the aim of training participants on the requirements and recommendations of Agency safety standards and their applicability to different types of SMRs throughout their lifetimes, the Agency held four Interregional Training Courses on Safety of Small Modular Reactors, in Vienna in March 2023, in Chengdu, China, in September 2023, and in Saint Petersburg, Russian Federation, and Boston, United States of America, in October 2023.

94. The Agency held an Interregional Workshop on Graded Approach for Site Evaluation for Small Modular Reactors in Beijing in June 2023 to support Member State capacity building on small modular reactors and microreactors and their technology and applications and to improve knowledge and safety review capability in developing countries.

95. The Agency held a National Workshop on Site Safety Evaluation and Regulatory Review for New Nuclear Installations in Poland in Warsaw in November 2023, to provide technical training focusing on country-specific weaknesses and issues that had been discovered through a self-assessment workshop.

96. The Agency held two Educational Workshops on Regulatory Challenges in Small Modular Reactors, in Rabat in October 2023 and in Prague in December 2023, to enhance the knowledge of Member States' regulatory bodies regarding challenges identified by the SMR Regulators' Forum and to provide information on any changes needed to national regulatory requirements and practices.

97. The Agency held the first Interregional Workshop on Emergency Preparedness and Response for Small Modular Reactors in Daejeon, Republic of Korea, in October 2023 to provide participants with information on the latest Agency developments in the area of EPR for SMRs.

C.3. Research Reactor Safety

98. The Agency postponed to a later date the International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future, which had been planned to be held in November–December 2023.

99. In 2023, the Agency completed the publication of 11 revised Specific Safety Guides for research reactors. These Safety Guides will provide additional guidance to fully implement the provisions of the Code of Conduct on the Safety of Research Reactors.

100. In October 2023, the Agency held a Workshop on the Safety of Experiments for Research Reactors in Aix-en-Provence, France, to provide participants with practical information on Agency safety standards related to the safety of design, fabrication, installation, operation and dismantling of experimental devices for research reactors.

101. The Agency held a Technical Meeting for the National Coordinators of the Incident Reporting System for Research Reactors in Vienna in March 2023. The meeting provided a forum for participants to discuss and exchange information on root causes, corrective actions and lessons learned in relation to safety significant events at research reactor facilities.

102. The Agency held a Technical Meeting on Digital Instrumentation and Control Systems for Research Reactors in Vienna in July 2023, where participants exchanged information and experience related to the safety, technical and managerial aspects of research reactor projects (both modernization projects and projects for the design and construction of new facilities) involving digital instrumentation and control systems.

103. In September 2023, the Agency held a Technical Meeting on Integrated Management Systems for Research Reactors in Daejeon, Republic of Korea, to provide participants with practical information on the establishment, implementation and continuous improvement of integrated management systems for research reactors on the basis of the Agency safety standards.

104. The Agency held a Technical Meeting on the Safety of Research Reactors Under Project and Supply Agreements and Review of their Safety Performance Indicators in Vienna in October 2023. The meeting provided participating Member States with a forum for the exchange of information on the safety status of research reactors under Agency project and supply agreements and reviewed the safety performance indicators for 2021 and 2022. The meeting also identified areas for the improvement of the operational safety of these facilities.

C.4. Fuel Cycle Facility Safety

105. The Agency held a Workshop on Operating Experience Feedback for Nuclear Fuel Cycle Facilities in Vienna in April 2023 where the users of the Fuel Incident Notification and Analysis System (FINAS) were provided with practical information on establishing programmes for operating experience feedback for nuclear fuel cycle facilities and on the updated features of FINAS.

106. In 2023, the Agency upgraded the IT platform supporting its operating experience reporting systems, including the International Reporting System for Operating Experience, the Incident Reporting System for Research Reactors and FINAS in order to enhance the effectiveness of the systems through an improved user interface and provide for better analysis of information.

107. The Agency held a Technical Meeting on Chemical and Fire Safety at Nuclear Fuel Cycle Facilities in Vienna in July 2023 where participants discussed and exchanged experience in safety assessment and measures for ensuring chemical and fire safety at nuclear fuel cycle facilities.

108. In October 2023, the Agency held a Workshop on Safety Considerations in the Use of Advanced Technologies at Nuclear Fuel Cycle Facilities in Warrington, United Kingdom, where participants discussed and exchanged experience in design and operational safety, and regulatory oversight in the use of advanced technology, including digital control systems, robotics and artificial intelligence applications at nuclear fuel cycle facilities.

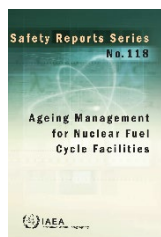
109. The Agency published *Ageing Management for Nuclear Fuel Cycle Facilities* (Safety Reports Series No. 118) in May 2023 and completed the development of a draft Safety Report provisionally entitled *Periodic Safety Review for Nuclear Fuel Cycle Facilities*. The Agency also finalized the development of a draft TECDOC on regulatory inspection programmes for nuclear fuel cycle facilities.

110. The Agency held a Technical Meeting on the Consideration of Human Factors in the Safety of Nuclear Fuel Cycle Facilities in Vienna in November 2023 where participants discussed and exchanged experience in the application of Agency safety standards related to the consideration of human factors in the design, safety assessment and operation of nuclear fuel cycle facilities.

C.5. Safety Infrastructure for Embarking Countries

C.5.1. Nuclear Power Programmes

111. The Agency held a Meeting of the Steering Committee of the Regulatory Cooperation Forum (RCF) and Support Meeting in Vienna in July 2023 to review the status of regulatory infrastructure development in countries receiving support from the RCF and to foster the exchange of experience. In addition, the Agency held the RCF Plenary Meeting in Vienna in September 2023 to share the new focuses of the RCF programme, which had been developed based on a survey of its effectiveness completed by RCF members. In November 2023, the Agency held a meeting in Vienna to develop the outline of the new RCF strategic plan. Moreover, an RCF Workshop on Regulatory Body Communication and Consultation with Interested Parties was held in Vienna in September 2023 to provide regulatory bodies with guidance on effectively interacting with interested parties when establishing safety infrastructure.



112. The Agency held a Technical Meeting on the Protection of Nuclear Installations Against External Hazards in Vienna in September 2023 to review the progress made in EESS activities supporting the development and application of the relevant safety standards with regard to the protection of nuclear installations against external hazards.

113. The Agency held a Regional Workshop on Site Evaluation for Small Modular Reactors in Haikou, China, in November 2023 to share information on and knowledge of site evaluation for SMRs.

114. The Agency held two National Workshops on the development of an HRD Plan for the regulatory authority for Licensing and Regulatory Oversight of NPPs in Tashkent in May 2023 and in Colombo in August 2023, to provide information and guidance on staffing, organization and human resource development planning of the regulatory body for the regulatory oversight of NPPs.

115. The Agency held a National Workshop on the Legal and Regulatory Framework for a Nuclear Power Programme in Kelaniya, Sri Lanka, in February 2023 to provide information and guidance on the development of an effective and adequate national legal and regulatory framework for NPP projects.

116. The Agency held a Regional Workshop on the Review and Assessment of Nuclear Power Plant License Applications by the Regulatory Body in Manila in November 2023 to provide embarking countries with information and guidance on appropriate organization and management, and on the effective conduct of regulatory review and assessment.

117. The Agency organized an expert mission in Ankara in January 2023 on the regulatory oversight of the operating organization, including in relation to the organizational structure, training, certification, qualification and/or authorization of key staff important for the safe operation of NPPs.

118. In October 2023, the Agency published Licensing Process for Construction, Commissioning and Operation of Nuclear Power Plants (Safety Reports Series No. 119). The Agency also finalized a draft TECDOC on planning, management and conduct of regulatory review and assessment for NPPs. Both publications provide additional information and practical guidance, mainly for embarking countries, on different aspects of the licensing process to be applied to NPPs and the safety review and assessment process to be conducted by Member State regulatory bodies during the licensing of an NPP.

C.5.2. Research Reactor Programmes

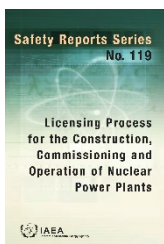
119. The Agency held a Training Workshop on the Assessment of National Nuclear Infrastructure to Support a New Research Reactor Project in Vienna in October–November 2023 and provided guidance to Member States embarking on new research reactor projects on assessing and developing national infrastructure.

120. The Agency held a National Workshop on Milestones Approach for New Research Reactor Programmes in Lusaka in March 2023 where participants shared and discussed experience, challenges and lessons learned in the development and implementation of new research reactor projects.

D. Strengthening Emergency Preparedness and Response

D.1. Arrangements for Information Exchange, Communication and Assistance

121. The Agency held three Workshops on Arrangements for Notification, Reporting and Assistance in Nuclear or Radiological Incidents and Emergencies in Vienna in February, April and October–



November 2023 and a virtual working meeting with counterparts from Turkmenistan in March 2023 to discuss matters related to adherence to the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention).

122. The Agency held two National Workshops on Arrangements for Notification, Reporting and Assistance in Nuclear or Radiological Incidents and Emergencies, in Cotonou, Benin, in June 2023, and in Abidjan, Côte d'Ivoire, in August 2023 to increase participants' knowledge and ability regarding the use of the Agency's arrangements and resources for international notification, reporting and requesting assistance during an emergency.

123. The Agency held a National Workshop on Emergency Preparedness and Response in Koriyama, Japan, in February 2023 where participants acquired knowledge and practical skills for effective response to a nuclear or radiological emergency. The workshop was aimed at examining the concept of protection strategies, including the use of emergency response criteria, in the context of the lessons learned from the Fukushima Daiichi accident.

124. The conclusions of the 11th Meeting of the Representatives of Competent Authorities Identified Under the Early Notification Convention and the Assistance Convention, held in Vienna in June 2022, continued to be addressed by the Secretariat. Actions derived from these conclusions were conducted in areas such as the following:

- Support to Member States in the adherence process and in the implementation of the Early Notification and Assistance Conventions;
- Support for the preparation and conduct of EPR exercises, and continuous improvement of the Unified System for Information Exchange in Incidents and Emergencies platform;
- Identification of impediments to signing assistance action plans; and
- Contribution to the establishment of harmonized EPR arrangements, the development of a database of source terms, the implementation of the International Radiation Monitoring Information System (IRMIS) and International Radiological Information Exchange (IRIX) standards, and the conduct of ConvEx exercises.

125. The Agency held a Workshop on the Implementation of the International Radiation Monitoring Information System in Vienna in December 2023 to improve participants' awareness and understanding of IRMIS, including training on roles, features and information sharing arrangements for monitoring data.

126. The Agency participated in two regional large scale exercises in Norway and in Romania in 2023. During these exercises, the Agency's field response team was deployed together with other assistance teams from Member States and integrated into the national response capabilities. IRMIS was used to process radiation monitoring data and assess the radiological situation.

127. The Agency held a Regional Training Course on IRIX Format, IRMIS, and Monitoring Data Sharing in Phuket, Thailand, in June 2023 to improve participants' awareness and understanding of IRMIS, including with regard to roles, features and information sharing arrangements.

128. In 2023, eight IRMIS radiation monitoring stations were provided on loan by the Agency to be deployed in the Republic of Moldova. The radiation data are available on IRMIS, enhancing the region's radiation monitoring coverage in case of an event.

129. The Agency held a virtual multi-day training exercise in September 2023 with public information officers of the member organizations of the Inter-Agency Committee on Radiological and Nuclear Emergencies.

D.2. Harmonization of Arrangements for Preparedness and Response

130. The Agency held an International Workshop on Self-assessment of Emergency Arrangements and Use of the Emergency Preparedness and Response Information Management System (EPRIMS) virtually in April 2023 to familiarize participants with, and train them on, the Agency's EPRIMS system.

131. The Agency held a Technical Meeting on Draft Safety Guides Related to Protection Strategy and Criteria for a Nuclear or Radiological Emergency in Vienna in February 2023 to review the draft texts of a proposed new Safety Guide provisionally entitled *Protection Strategy for a Nuclear or Radiological Emergency* (DS534) and of the revision of *Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSG-2).

D.3. Testing Readiness for Response

132. The Agency held an International Workshop on Nuclear Security Measures and Emergency Response Arrangements for Ports in Las Vegas, United States of America, in November 2023 to facilitate the exchange of information among Member States that are developing or revising their nuclear security measures or emergency response arrangements at ports.

133. In 2023, the Agency conducted two ConvEx-1 exercises, with the participation of over 80 Member States, and four ConvEx-2 exercises.

134. In 2023, the Agency conducted four internal full response exercises (FREX) for the purpose of demonstrating the ability of the Agency's Incident and Emergency System (IES) to respond to a simulated nuclear or radiological incident or emergency, and training the Secretariat staff within the IES. Each FREX lasted 8 hours and had the participation of 35–40 Agency staff members. The FREX in October 2023 was conducted in conjunction with the regional large scale exercises in Romania and was then used to test the operational arrangements for implementing the Agency's response roles (ConvEx-2c).

E. Improving Management of the Safety and Security Interface

135. During the reporting period, the Agency continued drafting a new joint Safety Guide and Implementing Guide on managing the interfaces between nuclear and radiation safety and nuclear security.

136. In April 2023, the Agency's Advisory Group on Nuclear Security and the International Nuclear Safety Advisory Group together published a joint report entitled *A Systems View of Nuclear Security and Nuclear Safety: Identifying Interfaces and Building Synergies*.

137. Progress continued towards the publication of *Safety and Security Interfaces in the Regulatory Infrastructure for the Oversight of Nuclear Power Plants* (Technical Reports Series No. 1003).

138. The Agency held one Regional School on Drafting Regulations for Radiation Safety and Security of Radioactive Material in Vienna in July 2023 for Member States in the Caribbean. The school was intended to mentor training teams of participating countries in drafting regulations, considering the radiation safety and security of radioactive material.

139. The Agency held a Regional Training Course on the Authorization and Inspection of Radiation Safety and Nuclear Security for Medical Practices in Lusaka in June 2023, and a Regional Training Course on the Authorization and Inspection of Radiation Safety and Nuclear Security for Industrial Practices in Rabat in September 2023 in order to train regulatory staff of the respective regions to perform the core regulatory functions of authorization, including review, assessment, inspection and enforcement, considering both radiation safety and nuclear security aspects.

140. The Agency held three Training Courses on the Security of Radioactive Material in Use and Storage, in Bogotá in October 2023 for Latin American States, in Dakar in October 2023 for French-speaking African States, and in Nairobi in November 2023 for English-speaking African States in order to enhance the participants' understanding of key Agency guidance on the security of radioactive material and associated facilities in use and storage.

141. The Agency is advancing the development of the TSR guidelines on safety, security and safeguards with the objective of providing a consolidated basis for TSR services. The guidelines aim to streamline, harmonize and formalize the process of conducting TSRs. These review guidelines can also be used to support the review of safety–security–safeguards interfaces.

142. The Agency organized an Interregional Workshop on Safety, Security and Safeguards by Design in Small Modular Reactors in Idaho Falls, United States of America, in September 2023. Discussions held during the workshop confirmed that several SMR designers are currently addressing safety–security–safeguards measures in the early stages of design, and that there is valuable practice to build upon.

143. Within the framework of the Regulatory Infrastructure Development Project, the Agency held a Regional Workshop on Safety and Nuclear Security Culture Values and Approaches in Saint Lucia in November 2023 for countries in the Caribbean region, in order to raise awareness of the importance of nuclear safety and nuclear security cultures.

F. Strengthening Civil Liability for Nuclear Damage

144. The 23rd regular meeting of the International Expert Group on Nuclear Liability (INLEX) took place at IAEA Headquarters in Vienna in July 2023. The meeting provided a forum to present new developments in Member States and activities by the Secretariat in the field of civil liability for nuclear damage, as well as to discuss future outreach activities. The Group also welcomed three new members and, for the first time since its establishment in 2003, a new Chair. At the meeting, the Group discussed, inter alia, the geographical scope of the Paris Convention on Third Party Liability in the Field of Nuclear Energy as amended by the 2004 Protocol, the 1997 Vienna Convention on Civil Liability for Nuclear Damage and the Convention on Supplementary Compensation for Nuclear Damage (CSC). The Group also discussed the understanding of the term 'for use' provided in the Board of Governors resolution contained in document GOV/2014/63 on the establishment of maximum limits for the exclusion of small quantities of nuclear material from the application of the 1963 and 1997 Vienna Conventions and the CSC, and the related 2016 decision (NEA/NE(2016)8/FINAL) of the OECD/NEA Steering Committee. In addition, the Group discussed the operator's right of recourse under the conventions and liability issues during the transport of nuclear material and in relation to outer space activities, small modular reactors and nuclear fusion.

145. With the support of INLEX and in cooperation with Brazil's National Nuclear Energy Commission, the Agency held a Workshop on Civil Liability for Nuclear Damage for Latin American

countries in Rio de Janeiro, Brazil, in October 2023. In addition, a Technical Meeting and a National Workshop on Civil Liability for Nuclear Damage were held with the assistance INLEX members in Uruguay in April 2023. The purpose of these activities was to provide Member States with an overview of the international legal regime of civil liability for nuclear damage, with a focus on the CSC.

146. The Third Meeting of the Contracting Parties and Signatories to the CSC was held in Tokyo in June 2023. The meeting provided an opportunity to foster dialogue on matters relating to CSC implementation, and to promote participation in the CSC worldwide.

147. The Agency organized a Workshop for Diplomats on Civil Liability for Nuclear Damage in conjunction with INLEX in Vienna in July 2023. The purpose of the workshop was to provide an overview of the international legal regime on nuclear liability.

148. The Agency hosted a side event to mark the 20th Anniversary of the establishment of INLEX, on the margins of the 67th IAEA General Conference in September in Vienna. The event also provided an opportunity to raise awareness of the importance of addressing civil liability and compensation for nuclear damage.

149. In the context of the Agency's legislative assistance programme, assistance was provided to 22 Member States in the development of national legislation, including on civil liability for nuclear damage.

G. Technical Support and Assistance to Ukraine

150. At the United Nations Security Council on 30 May 2023, the IAEA Director General set out five concrete principles to help ensure nuclear safety and security at ZNPP in order to prevent a nuclear accident and ensure the integrity of the plant.

151. In 2023 the Agency continued providing technical support and assistance to Ukraine in terms of the delivery of nuclear safety- and security-related equipment. Twenty six deliveries of donated and procured nuclear safety- and security-related equipment to different organizations in Ukraine were organized, bringing the total number of deliveries to 33. In addition to these deliveries, the Agency supported three deliveries of spare parts for emergency diesel generators for South Ukraine NPP through a partnership agreement.

152. Eighty nuclear safety and security missions (rotations) were implemented to the five nuclear sites in Ukraine where Agency has a continuous staff presence (10 to ZNPP, 17 to Khmelnytsky, Rivne and South Ukraine NPPs and 19 to the Chernobyl NPP site).

153. The Agency implemented six additional missions to Ukraine, including the Director General visit on the occasion of inauguration of the continued presence of Agency staff in nuclear sites in Ukraine in January 2023, the second and third visits of the Director General to Zaporizhzhya in March and June 2023, medical assistance and coordination missions in June and November 2023, and an IAEA Support and Assistance Mission on the Safety and Security of Radioactive Sources in July 2023.

154. The Agency held regular coordination meetings with the State Nuclear Regulatory Inspectorate of Ukraine to coordinate the provision of technical support and assistance within the comprehensive assistance programme and to exchange on the nuclear safety and security situation at the ZNPP. In addition, national coordination meetings were held in May and July 2023 with different entities in Ukraine to discuss the situation in general and priority needs in the areas of nuclear safety and security and medical assistance.

155. The Agency held regular coordination meetings with the European Commission, as well as with a number of Member States and organizations such as the European Bank for Reconstruction and Development, to ensure effective coordination in the provision of assistance and to secure the necessary funding. Moreover, the Agency participated in two meetings on the information sharing initiative pertaining to assistance to Ukraine, in Oslo in April 2023 and in Krakow, Poland, in October 2023.

156. The Agency continued to review challenges in the application of its safety standards and nuclear security guidance during an armed conflict. The Agency initiated the preparation of a TECDOC that will analyse the issues and challenges faced at nuclear facilities in terms of the practical application of such standards and guidance during an armed conflict, using the knowledge and experience collected in Ukraine since February 2022, and how these issues and challenges might be addressed, if possible, by all interested parties, including the Agency.

157. The Agency continued sharing information with Member States, international organizations and the public on the nuclear safety and security situation in Ukraine. The Agency issued a public report entitled ‘Nuclear Safety, Security and Safeguards in Ukraine, February 2022–February 2023’, marking one year since the beginning of the armed conflict in Ukraine. The Director General provided detailed reports on the situation in Ukraine to the Agency’s Board of Governors in March, June, September and November 2023, which were made available to the public, and also provided a detailed report on the situation in Ukraine to the 67th regular session of the Agency’s General Conference (GC(67)/10). The Agency continued providing regular updates on the situation in Ukraine on its website with over 60 updates published throughout the year.

Appendix B

The Agency's Safety Standards Activities in 2023

1. The Agency issued 2 General Safety Guides and 15 Specific Safety Guides after endorsement by the Commission on Safety Standards (CSS):
 - *Application of the Concept of Exemption*, IAEA Safety Standards Series No. GSG-17
 - *Application of the Concept of Clearance*, IAEA Safety Standards Series No. GSG-18
 - *Safety of Conversion Facilities and Uranium Enrichment Facilities*, IAEA Safety Standards Series No. SSG-5 (Rev. 1)
 - *Safety of Uranium Fuel Fabrication Facilities*, IAEA Safety Standards Series No. SSG-6 (Rev. 1)
 - *Safety of Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities*, IAEA Safety Standards Series No. SSG-7 (Rev. 1)
 - *Ageing Management for Research Reactors*, IAEA Safety Standards Series No. SSG-10 (Rev. 1)
 - *Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors*, IAEA Safety Standards Series No. SSG-22 (Rev. 1)
 - *Instrumentation and Control Systems and Software Important to Safety for Research Reactors*, IAEA Safety Standards Series No. SSG-37 (Rev. 1)
 - *Compliance Assurance for the Safe Transport of Radioactive Material*, IAEA Safety Standards Series No. SSG-78
 - *Hazards Associated with Human Induced External Events in Site Evaluation for Nuclear Installations*, IAEA Safety Standards Series No. SSG-79
 - *Commissioning of Research Reactors*, IAEA Safety Standards Series No. SSG-80
 - *Maintenance, Periodic Testing and Inspection of Research Reactors*, IAEA Safety Standards Series No. SSG-81
 - *Core Management and Fuel Handling for Research Reactors*, IAEA Safety Standards Series No. SSG-82
 - *Operational Limits and Conditions and Operating Procedures for Research Reactors*, IAEA Safety Standards Series No. SSG-83
 - *The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors*, IAEA Safety Standards Series No. SSG-84
 - *Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors*, IAEA Safety Standards Series No. SSG-85

- *Radiation Protection Programmes for the Transport of Radioactive Material*, IAEA Safety Standards Series No. SSG-86
2. The CSS met twice, in May and November 2023. It endorsed for submission for publication the following draft Safety Guides:
 - DS508: *Assessment of the Safety Approach for Design Extension Conditions and Application of the Concept of Practical Elimination in the Design of Nuclear Power Plants*
 - DS512: *Borehole Disposal Facilities for Disused Sealed Radioactive Sources*
 - DS522: *Evaluation of Seismic Safety for Nuclear Installations*
 - DS524: *Radiation Protection Aspects of Design for Nuclear Power Plants*
 3. In 2023, the CSS also approved the following document preparation profiles for safety standards:
 - DPP DS541: *Safety Guide on Assessment of Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations* (revision of SSG-18)
 - DPP DS542: *Safety Guide on Release of Sites from Regulatory Control on Termination of Activities in Planned Exposure Situations* (revision of WS-G-5.1)
 - DPP DS543: *Safety Requirements publication on Regulations for the Safe Transport of Radioactive Material*, 20xx Edition (revision of SSR-6 (Rev. 1))
 - DPP DS544: *Safety Guide on Radiation Protection and Safety in Existing Exposure Situations*
 - DPP DS545: *Safety Guide on Radiation Safety of Gamma, X Ray and Electron Beam Irradiation Facilities* (revision of SSG-8)
 - DPP DS546: *Safety Guide on Ageing Management and Maintenance of Radioactive Material Transport Packages*
 - DPP DS547: *Safety Guide on Regulatory Experience Feedback Management*
 - DPP DS548: *Safety Requirements on Predisposal Management of Radioactive Waste* (revision of GSR Part 5)
 - Draft DPP DS549: *Safety Guide on Control of Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries* (revision of SSG-17)
 - DPP DS550: *Safety Guide on Storage of Radioactive Waste* (revision of WS-G-6.1)
 - DPP DS551: *Safety Guide on Decommissioning of Uranium Production Facilities*
 4. The CSS meetings held in 2023 were the final two meetings of the Commission's seventh term. The CSS, as well as the Safety Standards Committees, discussed the medium term plan for the safety standards and a concept paper for development of the long term structure and plan for the standards. At its last meeting, the CSS also prepared its end of term report with recommendations for the eighth term.
 5. The CSS held two round-table discussions on the safety implications of the situation in Ukraine. The Secretariat is conducting a review of challenges to the application of the safety standards and nuclear security guidance during an armed conflict.
 6. In October 2023, the Agency published *Attribution of Radiation Health Effects and Inference of Radiation Risks: Considerations for Application of the IAEA Safety Standards* (Safety Reports Series

No. 122), which explains how the concepts of attribution of health effects and inference of risks as set out in the 2012 report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) can be taken into account in applying Agency safety standards more effectively.

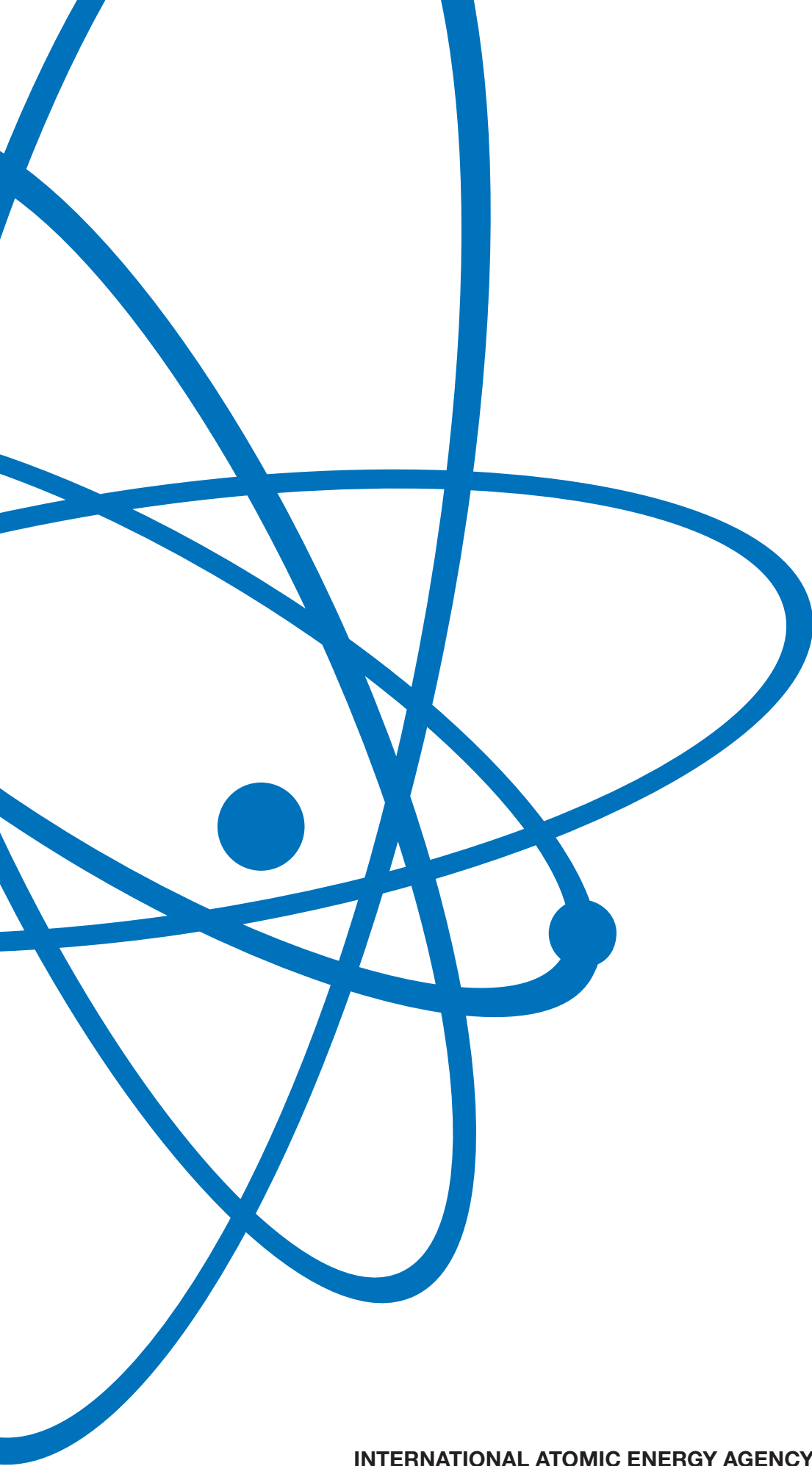
7. The Agency included all newly issued safety standards and nuclear security guidance in the Nuclear Safety and Security Online User Interface (NSS-OUI) platform. All IAEA Safety Standards Series and IAEA Nuclear Security Series publications are available in full, are up to date and can be searched as a uniform knowledge base. The overall search mechanism of the platform was made more user-friendly in 2023.

8. The NSS-OUI platform also enables the collection, storage and retrieval of feedback on the use of the current publications in both the IAEA Safety Standards Series and the IAEA Nuclear Security Series. In 2022 the feedback functionality was further enhanced to allow a consolidated view of feedback to be provided. The NSS-OUI platform will be further used for the systematic revision of Agency safety standards.

9. A Training Course on the IAEA Safety Standards was held in Vienna in May 2023 to facilitate better understanding and awareness of Agency safety standards and to enhance access to and use of the standards in Member States. In addition, one related national training course was held in Sofia in June 2023. The Agency continued its work on translating Agency safety standards into other languages.

10. In 2023, the Agency finalized the set of e-learning modules for all General Safety Requirements. It is also close to completing the set of e-learning modules on the Specific Safety Requirements.

11. In 2023, following the involvement of the Safety Standards Committees and consultations at the 53rd meeting of the CSS in May 2023, the Agency revised the document *Strategies and Processes for the Establishment of IAEA Safety Standards* on the step by step process for the establishment of safety standards that is used to implement the Board of Governors documents GOV/INF/772, GOV/INF/2012/3 and GOV/INF/2015/9 on the development and review of the Agency's safety standards and nuclear security guidance.



INTERNATIONAL ATOMIC ENERGY AGENCY
Department of Nuclear Safety and Security
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
iaea.org/ns | Official.Mail@iaea.org