Nuclear Safety Review 2025

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NUCLEAR SAFETY REVIEW 2025

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Foreword

The Nuclear Safety Review 2025 includes the global trends and the Agency's activities undertaken in 2024 and thereby demonstrates the progress made regarding the priorities for 2024. It also presents priorities for 2025 and beyond, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety, and emergency preparedness and 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 2025* was submitted to the March 2025 session of the Board of Governors in document GOV/2025/5. The final version of the *Nuclear Safety Review 2025* was prepared in light of the discussions held during the Board of Governors and also of the comments received from Member States.

Table of Contents

Nuclear Safety Review 2025

Report by the Director General

Executive Overview

1. The *Nuclear Safety Review 2025* reflects the global trends in 2024. It shows that the nuclear community continued to make steady progress in improving nuclear safety across the world. It also presents planned Agency activities for 2025 and priorities, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety, and emergency preparedness and response (EPR). Agency activities undertaken in 2024 to meet the priorities identified in the Nuclear Safety Review 2024 can be found in Appendix A. The Agency's safety standards activities in 2024 are provided in Appendix B.

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

General Safety
FOCUS AREAS

The Agency will continue to:

- Strengthen its safety standards and assist with their application;
- Strengthen its peer review and advisory services and self-assessment tools;
- 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;
- Assist Member States in the safe introduction and deployment of SMRs and innovative nuclear technologies;
- Assist Member States in research and development for safety; and
- Assist Member States in developing strategic approaches for nuclear safety and security.

3. The work on the Agency's safety standards addresses both the revision of existing safety standards and the establishment of a number of new standards. Eight Specific Safety Guides were published in 2024. The Agency continues to prepare a long term plan for safety standards in a comprehensive manner, taking into consideration new and innovative technologies as well as emerging challenges for the application of nuclear and radiation technologies, and ensuring coordination with relevant international organizations.

4. Analysis of peer review and advisory service mission reports shows that these include recommendations relating to regulatory body independence; building regulatory capacity and competence; establishing safety regulations and licensing processes as part of effective legal and regulatory oversight programmes; leadership; management for safety; safety culture; national policies, strategies and frameworks for radioactive waste management; and optimization of protection particularly in relation to the safety of decommissioning, remediation and management of radioactive waste and discharges.

5. In 2024, there were three new Contracting Parties to the Convention on Nuclear Safety (CNS); by the end of the year, there were 96 Contracting Parties to the CNS. Meanwhile, there was a 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 90 Parties to the Joint Convention.

6. In 2024, there was one new State Party to the Convention on Early Notification of a Nuclear Accident (Early Notification Convention), bringing the total number of State Parties to 134. There was also a 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 129. By the end of 2024, 43 States Parties to the Assistance Convention had registered National Assistance Capabilities in the Agency's Response and Assistance Network, of which two registered or updated their National Assistance Capabilities in 2024.

7. The Integrated Regulatory Review Service (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 legal and regulatory oversight programmes. Some Member States considering or planning their first nuclear power programme or research reactor project tend to invite an IRRS mission only at Phase 3 of introducing a nuclear power programme under the IAEA Milestones approach. To encourage a review mission at Phase 2 of the development of the infrastructure for safety, the Agency offers a complementary mission addressing the implementation of the relevant actions from the first two phases.

8. There is a growing interest among Member States in enhancing their regulatory infrastructure to ensure a competent workforce at facilities and in activities. Requests for assistance in establishing national strategies for education and training in radiation protection and safety continue, particularly in countries with multiple regulatory authorities. The Agency has been aligning its capacity building assistance for regulatory bodies with the priorities of its flagship initiatives, including Rays of Hope, Atoms4Food, Atoms4NetZero and Nuclear Technology for Controlling Plastic Pollution (NUTEC Plastics).

9. Member States are increasingly interested in elaborating a general national policy and strategy for safety or in specific technical safety areas, creating high demand for assistance in drafting or reviewing national policy and strategy documents for nuclear safety and security.

10. Many regulatory bodies have responsibilities for both nuclear safety and nuclear security, and there is a growing interest among them in effectively combining these regulatory duties, without compromising either one. The Agency, through Regulatory Infrastructure Development Projects (RIDPs), provides specialized assistance to develop the capacities and means to integrate regulatory duties for radiation safety and security of radioactive material.

11. Member States are increasingly focused on elevating and improving leadership knowledge, skills, and attitudes for safety, with a growing demand for educational and training events at the national and regional levels. There is a particular emphasis on developing leadership competencies among the next generation of practitioners.

12. Member States are showing heightened interest in organizing safety culture capacity building events and in accessing e-learning resources to further strengthen radiation safety culture in medical radiation uses, in particular in relation to patient and staff protection.

13. The control, monitoring, assessment and recording of natural radiation exposure for workers are becoming essential components of occupational radiation protection strategies in Member States. A notable trend is the increasing use of the Agency's Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR), which facilitates data collection to optimize radiation protection across various sectors, including interventional cardiology, industrial radiography and industrial processes involving naturally occurring radioactive material (NORM). Member States are leveraging ISEMIR to enhance their legislative frameworks and facilitate benchmarking. Additionally, there is growing demand for Occupational Radiation Protection Appraisal Service (ORPAS) review missions to promote a harmonized approach to occupational radiation protection, with plans to upgrade the ORPAS self-assessment tool and conduct missions in various Member States.

Radiation, Transport and Waste Safety
FOCUS AREAS

The Agency will continue to:

- Assist Member States in achieving a fit-for-purpose regulatory infrastructure for radiation safety;
- Assist Member States in building capacity for ensuring the safety of the general public, workers, patients and the environment;
- Assist Member States in the management of radioactive sources and 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 building capacity for the safe transport of radioactive material, including for SMRs;
- Assist Member States in building capacity for the safe management of radioactive waste and spent fuel, including disposal, and for decommissioning; and
- Assist Member States in building capacity, by promoting and facilitating the sharing of experience regarding the remediation of contaminated areas.

14. Interest from Member States in green energy and small modular reactors (SMRs) continued to rise in 2024, highlighting the importance of ensuring that safe and sustainable decommissioning and management of radioactive waste and discharges are integrated into the design phase by vendors and considered by Member States when creating an enabling environment for the safe and secure deployment of SMRs. The Agency has facilitated information exchange on this topic, which will continue into 2025.

15. Anticipated increases in the demand for uranium, thorium and precious metals are likely to drive growth in mining and mineral processing. In response, work to support Member States on the decommissioning of uranium production facilities began in 2024, alongside the ongoing development of guidance and support for managing NORM residues.

16. Advisory missions have indicated that some Member States would benefit from further guidance on optimizing protection, in particular regarding the safety of decommissioning, remediation, and the management of radioactive waste and discharges.

17. International attention continues to be paid to the Agency's safety review of the discharges of Advanced Liquid Processing System (ALPS) treated water into the sea by the Tokyo Electric Power Company (TEPCO) at the Fukushima Daiichi nuclear power station.

18. Given the ongoing concerns about areas radiologically contaminated by past practices, there is a continued focus on identifying and characterizing these areas to ensure the protection of human health and the environment. When remediation is justified and planned, Member States are actively seeking Agency support to facilitate open communication with interested parties.

Safety in Nuclear Installations
FOCUS AREAS

The Agency will continue to:

- Assist Member States in maintaining a high level of safety for operating nuclear installations, including facilitating the exchange of operating experience;
- Provide assistance in implementing programmes for ageing management and long term operation;
- Assist Member States in the evaluation of nuclear installation site and design safety, and safety assessment;
- Assist Member State activities related to SMRs and other types of innovative technologies;
- Assist Member States' efforts for the safety of fuel cycle facilities and research reactors;
- Assist Member States with the various instruments related to safety, such as the Convention on Nuclear Safety and 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.

19. In the more than 40 years since the launch of the Operational Safety Review Team (OSART) mission, the Agency has conducted 227 OSART missions and 167 follow-up missions. This milestone underscores the ongoing commitment to enhancing nuclear safety with a focus on management expectations, safe operations, maintenance optimization, operating experience feedback, accident management and on-site EPR.

20. There is a renewed interest in nuclear power among Member States, in particular the construction of new NPPs and planning for the long term operation (LTO) of existing facilities, alongside a strong push for advancing fusion energy production. To support these initiatives, comprehensive safety standards for assessment and design are essential, with ongoing revisions to ensure these reflect state-of-the-art knowledge. Furthermore, there is a growing interest in harmonizing national safety requirements and licensing approaches, as well as sharing knowledge related to the design and safety evaluation of new NPPs, including innovative designs and cross-cutting areas such as digital instrumentation reliability and risk analysis in complex operational contexts.

21. There is sustained interest among Member States in developing and deploying evolutionary and innovative reactor technologies, including large reactors, SMRs and microreactors. With nearly 70 SMR designs in progress globally, nuclear safety and security are expected to be prioritized early in the design phase. The Agency will focus on preparing to develop or revise safety standards for advanced reactor technologies such as high temperature gas cooled reactors, liquid metal cooled fast reactors and molten salt reactors and for floating nuclear power plants (FNPPs).

22. Member States continue to actively engage with the Nuclear Harmonization and Standardization Initiative (NHSI), with nearly 30 regulatory bodies and industry representatives participating in the first phase of the Regulatory Track, resulting in three finalized technical documents to enhance regulatory cooperation. Additionally, the Agency's first International Conference on Small Modular Reactors and their Applications, held in Vienna in October 2024, saw participation from 97 Member States and 18 international organizations, providing a platform to discuss progress, opportunities, challenges, and enabling conditions for the safe and secure deployment of SMRs.

Emergency Preparedness and Response
FOCUS AREAS

The Agency will continue to:

- 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
- Implement an active exercise programme at the international level to test EPR and support national EPR exercise programmes.

23. There is a growing demand from Member States for education and training activities relating to public communication in nuclear and radiological emergencies, emerging technologies in emergency response, and considerations for preparedness and response for nuclear or radiological emergencies triggered by nuclear security events related to the management, use and transport of radiation sources.

24. Member States are also seeking training on developing strategies for managing combined events, where nuclear or radiological emergencies coincide with other hazardous situations such as natural disasters. Additionally, there is increasing interest in establishing EPR arrangements for new reactor types, particularly SMRs and transportable nuclear power plants (TNPPs).

25. The Agency continues to facilitate a coordination process to address the interface between nuclear safety and security, for example by responding to requests from Member States as reflected in the main trends, including implementing RIDPs, conducting peer review missions such as the Regulatory Infrastructure for Radiation Safety and Nuclear Security (RISS) mission, and addressing the safe and secure management of disused sources. Member States also continue to encourage the Secretariat to develop guidance on how to effectively address the interface, while acknowledging the distinctions between nuclear safety and security.

Nuclear Law and Legislative Assistance
FOCUS AREAS

The Agency will continue to:

- On request, provide legislative assistance to Member States to support them in establishing and strengthening their national nuclear legal frameworks and in joining and committing to the relevant international legal instruments; and
- 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 the International Expert Group on Nuclear Liability (INLEX) in 2012.

26. An increasing number of Member States are joining international legal instruments for nuclear safety and security, leading to greater demand for the Agency's support, under its legislative assistance programme, in raising awareness of the relevant instruments and strengthening national legal frameworks. This includes capacity building and training in nuclear law. Additionally, Member States continue to request Agency assistance in their efforts to adhere to and implement the international nuclear liability conventions.

27. There continues to be international concern about the nuclear safety and security situation in Ukraine, especially at the Zaporizhzhya NPP. The Agency maintained the continued presence of its staff at the five nuclear sites in Ukraine (Khmelnytskyy NPP (KhNPP), South Ukraine NPP (SUNPP), Rivne NPP (RNPP), Zaporizhzhya NPP (ZNPP) and the Chornobyl NPP (ChNPP) site) without any interruption, and continued to provide other technical support and assistance to help ensure the safe and

secure operation of nuclear facilities and activities involving radioactive sources in Ukraine through its comprehensive programme of assistance. The Agency continued sharing information with Member States, international organizations and the public on the nuclear safety and security situation in Ukraine.

28. The Agency's priorities for 2025 regarding strengthening nuclear, radiation, transport and waste safety, and EPR are as follows:

Nuclear Safety
AGENCY PRIORITIES

The Agency will continue 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;
- Support Member States in the application of the Agency's safety standards;
- Assist Member States in establishing or enhancing a fit-for-purpose regulatory framework for radiation safety and in capacity building in the areas of radiation transport and waste safety through guidance documents, peer reviews, advisory services, training and education and workshops;
- Support Member States in the safe deployment of advanced and innovative technologies by further developing the related safety standards and other publications, supporting capacity building and information sharing, and progressing the harmonization of regulatory approaches through NHSI;
- Enhance the safety of operating NPPs and research reactors and support Member States in long term operation and ageing management by effectively conducting OSART, INSARR and SALTO review missions;
- Support Member States with regard to site and design safety and severe accident prevention and mitigation, with special reference to the effects of climate change on the safety of nuclear installations by holding the first IAEA International Conference on Resilience of Nuclear Installations Against External Events from a Safety Perspective – Focus on Climate Change;
- Monitor and assess activities at the 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;
- Assist Member States in the development and implementation of national, bilateral, regional, and international emergency preparedness and response mechanisms, arrangements, and exercises. This includes the development of the necessary institutional networks, infrastructure, capabilities, and capacities to respond to any nuclear or radiological incident or accident;
- Develop and promote harmonized safety standards and guidance to be prepared to respond to any nuclear or radiological incident or accident. This includes EPR response strategies and guidelines to address emerging challenges such as the increased use of SMRs and other innovative nuclear reactor designs and preparing for effective response to incidents and emergencies specific to these new technologies;
- 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
- Respond to requests from Member States to facilitate a coordination process to address safety and security interfaces and further develop guidance on how to effectively address them.

Abbreviations

AdSec	Advisory Group on Nuclear Security
ALPS	Advanced Liquid Processing System
ANSN	Asian Nuclear Safety Network
ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
CANDU reactor	Canada 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
DIRATA	Database on Discharges of Radionuclides to the Atmosphere and Aquatic Environment
DPP	document preparation profile
EBRD	European Bank for Reconstruction and Development
EduTA	Education and Training Appraisal
EPR	emergency preparedness and response
EPREV	Emergency Preparedness Review
EPRIMS	Emergency Preparedness and Response Information Management System
FORO	Ibero-American Forum of Radiological and Nuclear Regulatory Agencies
FNPP	floating nuclear power plant
GNSSN	Global Nuclear Safety and Security Network
GRM	Generic RoadMap
IMO	International Maritime Organisation
imPACT	integrated missions of the Programme of Action for Cancer Therapy
INLEX	International Expert Group on Nuclear Liability
INSAG	International Nuclear Safety Advisory Group

IRMIS	International Radiation Monitoring Information System
IRRS	Integrated Regulatory Review Service
IRS	International Reporting System for Operating Experience
IRSRR	Incident Reporting System for Research Reactors
ISAMRAD	IAEA Support and Assistance Mission on the Safety and Security of Radioactive Sources
ISCA	Independent Safety Culture Assessment
ISEMIR	Information System on Occupational Exposure in Medicine, Industry and Research
LTO	long term operation
MEREIA	Methods for Radiological and Environmental Impact Assessment
NHSI	Nuclear Harmonization and Standardization Initiative
NORM	naturally occurring radioactive material
NPP	nuclear power plant
NSS-OUI	Nuclear Safety and Security Online User Interface
NUTEC Plastics	Nuclear Technology for Controlling Plastic Pollution
OECD/NEA	Nuclear Energy Agency of the Organisation for Economic Co-operation and Development
ORPAS	Occupational Radiation Protection Appraisal Service
OSART	Operational Safety Review Team
PGEC	Postgraduate Educational Course
PROSPER	Peer Review of Operational Safety Performance Experience
PSR	periodic safety review
RAIS+	Regulatory Authority Information System
RANET	Response and Assistance Network
RASIMS	Radiation Safety Information Management System
RCF	Regulatory Cooperation Forum
REGSUN	Regulatory Forum for Safety of Uranium Production and Naturally Occurring Radioactive Materials
REIA	radiological and environmental impact assessment
RIDP	Regulatory Infrastructure Development Project
SALTO	Safety Aspects of Long Term Operation
SAMGs	severe accident management guidelines

SEED	Site and External Events Design
SMR	small modular reactor
TECDOC	IAEA Technical Document
TEPCO	Tokyo Electric Power Company
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
USIE	Unified System for Information Exchange in Incidents and Emergencies
ZNPP	Zaporizhzhya nuclear power plant

Analytical Overview

General Safety Areas

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. As the work under the previous long term plan is coming to finalization, the Secretariat, together with the CSS and the Safety Standards Committees, continues to prepare a new long term plan, addressing the existing and future set of safety standards in a comprehensive manner and taking into consideration new and innovative technologies as well as emerging challenges for the application of nuclear and radiation technologies.

2. The Agency has now finalized the set of e-learning modules for all Safety Requirements publications (see Figure 1), and Member States are increasingly accessing and gaining certificates in these modules, which enable them to have a better understanding of the Agency safety standards and their application.

Fig. 1. Agency's safety standards publications and associated e-learning modules available.

3. 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 2).

Fig. 2. Number of Member State requests for Agency peer review and advisory services to be conducted in 2025 and 2026 (status: June 2025).

Related Activities

4. ***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 encouraging Member States to request 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;

- Hold a training course for IRRS mission reviewers on the IRRS process and the conduct of such missions;

- Continue encouraging Member States to request ORPAS missions, including ORPAS follow-up missions to review specific occupational radiation protection areas not previously covered; continue delivering such missions upon request; and complete the current cycle of simulation-based training of future ORPAS reviewers to ensure regional coverage;

- Continue encouraging Member States to request Site and External Events Design (SEED) review services and Technical Safety Review (TSR) services on the siting and design safety of conceptual reactor designs for SMRs in order to increase confidence in the site selection and design safety of SMRs and the adequacy of their safety assessments, and to identify the path to making practicable improvements to nuclear safety;

- Hold a training course on Agency safety standards to facilitate better understanding and awareness of the safety standards; and

- Maintain the Nuclear Safety and Security Online User Interface (NSS-OUI) platform and use innovative technologies to improve the user friendliness of the platform and enhance access to the standards by users in Member States.

International Safety Conventions

Trends

5. The Convention on Nuclear Safety (CNS) was adopted on 17 June 1994 and entered into force on 24 October 1996. In 2024, El Salvador, Iraq and Liberia became Contracting Parties to the CNS. As of 31 December 2024, there were 96 Contracting Parties to the CNS (see Figure 3).

6. 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. In 2024, Iraq became a Contracting Party to the Joint Convention. As of 31 December 2024, there were 90 Contracting Parties to the Joint Convention (see Figure 3).

7. 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. In 2024, Liberia became a Contracting Party to the Early Notification Convention. As of 31 December 2024, there were 134 States Parties to the Early Notification Convention (see Figure 3).

8. 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. In 2024, Liberia became a Contracting Party to the Assistance Convention. As of 31 December 2024, there were 129 States Parties to the Assistance Convention (see Figure 3).

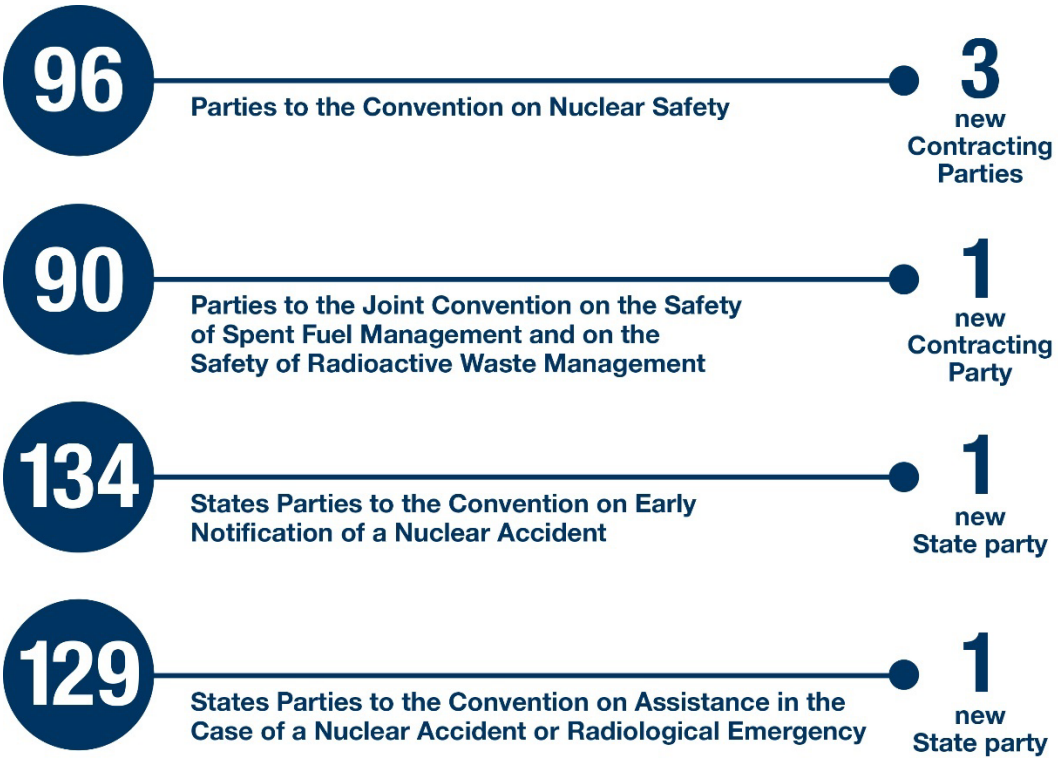

Fig.3. Number of contracting parties to the International Safety Conventions.

Related Activities

9. ***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:

- Provide education workshops to familiarize Member States with their rights and responsibilities for notification and reporting under the Early Notification Convention and the Assistance Convention;
- Hold the Eighth Review Meeting of the Contracting Parties to the Joint Convention;
- Organize regional workshops to promote the adherence of Member States in the Asian and African regions to the Joint Convention;
- Organize an interregional workshop to promote the Joint Convention;
- Hold the CNS Officers' Meeting in March 2025 to ensure the effective rotation and training of CNS Officers and progress preparations for the Tenth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety planned for 2026; and
- Organize an educational workshop for the CNS Contracting Parties and an educational workshop for Permanent Mission representatives to provide them with assistance and information on the CNS review process and obligations under the CNS.

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

Trends

10. Information provided in the Agency's Radiation Safety Information Management System (RASIMS) indicates that 88 of the 112 Member States with a published RASIMS profile have a regulatory infrastructure for radiation safety with a 'satisfactory', 'good' or 'very good' level of compliance with Agency safety standards. Compared to the previous year, 12 Member States have improved their profiles by strengthening their regulatory infrastructure.

11. The four IRRS missions and three IRRS follow-up missions conducted in 2024, along with more than 21 requests for missions in 2025 and 2026, highlight the continued commitment of the Member States concerned to strengthening their national legal, governmental and regulatory infrastructure for safety and demonstrate the interest of Member States in Agency review services. The Agency's analysis of IRRS missions conducted in the past year shows that regulatory bodies experience challenges related to coordination and cooperation with other regulatory authorities; long term human resource planning; implementation of a management system, including the lack of clear and documented regulatory processes; and the establishment of regulations for occupational and medical exposure control.

12. Interest in Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) missions remains high. Whereas in previous years, most requests for ARTEMIS missions were made by European countries, in 2025 new requests are also being made by non-European countries.

13. Member States are increasingly interested in enhancing their regulatory infrastructure to ensure a competent workforce at facilities and in activities. Requests for assistance in establishing national strategies for education and training in radiation protection and safety continue, in particular in countries

with multiple regulatory authorities. Some Members States have shown a preference for training their personnel in neighbouring countries rather than developing their own training service providers.

14. Member States have continued improving collaboration and coordination in regulatory infrastructure development by sharing regulatory knowledge and experiences among the members of the Regulatory Cooperation Forum (RCF). In 2024, five RCF activities were implemented, including the holding of a Technical Meeting on strengthening national regulatory infrastructure.

15. There is growing interest among Member States in the elaboration of a general national policy and strategy for safety or in specific technical safety areas. There is high demand for assistance in drafting or reviewing national policy and strategy documents for nuclear safety and security. The Agency has established the School for the Elaboration of National Policy and Strategy Documents for Radiation Safety and Security of Radioactive Material to help meet this demand. This specialized school is open to Member States that are in the process of drafting policy and strategy documents and are committed to completing their drafts while interacting with other countries performing the same exercise. The first pilot school was organized in July 2024 for countries of the Caribbean region and similar schools are planned for countries in other regions, starting in 2025.

16. Interest in integrated missions of the Programme of Action for Cancer Therapy (imPACT), which complement the Agency's flagship Rays of Hope initiative and, among other aspects, aim to assess the capacities and needs of national regulatory infrastructure for radiation safety with a focus on medical facilities, has also increased.

17. Since the launch of the upgraded Regulatory Authority Information System (RAIS+) in 2023, the Agency has reported increasing demand for its implementation, with more than 80 Member States expressing their interest and, as of September 2024, more than 40 official requests for RAIS+ implementation assistance, which the Agency has supported with the available resources. This is in line with the Agency's aim for all current and prospective RAIS users to switch to RAIS+ by the end of 2025.

18. Many regulatory bodies have responsibilities for both nuclear safety and nuclear security. There is growing interest among them in the exercise of regulatory duties that effectively combines nuclear safety and nuclear security aspects without compromising either one. The Agency, through RIDPs, provides specialized assistance to develop the capacities and means to combine regulatory duties for the safety and security of radioactive material. The growing membership of RIDPs confirms this trend. By the end of 2024, RIDPs had been implemented in regulatory authorities in 100 countries, including Member States and States that are not yet members of the Agency (see Figure 4).

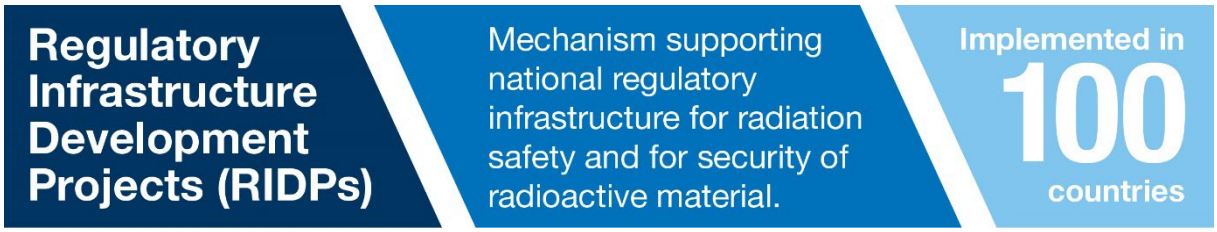

Fig. 4. Number of RIDPs implemented in Member States.

19. The Agency has continued supporting the implementation of the nuclear and radiological safety programme by the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO),

which launched a project on licensing and inspection requirements in proton therapy facilities in March 2024.

Related Activities

20. 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:

- Conduct ARTEMIS missions in Australia and Kenya, and a follow-up ARTEMIS mission in Spain;
- Conduct an Advisory Mission on Regulatory Infrastructure for Radiation Safety and Nuclear Security in Burundi and the Dominican Republic;
- Conduct IRRS missions in China, Hungary, Kenya, Norway, Spain, Thailand and Uganda;
- Continue promoting RAIS+ and assisting Member States in implementing and optimizing their use of RAIS+ through remote assistance, expert missions and regional workshops;
- Organize a two-week School for Drafting Regulations for Waste Safety;
- Organize four workshops for RASIMS coordinators;
- Organize a Regional Workshop on the School for the Elaboration of National Policy and Strategy Documents for Radiation Safety and Security of Radioactive Material;
- Hold a CANDU Senior Regulators' Meeting;
- Hold a Technical Meeting on Integrated Safety Assessment of Nuclear Installations by the Regulatory Body; and
- Hold a Technical Meeting on National Policy and Strategy for Safety and Security.

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

Trends

21. There is a growing interest among Member States in elevating and improving leadership knowledge, skills and attitudes for safety, and an ongoing demand for the organization of educational and training events at the national and regional levels. Building on the success of the first Regional Workshop on Safety and Nuclear Security Culture Values and Approaches for countries in the Caribbean region in November 2023, the Agency plans to organize similar workshops for countries in Asia and the Pacific and in Africa in 2025.

22. Members States have highlighted the need to elevate and improve leadership for safety skills and competencies among the next generation of practitioners.

23. Member States have shown increasing interest in organizing safety culture capacity building events and accessing e-learning resources to further strengthen radiation safety culture in medical radiation uses, especially in relation to the protection of patients.

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

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

26. Member States continue to highlight 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 GNSSN. Efforts to highlight diversity, including the role and number of women in professional positions and in leadership in safety, are being strengthened through cooperation with the Impact Group on Gender Equality in Nuclear Regulatory Agencies.

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

28. 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.

Related Activities

29. 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 to implement the International Schools on Nuclear and Radiological Leadership for Safety;
- Hold a Training Course on Leadership, Management and Culture for Safety;
- Hold a Workshop on Safety Culture Continuous Improvement Process;
- Hold a Regional Workshop on Safety and Nuclear Security Culture Values and Approaches; and
- Develop the programme on the application of a graded approach for safety and security in regulatory programmes, and deliver a regional workshop on this topic.

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

Trends

30. A growing trend in nuclear safety is the need for a strategic approach for capacity building, including the assessment of needs at the organizational, national and regional levels and international cooperation to meet this objective.

31. The Agency is increasing its efforts in capacity building at a strategic level as well as towards enhancing the effectiveness and efficiency of its activities. Specifically for regulatory bodies, the work

plan of RIDPs for the coming years will focus on capacity building events that are aimed at facilitating human resource planning and consider financial, human resources and competence elements in an integrated manner.

32. 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 Secretariat's activities in this area remain on track.

33. The Agency has been aligning its capacity building assistance for regulatory bodies with the priorities of the flagship initiatives, including Rays of Hope, Atoms4Food, Atoms4NetZero and NUTEC Plastics (see Figure 5). These initiatives involve the introduction of modern radiation technologies subject to the authorization and control of national regulatory authorities. The Agency has introduced, and continues to deliver, national and regional training courses adapted to relevant identified needs.

Fig.5. Support to regulatory bodies within Agency's Flagship Initiatives.

34. Demand for radiation protection officer (RPO) training remains high and the train the trainers approach, in combination with comprehensive training packages, continues to be the most effective training method. However, there is an increasing need for more detailed materials to support RPO training.

35. Demand for the Agency's Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radiation Sources remains high and the course is now being run from ten regional training centres in Latin America and the Caribbean, Asia and the Pacific, Europe, and Africa. The Agency is sharpening the focus of the learning objectives for the standard syllabus and seeking to better align the course content across all training centres.

36. There is growing interest in training courses for regulatory bodies on the regulatory control of radiotherapy sources and other medical sources. To enhance its services in this area, the Agency updated the methodology of its national on-demand training course, initiated in 2023, to better complement the assistance provided by the Agency under Rays of Hope, including a new self-training component, a remote (online) training component, and an in-country training component.

37. There is continued interest in the Agency's School of Drafting Regulations on Radiation Safety, which provides assistance to Member States in drafting national regulations in line with Agency safety standards. The school also has a specific programme to provide assistance in drafting national regulations combining radiation safety and security of radioactive material.

38. The Agency has noted increasing demand for competence management and capacity building within regulatory bodies responsible for radiation sources and nuclear safety. The Agency is increasingly combining its activities for regulatory bodies to jointly cover radiation sources and nuclear safety, where appropriate.

39. Many regulatory authorities continue to experience challenges in training new staff to replace outgoing staff, in particular retiring employees. To address these challenges, the Agency has created a comprehensive regional training course for regulators combining duties associated with the safety and security of radioactive material. This training was offered three times in 2023 and 2024 and will be repeated periodically in the future. In addition, the Agency is working on the establishment of a school for regulators to provide full scope training targeting young professionals who have recently begun, or are interested in pursuing, a professional career within their national regulatory authorities.

40. For effective capacity building and in response to Member States' requests, the Agency is extending its e-learning programme in all domains of radiation, transport and waste safety.

41. Member States are increasingly requesting 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, LTO and safety culture. Such requests are made by Member States with existing nuclear installations as well as those considering embarking on nuclear power programmes. There has also been an increase in the number of requests made by Member States embarking on new nuclear power programmes 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.

42. Member States have shown a growing interest in applying the Technical and Scientific Support Organizations Self Capability Assessment (TOSCA) to their technical and scientific support organizations (TSOs) to develop, enhance and sustain capabilities supporting regulatory functions. Two Member States held their TOSCA national workshops and eight additional Member States requested support on the application of the TOSCA methodology for the period 2025-2026.

43. Member State interest in EPR capacity building activities remains high, with 28 requests for support for education and training activities relating to public communication in nuclear and radiological emergencies, emerging technologies in emergency response, and considerations for preparedness and response for nuclear or radiological emergencies triggered by nuclear security events related to the management, use and transport of radiation sources.

Related Activities

44. 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:

- Hold an annual meeting of the Steering Committee on Regulatory Capacity Building;
- Hold the annual meeting of the Steering Committee on Education and Training in Radiation, Transport and Waste Safety;
- Conduct Education Training and Appraisal (EduTA) missions in Cameroon and Malaysia;
- Organize a Technical Meeting on Public Communication in Emergencies: Tackling Misinformation and Retaining Public Trust in Disruptive Information Environments;
- Organize training on strengthening EPR arrangements and on considerations for preparedness and response for nuclear or radiological emergencies triggered by nuclear security events related to the management, use and transport of radiation sources;

- Develop a series of syllabuses to support the training of RPOs working in industry and medicine;
- Continue working on the review and extension of the competence profiles of regulatory staff of nuclear and radiation source facilities and activities in all regulatory core function areas;
- Continue to develop the new publication on competence management for regulatory capacity building;
- Continue efforts to develop additional programmes of the School of Drafting Regulations on Nuclear Safety and Security, combining safety and security regulations for other thematic areas with a focus on waste safety and decommissioning, and develop a training course on the basics of drafting regulations, targeting countries with no prior experience in this area;
- Continue efforts to develop national strategies on building capacities for safety;
- Organize a regional workshop on the organization and staffing of an effectively independent regulatory body;
- Organize a national training course on the regulatory control of radiotherapy practices;
- Organize a regional training course for new regulators on the radiation safety and security of radioactive material; and
- Organize a regional training course on authorization, inspection and enforcement of radiation safety and nuclear security in medical practices.

Research and Development for Safety

Trends

45. Research and development work undertaken in Member States continues to be largely focused on enhancing knowledge related to 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.

46. Member States continue to be interested in the application of rapid characterization techniques for radiological contamination monitoring over large sites.

Related Activities

47. 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 with the implementation of the coordinated research project (CRP) entitled “Climate Change Challenges to the Safety of Nuclear Installations”, including case studies on coastal and river flooding, and the development of guidelines on hazard calculation accounting for projected changes in climate over time.
- Organize a Training Workshop on the Development of Severe Accident Management Guidelines (SAMG) Using the IAEA's SAMG Development Toolkit.

- Continue developing the Safety Report on “Development and Implementation of Severe Accident Management Programmes for Nuclear Power Plants” and the TECDOC of “Safety Aspects of equipment qualification for design extension conditions in nuclear power plant”.
- Continue on the preparation of a TECDOC to capture the results of the Coordinated Research Project (CRP) on “Development a Phenomena Identification and Ranking Table, and a Validation Matrix, and Performing a Benchmark for In-Vessel Melt Retention”.

Strengthening Radiation, Transport and Waste Safety

Radiation Protection of Patients, Workers and the Public

Trends

48. The control, monitoring, assessment and recording of natural radiation exposure of workers in various settings is becoming a key part of occupational radiation protection strategies in Member States. Current occupational exposure data are limited, and national dose registries are being developed or expanded to include natural exposure. Some Member States are modernizing their national dose registries through digitization and automation. The Agency continues to identify and share best practices and provide updated tools for the collection, recording, assessment and reporting of data on doses.

49. A growing trend in occupational radiation protection is the use of ISEMIR, which facilitates data collection to optimize radiation protection for workers in interventional cardiology (ISEMIR-IC), industrial radiography (ISEMIR-IR), and industrial processes involving naturally occurring radioactive material (ISEMIR-N). Member States utilize ISEMIR to strengthen and enhance their legislative and regulatory frameworks for occupational radiation protection, as well as to combine data collection for benchmarking purposes by operators. The Agency is currently planning to expand the system to include research and educational activities and facilities.

50. There is an increasing number of requests for ORPAS review missions, which aim to promote an internationally harmonized approach to occupational radiation protection. To accommodate requests from Member States, the ORPAS self-assessment tool will be upgraded in 2025. One ORPAS mission was conducted in Thailand in 2024, and additional missions are planned for other Member States in 2025.

51. Medical exposure remains the largest human-made source of radiation exposure. Computed tomography (CT) contributes around 62% to the collective effective dose, but only accounts for around 10% of all imaging procedures involving ionizing radiation. The number of installed CT scanners continues to increase. Recurrent imaging has led to high estimated cumulative doses, highlighting the need to enhance patient protection for those requiring multiple procedures. Interventional radiology procedures have increased six-fold in two decades, posing radiation protection challenges. The rapid increase in the use of new types of radiopharmaceuticals in diagnostic and therapy procedures in nuclear medicine requires specific measures to ensure optimal radiation protection of patients. The rise in radiotherapy treatments and image-guided procedures means higher patient doses, and with more radiation-treated cancer survivors, addressing radiation-induced second primary cancer is crucial, an area in which the Agency stands ready to support.

52. Interest from Member States in the publication *Patient Radiation Exposure Monitoring in Medical Imaging* (Safety Reports Series No. 112) has continued to grow. Within the Rays of Hope initiative, steps are being taken to liaise with anchor centres — cancer centres that have decades of experience of

working with the Agency to support their respective region — to provide regional training in radiation safety for patients and staff and radiation safety culture in a medical exposure context.

53. To support Member States' growing interest in having more guidance on the management of existing exposure situations, and based on their feedback and requests, the Agency has recently developed guidance on managing radiation safety in food commodities and for controlling radon exposure for the public and for workers. These publications are being promoted and discussed with Member States to ensure their optimal practical application. Additionally, to facilitate the international trade of non-food commodities containing radionuclides, a dedicated Safety Report is currently under development. Alongside the creation of numerous guidance documents focused on managing specific types of existing exposure situation, the development of overarching guidance for a consistent and harmonized approach to managing all types of existing exposure situation will assist Member States in achieving optimal radiation protection and safety in this challenging field.

Related Activities

54. 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:

- Hold a Technical Meeting on radiation protection challenges in modern nuclear medicine;
- Hold the International Conference on Radiation Protection in Medicine: X-Ray Vision;
- Organize an international symposium on the Information System on Occupational Exposure;
- Contribute to the organization of the 11th International Symposium on Naturally Occurring Radioactive Material (NORM XI);
- Develop draft Safety Reports on radiation protection related to nuclear medicine and on the international trade of non-food commodities;
- Finalize the draft Safety Report on education and training for building and maintaining competence in radiation protection in medicine; and
- Conduct workshops on radiation safety in food in non-emergency situations and on regulatory control of radioactivity in consumer goods.

Control of Radiation Sources

Trends

55. The use of radiation sources in medicine, industry, agriculture and research requires appropriate regulatory oversight to ensure safe and secure management throughout their lifetime and beyond. For radioactive sources in particular, this oversight is performed throughout their lifetime and includes national strategies for managing disused radioactive sources and establishing national programmes and regulatory requirements.

56. Member States continue to request assistance in establishing or enhancing their regulatory infrastructure for safety. The number of requests has been increasing in recent years due to the implementation of Rays of Hope. Member States participating in that initiative are demonstrating an increased commitment to aligning their radiation safety infrastructure with Agency safety standards and are working towards this goal.

57. The Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct) and its supplementary Guidance continues to gain visibility among certain policymakers and regulatory bodies. In 2024, Brunei Darussalam, Kenya, Kuwait and Lao People's Democratic Republic made a political commitment to implementing the Code of Conduct, increasing the total number of Member States that have done so to 153 (see Figure 6).

Fig.6. Number of contracting parties to the Code of Conduct.

58. In 2024, Brunei Darussalam, Kenya, Kuwait, the Kingdom of the Netherlands and Slovakia 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 (Guidance on Import and Export), bringing the total number of Member States that have done so to 139. The number of Member States that have nominated points of contact for facilitating the import and export of radioactive sources in accordance with the provisions of paragraphs 23 to 29 of the Code of Conduct and Guidance on Import and Export remains at 153. Belgium, Brunei Darussalam, Columbia, El Salvador, Kenya, the Republic of Korea, Kuwait, the Republic of Moldova, Slovakia and the United Kingdom (UK) made a political commitment to implementing the supplementary Guidance on the Management of Disused Radioactive Sources, bringing the total number of Member States that have done so to 74.

59. The Agency assists Member States, upon request, in implementing and optimizing their use of RAIS+ through remote assistance, expert missions, regional workshops and the provision of RAIS+ servers. As of 31 December 2024, 20 countries use RAIS+ as their main tool for managing their regulatory control programmes and/or national register of radiation sources. It is expected that the number of Member States using RAIS+ will continue to increase in 2025.

Related Activities

60. ***The Agency will assist Member States in establishing or enhancing their regulatory framework for safety, including 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 its supplementary Guidance, and facilitate the sharing of experience. The Agency is planning to undertake the following related activities***:

- Hold Technical Meetings of technical and legal experts to share experience of the implementation of the Code of Conduct and its supplementary Guidance;
- Continue to engage in high level meetings with policymakers for States that have not yet made a political commitment to the Code of Conduct;
- Conduct the Open-ended Meeting of Technical and Legal Experts on States' Implementation of the Guidance on the Management of Disused Radioactive Sources;
- Conduct the Regional Technical 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;

- Conduct regional training courses on RAIS+; and
- Hold the 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.

Safe Transport of Radioactive Material

Trends

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

62. 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 the design, licensing, operation and transport of these technologies continues to be an important issue for Member States and interaction with the International Maritime Organisation (IMO) both within the framework of individual working groups and within the framework of scientific and technical events and conferences will continue.

63. Member States continue to request support for the application of Agency safety standards through education and training on the safe transport of radioactive material, including the classification, design, assessment and approval of transport packages for fissile material. Many of these requests continue to come from Member 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. The availability of the e-learning tool for the safe transport of radioactive material in the official Agency languages is widely acknowledged and the Agency will continue to develop additional modules as needed.

Related Activities

64. 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:

- Conduct a Regional Workshop on the Design Safety Assessment of Transport Packages Containing Radioactive Material;
- Hold a meeting of the Denial of Shipment Working Group;
- Conduct a Regional Workshop for National Focal Points on Denial of Shipment;
- Hold a Technical Meeting on regulatory challenges in the transport of SMRs TNPPs;
- Hold a regional workshop on *Safe Transport of Radioactive Material* (Training Course Series No. 1); and
- Hold a regional workshop on inspection programmes for the transport of radioactive material; and
- Develop e-learning material linked with transport safety.

Decommissioning, Spent Fuel Management and Waste Management

Trends

65. In parallel with a renewed interest in nuclear technology, past generations of facilities continue to close and/or reach the end of their lifetime. As the number of nuclear decommissioning projects increases, so too does the need for Member States to develop and implement national decommissioning frameworks, strategies and plans. This leads to increased interest in the release of sites from regulatory control following clean-up.

66. Since the publication of the General Safety Guide *Application of the Concept of Clearance* (IAEA Safety Standards Series No. GSG-18) in 2023, interest in this topic has extended to the concept of specific clearance to support decisions on whether material containing levels of radioactivity slightly above the generic clearance levels can be safely recycled or disposed of in conventional landfills. Further, interest has been expressed regarding the application of the concept of clearance to residues containing NORM.

67. Despite international consensus that disposal is the ultimate solution for radioactive waste, in many countries some or all of the waste remains in storage. Member States continue to seek Agency assistance in developing and implementing safe interim waste management solutions (such as storage) and, increasingly, advice is requested regarding the management of extended storage (storage beyond the original design life of the storage facility). Assisting Member States in planning for and implementing national disposal programmes remains an ongoing priority for the Agency.

68. 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, from geological disposal of high level radioactive waste and spent fuel to near surface disposal of very low and low level radioactive waste. In 2025, the Agency will focus on the evolving safety case when providing support to Member States. Interest in associated methods and competence for radiological and environmental impact assessment (REIA) undertaken as part of safety assessments has also continued to grow.

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

70. Interest expressed by Member States in green energy and SMRs continued to increase in 2024, and with it the need to ensure that safe and sustainable decommissioning and management of radioactive waste and discharges are considered by vendors at the design stage and by Member States when creating an enabling environment for successful implementation. The Agency has provided for information exchange on this topic, which will continue into 2025.

71. Predicted increases in the demand for uranium, thorium and precious metals are likely to lead to increases in mining and mineral processing. As such, steadfast work on the decommissioning of uranium production facilities began in 2024, and guidance and support regarding the management of NORM residues continued.

72. In 2024, a review was conducted of findings from ARTEMIS peer review missions. The most common findings were related to national policies, strategies and frameworks for radioactive waste management. Efforts to finalize the first draft of a Safety Guide on national policies and strategies for the safety of radioactive waste and spent fuel management, decommissioning and remediation were reinvigorated accordingly.

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

Related Activities

74. 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:

- Conduct an interregional workshop to present and discuss the regulatory approaches for specific clearance levels and their establishment;
- Conduct a technical workshop on consistent approaches and tools to undertake REIA for humans and non-human biota under the Methods for Radiological and Environmental Impact Assessment (MEREIA) programme for a range of scenarios;
- Organize a Technical Meeting on the Safety of Radioactive Waste and Spent Fuel Management, and the Decommissioning of SMRs; and
- Conduct an international workshop of the Regulatory Forum for Safety of Uranium Production and Naturally Occurring Radioactive Materials (REGSUN).

Radiation Protection of the Environment and Remediation

Trends

75. There is continued interest in the Agency's safety review of the discharges of ALPS treated water at the Fukushima Daiichi nuclear power station following the publication of the Agency's comprehensive report in 2023, and the commencement of discharges into the sea by 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. In September 2024, the Agency agreed with Japan to implement additional measures, which focus on promoting transparency, expanding international participation and building trust, allowing hands-on independent measurements of the radionuclide concentrations in the environment and in the ALPS-treated water. Through additional measures, third parties can independently verify that radionuclide concentrations are consistent with international safety standards.

76. 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.

77. 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.

78. Observations from Agency missions continue to show that the use of a wide range of nuclear techniques and applications 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. The MEREIA programme continues to expand to meet Member State needs, covering diverse scenarios in which assessment of doses to the public and the environment is needed.

79. The relaunch of DIRATA for atmospheric and liquid discharges from nuclear facilities has led to more Member States submitting their discharge data, providing a resource for Member States, including for assessing doses to the public and the environment.

80. In 2024, the Agency's support to Member States in the management of uranium legacy sites expanded from Central Asia to Africa. This work is focused on the prevention of new legacies as well as the remediation of existing legacies.

Related Activities

81. 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:

- Conduct a regional workshop to present and discuss approaches for baseline REIA for Member States developing competence in this area;
- Conduct a training workshop on the practical application of REIA for young professionals in Member States developing expertise in the topic;
- Develop a draft Safety Report on consistent fit-for-purpose approaches for undertaking REIA for a range of scenarios;
- Hold a meeting of national counterparts and interested Member States on the use and further development of the Database on Discharges of Radionuclides to the Atmosphere and Aquatic Environment (DIRATA);
- Hold the Annual Meeting of the International Working Forum on Regulatory Supervision of Legacy Sites (RSLS);
- Hold the Annual Meeting of the Agency's Coordination Group for Uranium Legacy Sites (CGULS); and
- Organize a Technical Meeting on the drafting of the baseline technical document for CGULS Africa.

C. Strengthening Safety in Nuclear Installations

Nuclear Power Plant Safety

Operational Safety

Trends

82. The Agency has delivered 227 OSART missions and 167 follow-up OSART missions since the service was launched over 40 years ago. OSART missions continue to identify recommendations and suggestions regarding setting, communicating and implementing management expectations, strengthening the conduct of safe operations, optimizing maintenance activities, enhancing operating experience feedback practices and strengthening accident management and on-site EPR.

83. The Agency encourages Member States to report NPP events in the International Reporting System for Operating Experience (IRS) database to share events with all relevant Member States and to enhance the use of operating experience for safety. Analysis of data from 65 reports submitted to the IRS database in 2024 has indicated a continuing need to learn from events related to human performance, ensure equipment reliability, and improve in the areas of operations, maintenance fundamentals, leadership, management and oversight of processes and practices.

84. Nuclear power reactors around the world have programmes to address LTO and ageing management. As of 31 December 2024, approximately 67% of the 415 operating power reactors have been in operation for 30 years or more and approximately 35% have been in operation for 40 years or more.

85. 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.

86. The International Generic Ageing Lessons Learned (IGALL) programme continues to support Member States by providing a technical basis and practical guidance on managing ageing of mechanical, electrical and instrumentation and control (I&C) components and civil structures of NPPs important to safety. The programme includes the sharing of proven practices in the oversight of ageing management and preparedness for the long term operation of NPPs.

87. SALTO missions continue to assist in identifying areas for improvement in the preparedness of NPPs for LTO, in particular in the areas of safety assessments, including ageing, knowledge and competence management. The Agency will prioritize supporting NPPs in preparing for LTO, while at the same time supporting the safety of new advanced technologies.

Related Activities

88. 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 Technical Meetings to collect Member State experience in the use of *Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-48) and to train new SALTO reviewers to improve preparedness for future SALTO missions;

- Organize the annual Technical Meeting for National Coordinators of the International Reporting System for Operating Experience on Recent Events at Nuclear Power Plants to share operating experience and train users in the use of the IRS database;
- Organize a performance improvement training course for operators and regulators, following the Peer Review of Operational Safety Performance Experience (PROSPER) Guidelines;
- Hold a Technical Meeting on the evolution and effectiveness of the OSART service; and
- Hold a series of meetings of the four IGALL working groups.

Site Safety and External Hazards

Trends

89. 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 are concerned with the evaluation of new sites, conservatism in hazard assessments, evaluation of the impact of climate change on the safety of nuclear installations, and safety assessment (resilience evaluation) of current designs and the existing fleet.

90. The Agency continues to receive requests from Member States for SEED review missions, expert missions and capacity building and training workshops, in particular in countries embarking on SMR deployment.

91. There continues to be increased interest in investigating and reporting on the resilience and robustness of existing NPPs, as well as those under construction or in the licensing process, to withstand unanticipated external events. 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.

92. Member States have expressed further interest in interactive tools that can help to estimate the potential for exceeding design bases at nuclear facilities, thereby enabling the effective mitigation of associated risks. The Agency continues to operate 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.

Related Activities

93. 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 the International Conference on Resilience of Nuclear Installations against External Events from a Safety Perspective — Focus on Climate Change;
- Organize a Technical Meeting on the Optimization of Protection of Small Modular Reactors in Relation to External Events; and
- Support Member States in capacity building through education and training activities.

Design Safety and Safety Assessment

Trends

94. Several Member States have expressed renewed interest in nuclear power in a number of Member States, including in the construction of new NPPs and in planning for the LTO of many existing plants. There is also a strong interest in accelerating the ability to produce energy from fusion.

95. Such projects require a comprehensive set of safety standards on safety assessment and design safety, as well as the necessary capabilities for their rigorous application. The safety standards developed in these areas will continue to be revised as necessary to ensure that they represent state-of-the art knowledge. The safety standards will need to establish requirements and provide recommendations that are fully applicable to new technologies. The development of knowledge and competence in multiple technical areas is necessary to foster the rigorous application of the safety standards. These standards will be supplemented by more detailed informational publications such as Safety Reports or IAEA Technical Documents (TECDOCs) that provide practical examples of best practices, share experiences among interested parties and are of direct assistance to Member States.

96. Member States continue to express interest in sharing experience of 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.

97. There continues to be growing interest in the harmonization of national 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 cross-cutting areas such as the reliability of digital instrumentation and control, passive safety systems, new materials, the use of insights from safety analysis for security purposes, advanced manufacturing, and risk analysis in a multi-unit and multi-source context or for multi-module interactions.

98. Member States continue to revise severe accident management guidelines 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 guidelines, is acknowledged as an important contributor for demonstrating the practical elimination of plant event sequences that could lead to an early or large radioactive release.

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

100. 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.

101. The Agency will continue working with Member States in new areas of growing interest and develop guidance in areas such as the safety demonstration of innovative technologies in NPPs, including design safety considerations regarding fusion facilities, non-water-cooled reactors and TNPPs

and the safety implications of the use of artificial intelligence (AI) in NPPs. Several Member States are expressing an interest in the peaceful uses of nuclear power for propulsion of ships.

Related Activities

102. 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:

- Hold a Technical Meeting on Demonstration of Defence in Depth Implementation Using Probabilistic and Deterministic Approaches for Nuclear Power Plants;
- Hold a Technical Meeting on Progress in the Performance Assessment and Regulation of Passive Safety Systems in Advanced Nuclear Power Plant Designs;
- Hold the Joint IAEA–Generation IV International Forum Workshop on the Safety of Non-Water Cooled Reactors;
- Hold a Technical Meeting on safety considerations in non-water-cooled reactor fuel and core design;
- Conduct a workshop on the application of the concept of defence in depth and practical elimination;
- Hold a Technical Meeting on deterministic safety analysis for operational states and accident conditions for NPPs;
- Hold a Technical Meeting on design safety, safety assessment and regulatory activities to facilitate further development and future deployment of fusion facilities;
- Hold a Technical Meeting on safety considerations in the use of AI in NPPs with a focus on human factors engineering and instrumentation and control systems; and
- Develop a TECDOC provisionally entitled “Safety and Security Implications of the Use of Artificial Intelligence in Nuclear Installations”.

Safety of Small Modular Reactors

Trends

103. There is a sustained interest among Member States in the development and deployment of evolutionary and innovative reactor technologies, either as large size reactors or SMRs and microreactors. With nearly 70 SMR designs under development across the world, for these new technologies, nuclear safety and security are considered as early as possible in the development of the design. Based on the findings in *Applicability of IAEA Safety Standards to Non-Water Cooled Reactors and Small Modular Reactors* (Safety Reports Series No. 123), the Agency will focus on the preparatory work for developing or revising, as appropriate, the safety standards to ensure that advanced reactor technologies (including high temperature gas cooled reactors, liquid metal cooled fast reactors and molten salt reactors) and FNPPs are considered. For example, the Safety Guide *Licensing Process for Nuclear Installations* (IAEA Safety Standards Series No. SSG-12) is currently under revision and will include information dedicated to the licensing of SMRs. These standards will be supplemented by more detailed informational publications providing practical examples of best practices.

104. To support the future of nuclear power, rigorous application of the safety standards will be supported by advisory and TSR services and the delivery of safety assessment and design safety competency building programmes to ensure "the highest level of safety that can reasonably be achieved" as per the *Fundamental Safety Principles* (IAEA Safety Standards Series No. SF-1).

105. Member States have shown continued interest in the NHSI. Close to 30 regulatory bodies, in addition to industry representatives, have participated in the working groups and activities of the Regulatory Track and have successfully completed the first phase of its work. Three technical documents on regulatory cooperation have been finalized and provide a framework to enable the sharing of information among regulatory bodies to facilitate cooperation, a multinational pre-licensing joint regulatory review process, and a process to leverage the reviews of other regulators and for regulators to work together during ongoing regulatory reviews.

106. The Agency's first International Conference on Small Modular Reactors and their Applications, held in October 2024, was attended by 97 Member States and 18 international organizations (see Figure 7). The purpose of the conference was to provide an international forum to take stock of progress and discuss the opportunities, challenges and enabling conditions for the accelerated development and safe and secure deployment of SMRs among all possible stakeholders. The conference attracted over 1200 participants representing potential users and operators, regulatory bodies, relevant industries and technology holders, government officials, technical support organizations, representatives of international organizations, and technical and legal experts working in all areas of SMRs and nuclear power programmes. The conference covered various aspects related to safe and secure SMR deployment, including: SMR design, technology and fuel cycle; legal and regulatory frameworks; safety, security and safeguards; and considerations to facilitate deployment of SMRs.

Fig.7.Participation at the International Conference on Small Modular Reactors and their Applications.

107. The membership of the SMR Regulators' Forum has continued to grow, with the Kingdom of the Netherlands joining in March 2024, bringing the total number of participating Member States to 12.

108. 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 siting and design licensing of SMRs and other safety matters relating to SMRs. Several Member States are in the process of requesting TSR services for SMR designs as well as SEED review missions.

109. Member States embarking on SMR technologies continue to express the need for guidelines for the deployment of SMRs, in particular the development of suitable frameworks for a graded approach to siting, design and licensing.

Related Activities

110. 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:

- Conduct a workshop for senior officials in embarking Member States which will cover, at a high strategic level, a wide range of topics related to the deployment of SMRs;
- Deploy the pilot of the SMR Safety Academy, a two-week training course composed of a basic module followed by a focus on improving embarking Member States' practical knowledge of conducting or preparing to a receive design safety review of SMRs; and
- Commence the work to review, in consultation with the Safety Standards Committees, *Safety of Nuclear Power Plants: Design* (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1)), principally, but not only, to address the findings in *Applicability of IAEA Safety Standards to Non-Water Cooled Reactors and Small Modular Reactors* (Safety Reports Series No. 123).

Research Reactor Safety

Trends

111. Feedback from Agency activities continues to show 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.

112. Around 30 Member States continue to plan or implement 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.

Related Activities

113. The Agency will provide assistance to Member States in 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 a Technical Meeting for the National Coordinators of the Incident Reporting System for Research Reactors (IRSRR);
- Hold a Workshop on Periodic Safety Review for Research Reactors; and
- Hold a Technical Meeting on the Safety of Research Reactors Under Project and Supply Agreements and Review of their Safety Performance Indicators.

Fuel Cycle Facility Safety

Trends

114. In 2024, 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 312. 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. Forty-one Member States, which account for more than 92% of the world's nuclear fuel cycle facilities, are currently part of the system, reflecting an increase from previous years.

115. 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.

116. Member States continue to be interested in establishing systematic ageing management programmes and processes for PSRs of fuel cycle facilities, including the development of the corresponding regulatory competencies.

Related Activities

117. 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:

- Hold a workshop on preparation for decommissioning of nuclear fuel cycle facilities; and
- Hold a workshop on the use of a graded approach in the application of safety requirements for nuclear fuel cycle facilities.

Safety Infrastructure for Countries Embarking on Nuclear Power or Research Reactor Programmes

Trends

118. Over 30 Member States are considering or planning a new nuclear power programme. Of those, and within the framework of the IAEA Milestones approach, 20 are in the decision making phase, 12 are in the post-decision making phase, and 3 have started construction of their first NPP. In addition, about 20 Member States have identified nuclear power as a potential option for inclusion in their long term national energy strategy. 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 programme after several decades of dormant construction activity.

119. 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 legal and regulatory oversight programmes for embarking countries.

120. SEED safety reviews and capacity building in the field of site selection, site evaluation, and the design and safety assessment of nuclear installations in relation to external events are continuously requested by embarking countries.

121. According to *Establishing the Safety Infrastructure for a Nuclear Power Programme* (IAEA Safety Standards Series No. SSG-16 (Rev. 1)), the regulatory body should be well established by the end of Phase 2 of the IAEA Milestones approach for introducing a nuclear power programme. However, it has been observed that some embarking countries tend to invite an IRRS mission only at Phase 3. To encourage embarking countries to host an IRRS mission at Phase 2 of the development of their safety infrastructure, the Agency offers a complementary mission addressing the implementation of relevant actions from the first two phases. A subsequent IRRS mission, including a review of the regulatory oversight of an NPP, could then be hosted in Phase 3.

122. The Generic RoadMap (GRM) project continues to assist embarking countries to develop the infrastructure for nuclear safety for the licensing of a first nuclear reactor through sharing practical guidance on the implementation of safety actions recommended in SSG-16 (Rev. 1), incorporating Member States' lessons learned, challenges and best practices. It has been observed that more embarking countries are interested in the GRM, seeking the knowledge recently shared by experienced, expanding and advanced embarking countries (see Figure 8).

Fig.8. Agency assistance to embarking countries with Generic RoadMap project.

123. 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

124. The Agency will assist Member States in developing a safety infrastructure for new nuclear power and research reactor programmes. The Agency is planning to undertake the following related activities:

- Continue to assist embarking countries in the enhancement of their regulatory framework, regulatory infrastructure and regulatory capabilities for effective regulatory supervision of their nuclear power programmes;
- Hold the Meeting of the Steering Committee of the Regulatory Cooperation Forum and Support Meeting;

- Hold an RCF workshop on experience from cooperation between regulators of the recipient and technology providers and one on knowledge management and management systems;
- Hold a Technical Meeting on guidelines for the GRM to develop the infrastructure for nuclear safety for a first nuclear reactor;
- Hold a Technical Meeting on experiences of Member States in the construction and commissioning of new nuclear reactors (GRM);
- Hold a workshop on assessment of the national nuclear infrastructure to support a new research reactor project; and
- Hold a workshop on milestones for a new research reactor programme.

Strengthening Emergency Preparedness and Response

Arrangements for Information Exchange, Communication and Assistance

Trends

125. Effective information exchange and emergency communication remain a priority for Member States. In 2024, the Agency was informed by competent authorities, or became aware through earthquake alerts or media reports, of 178 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.

126. To date, 43 of the 129 States Parties to the Assistance Convention have registered National Assistance Capabilities[1] in the Agency's Response and Assistance Network (RANET). New or updated registrations were received in 2024 from Canada and the United Arab Emirates (UAE).

127. 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 51 in 2024, with an additional 2 Member States (Georgia and Morocco) providing radiation monitoring data routinely.

128. There is a growing interest among Member States in capacity building to strengthen preparedness to communicate effectively with the public and the media in a nuclear or radiological emergency and, in particular, to mitigate misinformation and disinformation, either in the context of actual or perceived emergencies with no safety significance. There is also a growing interest from Member States in the impact of AI on public communication in nuclear emergency response.

Related Activities

129. 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:

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[1] 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".

- Hold the International Conference on Nuclear and Radiological Emergencies: Building the Future in an Evolving World, in Riyadh;
- 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; 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 a social media simulator when appropriate.

Harmonization of Arrangements for Preparedness and Response

Trends

130. Member States continue to request training events on strategy development and management of preparedness and response to combined events, which are situations where a nuclear or radiological emergency occurs simultaneously or sequentially with another hazardous event or condition, such as a natural disaster, or multiple technological failures, thus amplifying the complexity and risk of managing the emergency.

131. Member States have continued high interest in using the Emergency Preparedness and Response Information Management System (EPRIMS). As of 2024, 130 Member States have appointed national EPRIMS coordinators, with a total of 550 users. There was no significant change in the number of published modules in 2024. 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.

132. An analysis of Member State EPRIMS self-assessments in 2024 shows the lowest level of implementation for managing radioactive waste in an emergency and for staffing for response organizations. The requirements with the highest level of implementation continue to be those related to EPR infrastructure.

133. 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.

134. Member States, in particular 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

135. ***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 the revision of *Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSR Part 7) to integrate user feedback and to adapt the publication for new technologies;
- 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 publication.

Testing Readiness for Response

Trends

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

137. The participation of Member States in Level 1 (ConvEx-1) and Level 2 Convention Exercises (ConvEx-2) continues to be high for the majority of exercises (see Figure 9).

138. The percentage of emergency contact points that confirmed a test message via the Unified System for Information Exchange in Incidents and Emergencies (USIE) website and through other communication channels such as email and fax during communication tests decreased to 42% in 2024, in comparison with 51% in 2023. The Agency is continuing to engage with contact points to ensure that such communication channels remain effective.

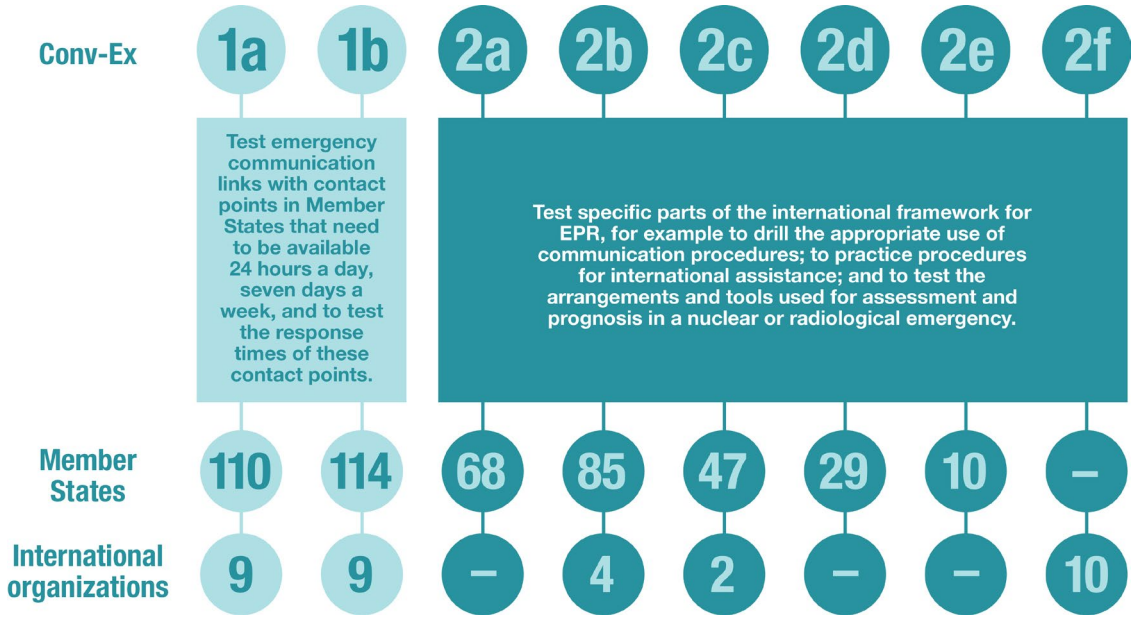


Fig. 9. Participation of Member States and international organizations in ConvEx exercises in 2024.

Related Activities

139. ***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 to 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;

- Support Member State requests for Agency participation in national and/or specific exercises organized by Member States;

- Conduct the seventh ConvEx-3 exercise (hosted by Romania) in June 2025, introducing new elements such as a regional collaboration approach (with Bulgaria and the Republic of Moldova), nuclear security aspects (cybersecurity and physical protection), and an integrated approach to planning, execution and evaluation; and

- Hold a Technical Meeting following the ConvEx-3 exercise, with a focus on analysing the exercise outcomes, identifying lessons learned, and discussing improvements in EPR.

Improving Management of the Safety and Security Interface

Trends

140. Member States continue to encourage the Secretariat to facilitate a coordination process to address safety and security interfaces, while recognizing the distinction between nuclear safety and security.

141. The Agency is placing more emphasis on assisting Member States in the effective management of the interface between radiation safety and nuclear security to avoid undue interference between safety measures and security measures. This is in response to the increasing number of Member State requests for Agency peer reviews to evaluate management of the interfaces between safety and security. The Agency also plans to address this emerging issue by developing Safety Guides and other publications, holding Technical Meetings and conducting training courses, including on the leadership and cultural aspects associated with the interfaces between safety and security.

142. There is an increasing demand from Member States to include in the work programme of RIDPs assistance for the effective management of the interfaces between safety and security at the national and organizational levels. The Agency is therefore planning additional capacity building activities for regulatory authorities to effectively address the regulatory control of safety and security interfaces, including the interfaces between safety culture and nuclear security culture.

143. The Agency's IRRS missions include one module devoted to the interfaces of safety with nuclear security. Furthermore, the Agency's Regulatory Infrastructure for Radiation Safety and Nuclear Security (RISS) peer review missions continue to provide advice to requesting Member States on the establishment or enhancement of their regulatory framework for radiation safety and nuclear security.

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

Related Activities

145. ***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:***

- Develop the methodology of a capacity building programme for regulatory bodies on the effective management of the interface between radiation safety and security of radioactive materials;
- Assist DSRS removals through the evaluation of removal bids by the relevant Agency safety and security organizational units; and
- Continue to offer the module on interfaces of safety with nuclear security under IRRS missions, and continue to provide RISS peer review missions to requesting Member States to establish or enhance their regulatory framework for radiation safety and nuclear security.

Supporting Member States on Nuclear Law and Legislative Assistance

Strengthening Nuclear Legal Frameworks

Trends

146. Nuclear law continues to be an essential prerequisite for the safe, secure and peaceful uses of nuclear technology and its applications. The continuing advancement of international and national nuclear law is key to promoting, maintaining and responding to new challenges across the nuclear field in the coming years.

147. An increasing number of Member States are joining international legal instruments for nuclear safety and security under the auspices of the Agency. There is therefore increased demand on the Agency to provide its services in this regard, including those aimed at raising awareness of the relevant instruments, supporting the establishment and strengthening of corresponding comprehensive national nuclear legal frameworks, and ensuring capacity building and training of officials in nuclear law. Consequently, Member States continue to show significant interest in the activities of the Agency's legislative assistance programme.

148. The 15 requests for reviews of draft and enacted nuclear legislation conducted in 2024 showed the commitment of Member States to establishing and strengthening robust national nuclear legal frameworks. The tailored approach to nuclear law has been developed by the Secretariat with the aim of addressing the needs of individual Member States in nuclear lawmaking and taking into account the extent of their activities with radiation sources.

149. Fundamental to effective nuclear law-making are well informed decision makers, policymakers and other knowledgeable senior officials, as well as legislatures. There is increasing interest from some Member States in raising their awareness of the benefits and implications of joining the international legal instruments, in the elements of comprehensive national nuclear legal frameworks, as demonstrated by the number of requests for such activities in 2024, which included 17 bilateral legislative assistance activities and four interregional, regional and subregional workshops. Member States interested in SMRs continue to seek information on the applicable legal frameworks.

150. Member States' interest in the need for further support in strengthening the knowledge and expertise of officials in nuclear law in order to enhance national capacities is evidenced by the increasing number of requests to attend the Agency's annual Nuclear Law Institute (NLI), an intensive nuclear law course

with a focus on legislative drafting. In response to an increased interest for training in nuclear law, the first Advanced Interregional Training Course on Nuclear Law was held in November 2024.

151. Globally, academic opportunities to study nuclear law are limited. Through the pilot university partnership initiative on nuclear law launched by the IAEA Director General in 2022, the Agency is supporting the establishment of postgraduate courses in nuclear law at the six participating institutions in Argentina (University of Buenos Aires), Brazil (Nuclear Engineering Institute of the National Nuclear Energy Commission), Egypt (Alexandria University), Jamaica (University of the West Indies), South Africa (University of the Witwatersrand), and the UAE (Khalifa University of Science and Technology) (see Figure 10). In May 2024, the University of Buenos Aires became the first university to launch a postgraduate course. The other five institutions are expected to launch their courses in late 2025.

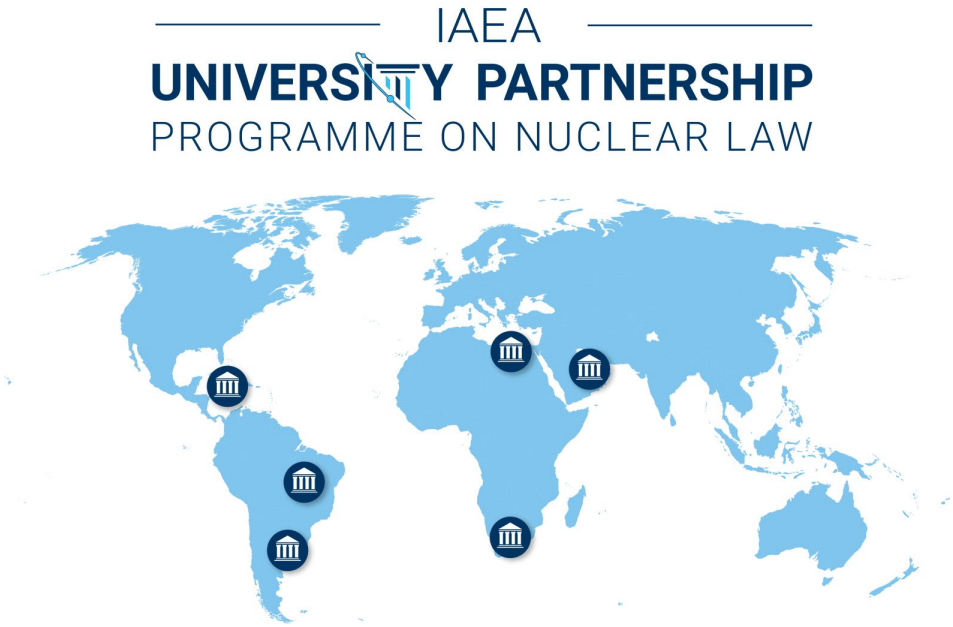


Fig.10. Institutions participating in IAEA University Partnership Initiative Programme on Nuclear Law.

Related Activities

152. The Agency will provide legislative assistance to Member States, on request, through workshops, meetings, missions, advice and training to support them in establishing and strengthening their national nuclear legal frameworks and in joining and committing to the relevant international legal instruments. The Agency will continue supporting the launch and implementation of postgraduate courses in nuclear law, at the six institutions participating in the pilot university partnership initiative on nuclear law. The Agency is planning to undertake the following related activities, on request of Member States:

- Continue to review draft and enacted national nuclear legislation and provide comments thereon;
- Continue to engage in high level meetings on nuclear law with decision makers, policymakers and senior officials, as well as legislatures;
- Continue to organize national, subregional and regional workshops and meetings on nuclear law for officials;

- Advance the development of a tailored approach to national nuclear law for Member States with limited facilities and activities including those with a limited number of low category radioactive sources;
- Hold the annual NLI; an intensive nuclear law course with a focus on legislative drafting; and
- Hold advanced regional training courses on nuclear law for officials in French and Spanish.

Strengthening Civil Liability for Nuclear Damage

Trends

153. 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. Member States continue to work towards establishing a global nuclear liability regime that addresses the concerns of all States that might be affected by a nuclear accident or incident with a view to providing appropriate compensation for nuclear damage, and to give due consideration to the possibility of joining the international nuclear liability instruments as a step towards achieving such a global regime.

154. Member States continue to request the Agency to assist them in their efforts to adhere to the international nuclear liability instruments, taking into account the recommendations on how to facilitate the achievement of a global nuclear liability regime that were adopted by the International Expert Group on Nuclear Liability (INLEX) in 2012[2], 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.[3]

155. The Convention on Supplementary Compensation for Nuclear Damage (CSC) is the instrument covering the greatest number of reactors worldwide. Significantly, there continues to be increased adherence to the other nuclear liability instruments adopted under IAEA auspices, namely the Vienna Convention on Civil Liability for Nuclear Damage (the 1963 Vienna Convention), the Vienna Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (the 1997 Vienna Convention), the CSC and the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (the 1988 Joint Protocol). More particularly, since January 2019:

- 6 countries joined the 1963 Vienna Convention (Benin (2019), El Salvador (2024), Ghana (2020), Morocco (2022), Rwanda (2019), Zimbabwe (2023));
- 4 countries joined the 1997 Vienna Convention (Benin (2019), Ghana (2020), Uruguay (2024), Zimbabwe (2023));
- 7 countries joined the 1988 Joint Protocol (Benin (2019), Belgium (2024), Ghana (2020), Montenegro (2019), Morocco (2022), Switzerland (2022), Zimbabwe (2023); and
- 1 country joined the CSC (Benin (2019)).

[2] The 2012 INLEX recommendations are available at: https://www.iaea.org/sites/default/files/17/11/actionplan-nuclear-liability.pdf.

[3] The 2022 INLEX Statement is available at: inlex-22nd-meeting0922.pdf (iaea.org).

Related Activities

156. 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 adopted under IAEA auspices, 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 and a workshop for diplomats on nuclear liability;
- Serve as the secretariat for the Contracting Parties and Signatories to the CSC and support the implementation of CSC-related outreach activities;
- Undertake outreach activities on nuclear liability upon request by Member States; and
- Continue to support Member States, upon request, in their efforts to adhere to the international nuclear liability instruments and adopt or revise national legislation on nuclear liability.

Technical Support and Assistance to Ukraine

Trends

157. 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 continued sharing information with Member States, international organizations and the public on the nuclear safety and security situation in Ukraine.

158. The Agency maintained the continued presence of its staff at the five nuclear sites in Ukraine (the KhNPP, the SUNPP, the RNPP, the ZNPP and the ChNPP site) without any interruption, and continued to provide other technical support and assistance to help ensure the safe and secure operation of nuclear facilities and activities involving radioactive sources in Ukraine through its comprehensive programme of assistance (see Figure 11). This programme, in addition to continued presence and other in-person missions, includes delivering nuclear safety- and security-related equipment, providing medical assistance for Ukrainian operating personnel, and providing assistance with radiation safety and nuclear security of radioactive sources and for mitigating the consequences associated with the destruction of the Kakhovka dam.

Fig.11. The Agency's technical support and assistance to Ukraine (2022-end 2024).

159. In 2024, the Agency expanded the assistance programme to Ukraine by taking a more proactive stance to help ensure stability of critical energy infrastructure so that it does not impact nuclear safety. Agency staff present at the five nuclear sites in Ukraine continued to monitor and assess the situation against the seven indispensable pillars for ensuring nuclear safety and security during an armed conflict

('Seven Pillars') that were first outlined on 2 March 2022. Agency staff present at the ZNPP continued to monitor and report on observance of the five concrete principles for protecting the ZNPP ('Five Principles') established on 30 May 2023.

160. The armed conflict continued to threaten nuclear safety and security in Ukraine throughout 2024. The KhNPP, the RNPP and the SUNPP continued to operate safely and securely despite the challenging circumstances imposed by the armed conflict. However, the military activities on the territory of Ukraine resulted in frequent reports of drones observed flying in close proximity to the NPPs, frequent air raid alarms at the sites and impacts on energy infrastructure, resulting in instability of the electrical grid and increasing the risk to the safe and secure operation of the plants.

161. In 2024, the situation at the ZNPP continued to be precarious, with all Seven Pillars being compromised fully or partially. On 7 April 2024, the ZNPP suffered direct attacks, threatening its physical integrity and the overall nuclear safety and security of the site, in violation of the first of the Five Principles. Military activities including explosions, drone attacks and gunfire in the vicinity of the ZNPP, as well as the presence of Russian armed troops and military equipment on site, continued to be reported and to put the Five Principles and the overall nuclear safety and security of the plant at great risk.

162. The Agency continued to cooperate closely with Member States and international organizations in the interests of efficiency.

Related Activities

163. 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, across all components of the comprehensive programme of assistance;
- 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; and
- Continue close cooperation with Member States and international organizations to ensure efficiency in the provision of technical support and assistance.

Appendix A

Agency Activities in 2024

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 2024, including all safety standards issued in 2024, is provided in Appendix B.

2. The Agency's peer review and advisory services continued to be provided upon request. The Agency conducted 46 peer review and advisory services across all safety areas in 2024 (see Figure A).

Fig. A. Number of Agency peer review and advisory services conducted in 2024.

3. The Agency conducted four initial IRRS missions: to the IAEA radiation safety and security regulator in September–October 2024, in Bulgaria and in the Republic of Korea in November 2024, and in Ghana in November–December 2024. Three IRRS follow-up missions were conducted: in the UK in January 2024, in Canada in June 2024 and in Latvia in October 2024.

4. The Agency conducted one ORPAS mission in Thailand in March 2024, the country's first.

5. The Agency encouraged Member States to request TSR services for the conceptual design of SMRs in 2024 and conducted three TSRs on Design Safety (TSR-DS): one for Rolls-Royce SMR Limited in

the UK in June 2024, one for the SALUS-100 reactor conceptual design in the Republic of Korea in October 2024, and one for NuScale US460 in the United States of America (USA) in December 2024.

6. The Agency held two Independent Safety Culture Assessment (ISCA) missions: in Canada in September 2024 and in Spain in October 2024.

7. In 2024, the Agency conducted five OSART missions: to Nogent NPP in France in May, to Temelin and Dukovany NPPs in the Czech Republic in September and October respectively, to Paks NPP in Hungary in November, and to Kozloduy NPP in Bulgaria in November. Five OSART follow-up missions were conducted in 2024: to Shin-Kori NPP Units 3 and 4 in the Republic of Korea in June, to Wolf Creek NPP in the USA in August, to Olkiluoto NPP Units 1 and 2 and to Olkiluoto NPP Unit 3 in Finland in September, and to Tihange NPP Unit 3 in Belgium in October.

8. In December 2024, the Agency conducted a PROSPER support mission to assess and improve three areas (management observation and coaching, human performance programme, and leadership and management for performance improvement) at Embalse NPP in Argentina.

9. In April 2024, a third analysis of ARTEMIS missions conducted in Member States in the European Union, as well as a summary of the findings of full scope ARTEMIS missions implemented from 2017 to 2023, were published.

10. The Agency held a Regional Workshop on Lessons Learned from ARTEMIS Missions in Vienna in July 2024. It also held a consultancy meeting to develop a summary report on good practices identified during ARTEMIS missions conducted during the period 2017–2023, in November 2024.

A.2. International Safety Conventions

11. The Agency held a Working Group Meeting of the Contracting Parties to the Convention on Nuclear Safety in March 2024 to consider potential changes to the CNS processes with a view to enhancing their effectiveness and efficiency. The Agency also held the Third Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety in September 2024 in Vienna, where 13 proposals for improvement of the CNS review process were adopted.

12. The Agency held the Organizational Meeting for the Tenth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety in Vienna in September 2024.

13. The Agency held an educational workshop for the CNS Contracting Parties and an educational workshop for Permanent Mission representatives in Vienna in July 2024 to provide them with assistance and information on the CNS peer review process and obligations.

14. The Agency held one interregional and two regional workshops to promote the benefits of and explain the process for adherence of Member States to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management: in Rio de Janeiro in May 2024, in Vienna in September 2024, and in Riyadh in December 2024.

15. To provide support to Contracting Parties to ensure effective implementation of the Joint Convention, the Agency organized two national workshops (in Ankara in May 2024 and in Baghdad in June 2024) and one virtual regional workshop (attended by Benin, Congo, Gabon and Rwanda in July 2024), assisting Contracting Parties to develop their first National Reports to the Joint Convention.

16. The Agency held the Fifth Extraordinary Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste

Management in Vienna in March 2024 to discuss possible changes to the guidelines of the Joint Convention to achieve the uniform identification of good practices.

17. The Agency held an Organizational Meeting for the Eighth Review Meeting of the Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in Vienna in March 2024 to elect the President and two Vice-Presidents, establish Country Groups and select Country Group Officers for the Eighth Review Meeting, decide on the provisional timetable and budget for the Eighth Review Meeting, and consider any other matters relevant to implementation of the Joint Convention.

18. The Agency held the Twelfth Meeting of the Representatives of Competent Authorities identified under the Early Notification Convention and the Assistance Convention in Vienna in June 2024. The participants emphasized the critical role of international conventions, tools and cooperation in enhancing EPR and underscored the value of ongoing training, sharing best practices and learning from real incidents to strengthen EPR frameworks globally. Key points included the role of USIE and the potential use of AI in EPR, and improvement of communication, training and information exchange among Member States, particularly in light of the cross-border consequences of nuclear and radiological emergencies and the challenge posed by misinformation during emergencies. The meeting also recognized the need for continuous improvement in notification systems, the effectiveness of Assistance Action Plans, and the use of early assessment for protective measures. The Agency's IRMIS was highlighted for its importance in radiological assessment, and suggestions were made for enhancing data quality and transmission frequency.

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

19. The Agency held three missions to set up RAIS+ and provide advisory services on RAIS+ customization and usage: in Jamaica in January 2024, in New Zealand in June 2024 and in Ethiopia in October 2024.

20. The Agency held a Latin America Regional Training Course on RAIS+ in Brazil in September 2024.

21. 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)) was circulated for the purpose of official consultation with Member States. The comments that were received were resolved and appropriate changes made to the draft publication, which was approved by the Safety Standards Committees and cleared by the Nuclear Security Guidance Committee.

22. The Agency held three workshops for RASIMS national coordinators to assist them in providing or updating information on their national radiation safety infrastructures in RASIMS, in Vienna in May and October 2024.

23. The Agency held a CANDU Senior Regulators' Meeting in Vienna in November 2024.

24. The Agency held the 21st Meeting of the Steering Committee of the Global Nuclear Safety and Security Network in June 2024, to review the Network's achievements and to discuss ways to promote cooperation among the regional and thematic networks on common issues pertinent to technical topics.

25. The Agency held the Eighth Global Nuclear Safety and Security Communication Network Steering Committee Meeting in November 2024, in a virtual format.

26. The Agency held the 15th Annual Meeting of the Arab Network of Nuclear Regulators in Vienna in February 2024, to discuss concrete action items to enhance nuclear and radioactive material safety and security in the Arab region for 2024–2025.

27. The Agency participated in the European Nuclear Safety Regulators Group meeting in Brussels in March and November 2024 to exchange information in the area of nuclear safety, in particular on the conduct of IRRS missions.

28. The Agency held the 34th Meeting of the Steering Committee of the Asian Nuclear Safety Network in China in April 2024 to discuss ways to improve the efficiency and effectiveness of the Network's activities and to review the work plan for 2024–2026.

29. The Agency held the Meeting of the Steering Committee of the Regulatory Cooperation Forum and Support Meeting in Vienna in June 2024.

30. The Agency held the 19th and 20th meetings of the Steering Committee of the TSO Forum in Vienna in April and October 2024, respectively.

31. The Agency and the SMR Regulators' Forum expanded and enhanced the training on regulating SMRs during a consultancy meeting in Vienna in June 2024. The Agency also held two educational workshops on regulatory challenges in SMRs: in Brazil in October 2024 and in India in December 2024.

32. The Agency held the 21st Meeting of the Steering Committee of the Forum of Nuclear Regulatory Bodies in Africa, in Egypt in June 2024, to review the Forum's achievements and approve the work plan for 2024.

33. The Agency held the 12th Meeting of the Steering Committee of the European and Central Asian Safety Network in Vienna in June 2024 to review and update the work of the Network in 2024 and discuss the work plan for 2025.

34. The Agency held the International Conference on Enhancing Nuclear Safety and Security Through Technical and Scientific Support Organizations (TSOs): Challenges and Opportunities in a Rapidly Changing World, in Vienna in December 2024 (see Figure B). The conference provided a forum for discussing current and emerging challenges, the interaction of TSOs with interested parties, and capacity building. It highlighted the importance of scientific and technical capabilities to support regulatory decision making for enhanced nuclear and radiation safety and security. A special session on the TOSCA methodology, showcasing the two TOSCA national workshops held in 2024, was organized during the conference.

Fig. B. Participation of Member States and international organizations in the International Conference on Enhancing Nuclear Safety and Security Through Technical and Scientific Support Organizations.

35. In 2024, the Agency launched the activities of the School of Drafting Regulations for Waste Safety, targeting Member States from the Europe region.

36. In April 2024, the Agency published the proceedings of the International Conference on Effective Nuclear and Radiation Regulatory Systems: Preparing for the Future in a Rapidly Changing Environment, held in Abu Dhabi in February 2023.

37. In September 2024, a new joint IAEA–FORO publication on regulatory processes for authorizing and inspecting cyclotron radiopharmaceutical production facilities (IAEA-TECDOC-2069) was released in Spanish.

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

37. The Agency held a National Workshop on Nuclear Security Culture in Practice in Serbia in September 2024.

19. The Agency held three regional Schools on Nuclear and Radiological Leadership for Safety: in Japan in February 2024, in Mexico in September 2024, and a Joint ICTP–IAEA School on Nuclear and Radiological Leadership for Safety in Italy in November 2024 (see Figure C).

20. Additionally, the Agency held two national Schools on Nuclear and Radiological Leadership for Safety: in Pakistan in June 2024 and in the UAE in December 2024 (see Figure C).

21. The Agency held two Train the Trainers Courses on the IAEA School on Nuclear and Radiological Leadership for Safety — in Vienna in April 2024 and in Cambodia in November 2024 — to share lessons learned and train new trainers in the School methodology (see Figure C).

22. The Agency held a Training Course on Leadership, Management and Culture for Safety in Vienna in May 2024 and a Training Workshop for Safety Culture Continuous Improvement in Vienna in July 2024.

23. The Agency assisted Uruguay's National Regulatory Authority for Radiation Protection to perform the first review of its management system, in Uruguay in October 2024.

Fig. C. Overview of Agency Schools on Nuclear and Radiological Leadership for Safety in 2024.

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

24. The Agency held a workshop on the draft publication *Safe Transport of Radioactive Material: Fifth Edition* (Training Course Series No. 1) in Vienna in February 2024 to raise awareness among Member States and obtain feedback on the draft.

25. The Agency held a Workshop on the Safe Transport of Fissile Material in Ankara in January 2024 to highlight the administrative and design requirements for packages containing fissile material, as outlined in the *Regulations for the Safe Transport of Radioactive Material* (IAEA Safety Standards Series No. SSR-6 (Rev. 1)).

26. The Agency held a Workshop on the Design Safety Assessment of Transport Packages Containing Radioactive Material in Vienna in March 2024 to introduce the training needed for the development and review of the documentary evidence in a package design safety report that demonstrates compliance of package designs with the requirements of SSR-6.

27. EduTA missions to Brazil and Greece in 2024 provided advice to strengthen the regulatory framework on education, training, qualification and competence, paving the way to the sustainability of national training programmes.

28. The Agency held a Regional Meeting on Harmonizing the Regulatory Requirements for Radiation Protection Officer Qualification and Competence for members of ANNuR in Egypt in May 2024, to provide a foundation for establishing Arab training programmes for RPOs and qualified experts.

29. The Agency conducted PGECs in Radiation Protection and the Safety of Radiation Sources in Algeria, Argentina, Ghana, Greece, Jordan, Kenya, Malaysia and Morocco, in a number of languages.

A.6. Research and Development for Safety

30. The Agency held a research coordination meeting for the CRP entitled “Developing a Phenomena Identification and Ranking Table (PIRT) and a Validation Matrix, and Performing a Benchmark for In-Vessel Melt Retention (IVMR)” in Vienna in May 2024.

31. The Agency held a Technical Meeting on Advanced Manufacturing and Qualification Programmes for New Materials for Small Modular Reactors and Non-Water Cooled Reactors: Safety Considerations in Vienna in November 2024 to compile information for the future revision of relevant safety standards.

32. The Agency held the first coordination meeting for the CRP entitled “Climate Change Challenges to the Safety of Nuclear Installations” in Vienna in June 2024.

B. Strengthening Radiation, Transport and Waste Safety

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

33. The Agency held a Technical Meeting of the REGSUN in Vienna in June 2024.

34. The Agency continued to revise a draft Safety Report on radiation protection related to NORM in the oil and gas industries. The Agency continued to revise a draft Safety Report on radiation protection and management of radioactive waste in the oil and gas industry, and to develop a draft Safety Report on occupational radiation protection related to NORM in the water supply and treatment industry.

35. The Agency held a virtual consultancy meeting in October 2024 to prepare the draft document preparation profile (DPP) for the revision of *Health Surveillance of Persons Occupationally Exposed to Ionizing Radiation: Guidance for Occupational Physicians* (Safety Reports Series No. 5).

36. The Agency held a consultancy meeting on the Information System on Occupational Exposure in Medicine, Industry and Research-Industrial Radiography (ISEMIR-IR) in Vienna in February 2024. The activities conducted in 2023 were reviewed and the fourth global survey on ISEMIR-IR was planned during the meeting.

37. The Agency held a second consultancy meeting to develop the draft Safety Guide on Radiation Protection and Safety in Existing Exposure Situations (DS544) in August 2024.

38. The Agency held a Technical Meeting on Radiation Protection and Safety in High Level Background Radiation Areas in Vienna in September–October 2024.

39. The Agency held a fourth consultancy meeting to develop a Safety Report on radiation safety in international trade of non-food commodities in Vienna in August 2024.

40. The Agency held a Regional Training Course on Prevention and Mitigation Methods for Protection against Radon Exposure in Buildings in Portugal in January 2024.

41. The Agency held a Technical Meeting on the Radiation Protection of Patients in the New Era of Medical Imaging in Vienna in March 2024.

B.2. Control of Radiation Sources

42. The Agency held an Open-ended Meeting of Technical and Legal Experts on States' Implementation of the Guidance on the Import and Export of Radioactive Sources in Vienna in May 2024.

43. The Agency held Regional Meetings to Share Experiences and Lessons Learned in Implementing the Code of Conduct on the Safety and Security of Radioactive Sources and its Supplementary Guidance: in Mexico in February 2024, in the UAE in October 2024 and in Zimbabwe in November 2024.

44. The Agency held an Africa Regional Technical 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 in Namibia in October 2024.

45. The Agency continued to engage with and encourage States that have not yet made a political commitment to the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance. These efforts have contributed to annual increases of political commitments.

46. The Agency finalized a draft TECDOC on establishing financial provisions for the management of disused radioactive sources.

B.3. Safe Transport of Radioactive Material

47. The Agency held the Third Meeting of the Denial of Shipment Working Group in Vienna in April 2024.

48. The Agency held an Open-Ended Meeting of Legal and Technical Experts on the Draft Code of Conduct on the Facilitation of the Safe and Secure Transport of Radioactive Material in Vienna in July 2024.

49. The Agency conducted a Workshop for National Focal Points on Denial of Shipment of Radioactive Material in Vienna in November 2024.

50. The Agency held the 48th and 49th meetings of the Transport Safety Standards Committee (TRANSSC) in Vienna in June and November 2024 respectively, at which the Denial of Shipment Working Group presented its report. The Agency also briefed the International Nuclear Safety Advisory Group (INSAG), the Advisory Group on Nuclear Security (AdSec) and the Radiation Safety Standards Committee (RASSC) on the Denial of Shipment Working Group outcomes.

51. Drafting of the *Safe Transport of Radioactive Material: Fifth Edition* (Training Course Series No. 1) was completed and the text is being finalized.

52. The Agency held a Workshop on the Design Safety Assessment of Transport Packages Containing Radioactive Material in Vienna in March 2024.

53. The Agency launched e-learning modules 1–4 on the safe transport of radioactive material in French in March 2024 and in Arabic in September 2024.

54. The Agency held a Follow-Up Workshop on the Transport Safety Regulatory Programme for Uranium and Other Naturally Occurring Radioactive Material Produced by Mining and Milling in Pretoria, South Africa in February 2024.

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

55. The Agency held a Technical Meeting on the IAEA Publication on Derivation of Specific Clearance Levels for Materials Suitable for Recycling, Reuse, or for Disposal in Landfills, in Vienna in March 2024.

56. The Agency held a consultancy meeting for the development of training materials on the derivation of specific clearance levels in Vienna in September–October 2024.

57. The Agency held the Annual Meeting of the REGSUN in Vienna in June 2024.

58. The Agency held a Technical Meeting on Topical Issues of Decommissioning of Uranium Production Facilities in Vienna in October 2024.

59. The Agency held the Eighth Technical Meeting of the International Project on Completion of Decommissioning in Sofia in May 2024.

60. The Agency held the Eighth Technical Meeting of the International Project on Decommissioning of Small Medical, Industrial and Research Facilities in Vienna in May 2024.

61. The Agency held the International Conference on the Management of Spent Fuel from Nuclear Power Reactors: Meeting the Moment, in Vienna in June 2024. The conference provided a forum to explore the integration of new technologies into spent fuel management strategies, stakeholder

engagement, as well as storage, recycling, and transportation. It also addressed the impacts of advanced energy systems and the integrated management of spent fuel. The discussions underscored the need to establish comprehensive national policies and strategies for the long term management of spent fuel.

62. The proceedings of the International Conference on the Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation: Ensuring Safety and Enabling Sustainability, held in November 2023, were drafted. Other modes of dissemination of the outcomes of the conference are also being adopted (e.g. the joint World Nuclear Association–International Commission on Radiological Protection webinar on enabling sustainable development through the system of protection) and a plan has been developed for follow-up activities in 2025.

B.5. Radiation Protection of the Environment and Remediation

63. In April 2024 and in December 2024 respectively, the Agency conducted the second and third ALPS Task Force missions to evaluate and reevaluate the status of the discharge plan and the progress related to the findings from the *IAEA Comprehensive Report on the Safety Review of the ALPS-Treated Water at the Fukushima Daiichi Nuclear Power Station*. The mission team, coordinated and led by the Agency, was composed of 15 members, including experts from the Secretariat and international experts who are designated members of the ALPS Task Force.

64. On site, the Agency took regular samples and measurements of the ALPS treated water prior to batch discharge.

65. 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* were published.

66. The Agency organized the work of the international ALPS Task Force to review the safety of the Fukushima treated water release into three main components: namely the assessment of protection and safety; regulatory activities and processes; and sampling, independent analysis and data corroboration. The Agency's sampling, independent analysis and data corroboration activities also included a review of sampling and analytical methods used by TEPCO and other relevant technical institutions.

67. In March 2024, the Agency held a Technical Meeting on Initiating the Coordination Group for Uranium Legacy Sites for African Regions in Lusaka to discuss the role of CGULS in addressing the challenges and opportunities associated with uranium legacy sites in Africa, as well as to agree on the scope, objectives and terms of reference of CGULS Africa.

68. The Agency conducted an expert mission in Kyrgyzstan, Tajikistan and Uzbekistan in March 2024 on the improvement of water analysis methods in participating laboratories of CGULS.

69. The Agency held a virtual training workshop on methods for radiological impact assessment in May 2024, aimed at young and early career professionals. The annual MEREIA workshop was held in Vienna in November 2024. The Agency also held three interim meetings for the working groups under MEREIA programme: in Oslo and Vienna in June, and in Aube, France in September.

C. Strengthening Safety in Nuclear Installations

C.1. Nuclear Power Plant Safety

C.1.1. Operational Safety

70. The Agency held a Technical Meeting on Safety Aspects of Long Term Operation Peer Reviews. During the Early Stages of Operation in Vienna in November 2024. In addition, it completed five SALTO missions in Argentina, Brazil, Japan, Sweden and Uzbekistan, two Pre-SALTO missions in the Kingdom of the Netherlands and Romania, a SALTO expert mission in Slovakia and a SALTO follow-up mission in South Africa.

71. In January 2024, the Agency published *Operating Experience from Events Reported to the IAEA Incident Reporting System for Research Reactors* (IAEA-TECDOC-1762/Rev. 1), which incorporates the experience and feedback from events reported to the IRSRR during the period 2015–2023.

72. The Agency held a Technical Meeting for National Coordinators of the International Reporting System for Operating Experience on Recent Events at Nuclear Power Plants in Vienna in October 2024 and provided training to IRS national coordinators in July 2024.

73. The Agency held a training course on performance improvement, using the PROSPER Guidelines as a basis, in Vienna in May 2024. In December 2024, it conducted a dedicated training course on root cause analysis for representatives from regulatory bodies in the UK.

74. The Agency organized the International Conference on Enhancing the Operational Safety of Nuclear Power Plants in Beijing in April 2024. The conference reaffirmed the importance of ensuring the safe and reliable operation of existing NPPs as a priority to protect people and the environment. It also underscored safe and reliable NPP operation as the foundation for the safe long term development of the nuclear power industry and of new designs, including SMRs, which will contribute to realizing the goal of tripling nuclear power by 2050 and reaching net zero emissions.

C.1.2. Site Safety and External Hazards

75. The Agency held an International Workshop on Recent Advances in Seismic and Fault Displacement Hazard Assessment for Nuclear Installations in Vienna in June 2024. This workshop covered key areas of importance such as regulatory challenges in the review and assessment of seismic safety, and changes in practices in the last decade, in particular after the accident at Fukushima Daiichi NPP.

76. The Agency held the first research coordination meeting on the CRP entitled “Climate Change Challenges to the Safety of Nuclear Installations” in Vienna in June 2024 to plan the numerical simulation of hydrological hazards in selected case studies, including the effects of climate change, in a benchmark environment. The meeting helped to encourage networking among scientists and institutes and to support transfer of knowledge between embarking countries and countries with mature nuclear programmes.

77. The Agency conducted a SEED review mission and a workshop on the site selection process for the deployment of SMRs at SaskPower in Canada in September 2024.

78. The Agency conducted SEED review missions in Kenya in January 2024, in Sri Lanka in May–June 2024, in Armenia in July 2024 and in Mongolia in December 2024.

79. The Agency conducted a SEED follow-up review mission to Romania’s SMR site in April 2024.

80. The Agency conducted three SEED workshops in 2024: in Kazakhstan in April, in Nigeria in July, and in Egypt in November.

C.1.3. Design Safety and Safety Assessment

81. The Agency held a Technical Meeting on Probabilistic Safety Assessment for Non-Reactor Nuclear Facilities in the Kingdom of the Netherlands in September 2024.

82. The Agency held a Technical Meeting on Equipment Qualification for Design Extension Conditions in Nuclear Power Plants in Vienna in April 2024.

83. The Agency held a Training Workshop on the Development of Severe Accident Management Guidelines Using the IAEA's Severe Accident Management Guideline Development (SAMG-D) Toolkit in Vienna in December 2024.

84. The Agency conducted an expert mission on guidance on accident management programmes for NPPs in Türkiye in February 2024.

85. The Agency held two Training Courses on Safety Aspects of Small Modular Reactors and Other Innovative Reactor Technologies, in Vienna in February 2024 and in Japan in November 2024.

86. The Agency held an Interregional Training Course on Design Safety and Safety Assessment for Nuclear Power Plants, Including SMRs in the Russian Federation in October 2024.

87. The Agency held an Interregional Training Course on Cost-effective Solutions in the Radioactive Waste Management for Small Modular Reactors and Decommissioning by Design in the Russian Federation in September 2024.

88. The Agency held an Interregional Workshop on Transportable Nuclear Power Plants in China in September 2024.

89. The Agency conducted three TSRs for concept reactor designs for SMRs (TSR-DS): for Rolls-Royce SMR Limited in the UK in June 2024, for the SALUS-100 reactor conceptual design in the Republic of Korea in October 2024, and for NuScale US460 in the USA in December 2024.

90. A TSR on Probabilistic Safety Assessment (TSR-PSA) of the PALLAS reactor in the Kingdom of the Netherlands was conducted in September–October 2024, and a TSR-PSA follow-up on a Level 1 PSA study of Kozloduy NPP Units 5 and 6 in Bulgaria was conducted in May 2024.

C.2. Safety of Small Modular Reactors

91. The Agency held the first International Conference on Small Modular Reactors and their Applications in Vienna in October 2024. The conference provided an international forum to take stock of the progress and discuss the opportunities, challenges and enabling conditions for the accelerated development and safe and secure deployment of SMRs among all possible interested parties.

92. The Agency held a Technical Meeting on Advanced Manufacturing and Qualification Programmes for New Materials for Small Modular Reactors and Non-Water Cooled Reactors: Safety Considerations in Vienna in November 2024.

93. The Agency held the third consultancy meeting to develop a safety report on the application of a graded approach for site evaluation of advanced NPPs in Vienna in April 2024.

94. In partnership with the SMR Regulators' Forum, the Agency supported embarking countries or countries expanding their nuclear programmes that have an interest in SMR deployment by holding two regional Educational Workshops on Regulatory Challenges in Small Modular Reactors: in Brazil in October 2024 and in India in December 2024.

95. The Agency continued actively working under the umbrella of the SMR Platform. A booklet was released during the 68th IAEA General Conference, providing an overview and update of the Agency's work on SMRs.

96. In 2024, the Agency continued implementing the NHSI and held several in-person and virtual meetings under the NHSI Regulatory Track. Working Group 1 held two meetings in January and April 2024 on building a framework for regulators to share information, including a discussion on the obstacles to sharing information and potential solutions. Working Group 2 held three meetings in February, May and September 2024 on developing a process for multinational pre-licensing joint review. Working Group 3 held four meetings in February, April, September and November 2024 on processes for leveraging other regulatory reviews and for regulators to work together during ongoing reviews, as well as dealing with regulatory differences.

97. The Agency organized two meetings of the SMR Regulators' Forum in April and November 2024.

98. The Agency and the SMR Regulators' Forum held a series of three webinars with a focus on regulatory challenges for SMRs, based on the Forum's recent outputs in April, May and June 2024.

C.3. Research Reactor Safety

99. The Agency held the International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future in Vienna in November 2024. The conference provided a forum for reactor operators, managers, users, regulators, designers and suppliers to share experience in areas including safety, security, operation, fuel cycle options, utilization, infrastructure and capacity building, and management. The conference showcased how achievements and experience attained with research reactors in these areas contribute to a sustainable future.

100. The Agency held an International Meeting on the Code of Conduct on the Safety of Research Reactors in Vienna in August 2024. The meeting showed continued improvement in the application of the Code of Conduct by Member States, notably in the areas of regulatory inspection, ageing management, and safety management of reactors in extended shutdown states. The meeting also identified areas needing further improvement in application of the Code of Conduct related to preparation for decommissioning and building regulatory capacity to address emerging challenges such as the use of AI and innovative technologies.

101. The Agency held a Technical Meeting on Safety and Operational Considerations in the Use of Advanced Technologies at Research Reactors in Vienna in September–October 2024 to provide a forum to discuss and share information on safety considerations in the use of advanced technology, including digital control systems, robotics and AI at research reactors, including with respect to safety assessment and operational safety.

102. The Agency published *Analysis of Results from Integrated Safety Assessment of Research Reactors (INSARR) Missions* (IAEA-TECDOC-2048) and the revised *Guidelines for the Review of Research Reactor Safety* (IAEA Services Series No. 25 (Rev. 1)), the reference document for INSARR, in April 2024.

103. The Agency held a Training Workshop for Reviewers in Future Integrated Safety Assessment of Research Reactors Missions in Vienna in May 2024 to provide information and guidance for experts who may participate as team members in future INSARR missions.

C.4. Fuel Cycle Facility Safety

104. The Agency held a Workshop on Regulatory Supervision of Nuclear Fuel Cycle Facilities in Vienna in December 2024 to provide a forum for exchange of information and sharing experience in establishing effective regulatory inspection programmes for nuclear fuel cycle facilities.

105. The Agency held a virtual Workshop on Ageing Management for Nuclear Fuel Cycle Facilities in April 2024 to provide guidance on the application of Agency safety standards and a forum for sharing information and experience in the development and implementation of systematic ageing management programmes for nuclear fuel cycle facilities.

106. The Agency held a virtual Workshop on Operational Radiation Protection Programmes for Nuclear Fuel Cycle Facilities in May 2024 to provide Member States with a forum for exchange of information and experience on the development and implementation of operational radiation protection programmes at nuclear fuel cycle facilities.

107. The Agency held a Workshop on the Safety of Fuel Manufacturing for Advanced Reactors in June 2024 to provide a forum for Member States to discuss and exchange information and share experience on the safety of manufacturing new fuels for advanced reactors, including their regulatory oversight.

C.5. Safety Infrastructure for Countries Embarking on Nuclear Power or Research Reactor Programmes

108. The Agency held a training course for reviewers in IRRS missions in Vienna in April 2024.

109. The Agency held a consultancy meeting on training developments for the IRRS programme in Vienna in February 2024 to review the technical background material of the e-learning course for countries preparing to host an IRRS mission.

110. The Agency held a consultancy meeting on the guidelines for the GRM to develop infrastructure for nuclear safety for licensing a first nuclear reactor, in Vienna in April 2024.

111. The Agency held the third consultancy meeting under the GRM on regulatory oversight of construction and commissioning of nuclear reactors for embarking countries. The Agency published the following technical documents: *Assessment of High Wind and External Flooding (Excluding Tsunami) Hazards in Site Evaluation for Nuclear Installations* (Safety Reports Series No. 120); *Evaluation of Probabilistic Seismic Hazard Analysis (PSHA) for Nuclear Installations Based on Observational Data* (IAEA-TECDOC-2067); *Optimization of Safety Measures for Protection of Nuclear Installations Against External Hazards* (IAEA-TECDOC-2042); and *Evaluation of Design Robustness of Nuclear Installations Against External Hazards* (IAEA-TECDOC-2043).

112. The Agency held a Technical Meeting on the Challenges Faced by Newcomer Countries in the Establishment of Effective Regulatory Frameworks and Infrastructures for Safety, in Egypt in October 2024.

113. The Agency held a meeting of the Steering Committee of the Regulatory Cooperation Forum in Vienna in June 2024 to review the status of regulatory infrastructure development in countries receiving support and to foster the exchange of experience.

114. The Agency held a Technical Meeting on Strengthening National Regulatory Infrastructure, in Japan in February 2024.

115. The Agency conducted a safety review mission of the safety aspects of the construction programme for the PALLAS research reactor in June–July 2024. The mission identified areas with opportunities for improvement and provided recommendations and suggestions covering organizational and management aspects, construction programme and activities, training and qualification programmes, and safety documents.

116. The Agency held a Training Workshop on the Preparation of a Feasibility Study for a New Research Reactor Project in Vienna in July 2024, to provide the participating Member States with practical information and knowledge on the preparation of a feasibility study for a new research reactor project, taking into account operation, utilization and safety requirements.

117. The Agency held a Training Workshop on Technical Requirements in the Bidding Process for a New Research Reactor in Vienna in October 2024, to provide the participating Member States with practical information and knowledge on developing the technical requirements for the bidding process for a new research reactor project, taking into account operation, utilization and safety requirements, and guidance on the criteria for bid evaluation.

D. Strengthening Emergency Preparedness and Response

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

136. The Agency held three Workshops on Arrangements for Notification, Reporting and Assistance in Nuclear or Radiological Incidents and Emergencies, in Vienna in March, June and October 2024.

137. The Agency held a Workshop on Monitoring During a Nuclear or Radiological Emergency in Miharu, Japan, in October 2024, and a Workshop on the Implementation of the International Radiation Monitoring Information System (IRMIS) in Vienna in December 2024.

138. The Agency held two Workshops on Assessment and Prognosis During a Nuclear or Radiological Emergency, in Vienna in March 2024 and in Slovenia in November 2024.

139. The Agency made available to Member States an updated e-learning course on communication with the public in the event of a nuclear or radiological emergency, and held two regional workshops on the topic in a virtual format in June 2024 and October 2024, as well as a national training workshop in Pakistan in November 2024. The Agency also used a social media simulator to assist Member States and the Agency to test their arrangements for public communication in the event of a nuclear or radiological emergency in two emergency exercises.

D.2. Harmonization of Arrangements for Preparedness and Response

140. The Emergency Preparedness and Response Standards Committee (EPReSC) established three working groups in November 2022 to work on the review of GSR Part 7. In January 2024, non-EPReSC members met to collect additional views on the potential for revision and restructuring of GSR Part 7. An additional working group to process major takeaways from the review of GSR Part 7 was established in June 2024, and a proposal was submitted at the 19th EPReSC meeting in November 2024.

141. During the reporting period, the Agency continued the revision of GS-G-2.1 and GSG-2.

142. In January 2024, the Agency held a consultancy meeting to continue the review of GSR Part 7 and collect feedback, observations and suggestions from non-EPReSC members. The revision includes important considerations on SMRs.

143. The Agency held a consultancy meeting to develop new guidance on emergency preparedness and response for small modular reactors in Vienna in June 2024.

D.3. Testing Readiness for Response

144. The Agency hosted a ConvEx-1a exercise in February 2024 with the participation of 119 emergency contact points and a ConvEx-1b exercise in August 2024 with the participation of 123 emergency contact points to test the established communication channels.

118. The Agency conducted quarterly internal full response exercises in March and June 2024, a business continuity exercise in May 2024, a full response exercise combined with ConvEx-2c in October 2024 and a full response exercise with the Republic of Korea in November 2024, to demonstrate the ability of the Agency's Incident and Emergency System (IES) to respond to a simulated nuclear or radiological emergency and to provide training for IES staff. The full response exercises lasted 8 hours, each with the participation of over 30 Agency staff members, and the business continuity exercise lasted 4 hours with the participation of 16 Agency staff members.

119. The Agency conducted 3 ConvEx-2b exercises in 2024: in March with the participation of 35 Member States and 3 international organizations, in July with 22 Member States and 1 international organization, and in September with 35 Member States and 2 international organizations.

120. The Agency conducted 11 ConvEx-2e exercises in 2024 with the participation of 9 Member States.

121. The Agency organized a series of three task group meetings and three consultancy meetings with Bulgaria, the Republic of Moldova and Romania to support preparations for the ConvEx-3 large scale emergency response exercise to be held in 2025. A significant number of Member States have already expressed interest in sending observers to the exercise. The exercise will provide an opportunity for the Agency and eight States invited by the host country to deploy field teams integrated in a joint IAEA Assistance Mission, to provide the assistance requested by the host country (Romania) and to identify areas for improvement in the assistance mechanism.

122. The Agency held a ConvEx-2c exercise in October 2024 hosted by Pakistan, in which 47 Member States and 2 international organizations took part. The exercise lasted 10 hours with the participation of 32 Agency staff members.

E. Improving Management of the Safety and Security Interface

123. The Agency assisted in the review or drafting of regulations on the security of radioactive material in use and storage for the Bahamas, Barbados and Saint Kitts and Nevis.

124. The Agency conducted two National Training Courses on the Regulatory Control of Radiotherapy Practices for Kenya, one in a virtual format and the other in Nairobi in January 2024.

125. The Agency held one Regional Training Course on the Authorization and Inspection of Radiation Safety and Nuclear Security for Industrial Practices in Ethiopia in April 2024 for English-speaking African States.

126. The Agency conducted two Regional Training Courses for New Regulators in Radiation Safety and Security of Radioactive Material over the course of six weeks: one in May–June 2024 in Morocco for French-speaking African States and one in May–July 2024 in Ghana for English-speaking African States.

127. The Agency held one Regional Workshop on the Development and Implementation of Procedures for Authorization and Inspection of Radioactive Sources in Uruguay in July 2024 for Latin American States, conducted in Spanish.

128. The Agency held one School for the Elaboration of National Policy and Strategy Documents for Radiation Safety and Security of Radioactive Material in Vienna in July 2024 for Antigua and Barbuda, Barbados and Saint Lucia.

129. The Agency conducted one Regional Workshop on Organization and Staffing of an Effectively Independent Regulatory Body in Vienna in August 2024 for Caribbean States.

130. The Agency held an Interregional Workshop on Safety, Security and Safeguards by Design in Small Modular Reactors in the USA in November 2024.

F. Supporting Member States on Nuclear Law and Legislative Assistance

F.1. Strengthening Nuclear Legal Frameworks

131. The Agency supported 15 Member States (the Bahamas, Barbados, Brunei Darussalam, Colombia, Côte d'Ivoire, El Salvador, Estonia, Gabon, Ghana, Honduras, Iraq, the Philippines, Sri Lanka, Qatar, and Uganda) with country-specific bilateral legislative assistance through written comments and advice on drafting national nuclear legislation.

132. The Agency conducted 17 legislative assistance activities. Bilateral meetings with decision makers, policymakers and senior officials were held in 11 Member States (Brunei Darussalam, China, Congo, Côte d'Ivoire, El Salvador, Kenya, Poland, Qatar, Saint Kitts and Nevis, Sri Lanka and Uganda) to raise awareness about the various elements of comprehensive national nuclear legislation and/or the importance of adhering to relevant international legal instruments and to discuss specific issues. The Agency also organised 6 national workshops on nuclear law for Brunei Darussalam, Congo, Egypt, Kenya, Pakistan and Uganda to increase understanding of international legal instruments and the various

elements of comprehensive national nuclear legislation and to address specific topics of interest for each Member State.

133. The Agency held four interregional, regional and subregional workshops: one for English-speaking Member States in Africa in Cairo in July 2024; one for Pacific Island Member States in Vienna in September 2024; one for French-speaking Member States in Africa in Abidjan, Côte d'Ivoire in November 2024; and one for Member States in Asia in Manila in December 2024.

134. The Agency organized the 12th session of the NLI in Vienna in September–October 2024. This event enabled participants from 59 Member States to acquire a solid understanding of all aspects of nuclear law, with a particular focus on legislative drafting. The Agency also organized the first advanced interregional training course on nuclear law for all Member States in Belgrade in October–November 2024. This event enabled 33 lawyers and officials from 29 Member States to gain further knowledge in this area.

135. As part of the pilot university partnership initiative launched at the Agency's First International Conference on Nuclear Law: The Global Debate, held in April 2022, a short introductory course on nuclear law was held at the University of the Witwatersrand, Wits School of Law, Mandela Institute, South Africa, in March 2024.

F.2. Strengthening Civil Liability for Nuclear Damage

136. The International Expert Group on Nuclear Liability (INLEX) held its 24th regular meeting in Vienna in May 2024. 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. During the meeting, members reported on the most recent developments in the field of nuclear liability, including national aspects and the implementation of the international nuclear liability instruments. The Group also discussed several nuclear liability topics, including the geographical scope of the Paris Convention on Third Party Liability in the Field of Nuclear Energy as amended by the 2004 Protocol, the 1963 and 1997 Vienna Conventions on Civil Liability for Nuclear Damage and the CSC, as well as the current liability limits of the Parties to the 1963 Vienna Convention.

137. With the support of INLEX and in cooperation with the Philippine Nuclear Research Institute, the Agency held a Regional Workshop on the Convention on Supplementary Compensation for Nuclear Damage (CSC) for Member States of the Association of Southeast Asian Nations in July 2024. In addition, the Agency held a workshop on civil liability for nuclear damage in Islamabad in August 2024, and a workshop on the CSC in Cairo in November 2024.

138. The Fourth Meeting of the Contracting Parties and Signatories to the CSC was held in Vienna in June 2024. The Agency provided support to the Contracting Parties to the CSC in their consideration of amending the obligation under the Convention for non-nuclear Parties to contribute public funds to the supplementary international fund, through holding informal meetings, including an in-person meeting in November 2024.

139. The Agency organized the annual Workshop for Diplomats on Civil Liability for Nuclear Damage in conjunction with INLEX in Vienna in May 2024. The purpose of the workshop was to provide an overview of the global nuclear liability regime. In May 2024, a new IAEA publication entitled *International Expert Group on Nuclear Liability (INLEX): A Collective View on the First Two Decades*, was issued.

140. On the margins of the 68th General Conference in September 2024, the Agency hosted a side event for Member States to share their insights on joining the CSC.

141. In the context of the Agency's legislative assistance programme, assistance was provided to 17 Member States in the development of national legislation, including on civil liability for nuclear damage. The assistance provided opportunities to discuss adherence to and implementation of the 1963 Vienna Convention, the 1997 Vienna Convention, the CSC and 1988 Joint Protocol.

G. Technical Support and Assistance to Ukraine

142. In 2024, the Agency continued providing technical support and assistance to Ukraine across all the components of the comprehensive programme of assistance. The programme expanded by taking a more proactive stance to help ensure the stability of critical energy infrastructure so that it does not impact nuclear safety.

143. A total of 86 mission rotations have been deployed as part of the continued presence of Agency staff at the 5 nuclear sites in Ukraine (13 to the ZNPP, 19 to the ChNPP site, and 18 each to the KhNPP, the RNPP and the SUNPP).

144. The Agency implemented nine additional missions to Ukraine: two visits of the Director General to Ukraine, including his fourth and fifth visits to the ZNPP in February and September 2024, three medical assistance-related missions in April, September and November 2024, three missions to the electrical substations critical for nuclear safety in September, October and December 2024, and the second IAEA Support and Assistance Mission on the Safety and Security of Radioactive Sources in November 2024.

145. The Director General continued to provide briefings to the United Nations Security Council and to hold high level talks with officials from Ukraine and the Russian Federation to help stabilize the nuclear safety and security situation.

146. In 2024, 58 deliveries of procured nuclear safety- and security-related equipment and medical equipment and supplies to various organizations in Ukraine were organized, bringing the total number of deliveries to 91. In total, over €14.23 million worth of equipment has been delivered to 23 organizations in Ukraine since the start of the armed conflict.

147. The Agency continued with delivery of remote mental health training sessions for NPP staff and managers and their mental health teams to assist them in building skills to manage the impact of the stressful and traumatic experience of the armed conflict, and supported the delivery of an in-person workshop in November 2024. Additionally, the Agency delivered remote and in-person training for NPP staff and management on leadership for safety, human performance, and management observation and coaching in October and November 2024.

148. The Agency held regular coordination meetings with the State Nuclear Regulatory Inspectorate of Ukraine and the Ukrainian focal point of the Ministry of Energy to coordinate the provision of technical support and assistance within the comprehensive programme of assistance and to exchange information on the nuclear safety and security situation at all NPPs.

149. The Agency held regular coordination meetings with the European Commission, as well as with a number of Member States and organizations, including the European Bank for Reconstruction and Development (EBRD), to ensure effective coordination in the provision of assistance and to secure the necessary funding. Moreover, the Agency participated in a meeting on the information-sharing initiative

pertaining to assistance to Ukraine in Prague in May 2024, the G7 Nuclear Safety and Security Group Meeting in Rome in February and November 2024, and the assembly meeting of the EBRD's International Chernobyl Cooperation Account in July and December 2024.

150. 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 *Two Years of IAEA Continued Presence at the Zaporizhzhya Nuclear Power Plant*[4], marking two years since the establishment of the continued presence of Agency staff at the ZNPP. The Director General provided detailed reports on the situation in Ukraine to the Agency's Board of Governors in March, June, September and November 2024, which were made available to the public, and also provided a detailed report on the situation in Ukraine to the 68th regular session of the General Conference (GC(68)/8). The Agency continued providing regular updates on the situation in Ukraine on its website with 63 updates published throughout the year. Finally, the Agency launched a new webpage[5] consolidating all information regarding nuclear safety, security and safeguards in Ukraine and the comprehensive programme of assistance.

[4] Two years of IAEA continued presence at the Zaporizhzhya nuclear power plant: the IAEA's unwavering support for nuclear safety, security and safeguards in Ukraine is available here: two-years-of-iaea-continued-presence-at-the-zaporizhzhaya-nuclear-power-plant.pdf.

[5] Available here: Nuclear Safety, Security and Safeguards in Ukraine | IAEA.

Appendix B

The Agency's Safety Standards Activities in 2024

1. The Agency issued eight Specific Safety Guides after endorsement by the Commission on Safety Standards (CSS):

- *Radiation Safety in the Use of Radiation Sources in Research and Education*, IAEA Safety Standards Series No. SSG-87
- *Borehole Disposal Facilities for Disused Sealed Radioactive Sources*, IAEA Safety Standards Series No. SSG-1 (Rev. 1)
- *Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-3 (Rev. 1)
- *Chemistry Programme for Water Cooled Nuclear Power Plants,* IAEA Safety Standards Series No. SSG-13 (Rev. 1)
- *Design Extension Conditions and the Concept of Practical Elimination in the Design of Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-88
- *Evaluation of Seismic Safety for Nuclear Installations*, IAEA Safety Standards Series No. SSG-89
- *Radiation Protection Aspects of Design for Nuclear Power Plants,* IAEA Safety Standards Series No. SSG-90
- *Protection of Workers Against Exposure Due to Radon,* IAEA Safety Standards Series No. SSG-91

2. The CSS met twice, in May and November 2024. It endorsed for submission for publication the following draft Safety Guides:

- DS519: *Protection of Workers Against Exposure Due to Radon*
- DS525: *Chemistry Programme for Water Cooled Nuclear Power Plants*
- DS518A: *Safety of Nuclear Fuel Reprocessing Facilities*
- DS518B: *Safety of Nuclear Fuel Cycle Research and Development Facilities*
- DS528: *Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants*

3. In 2024, the CSS also approved the following document preparation profiles (DPPs) for safety standards:

- DPP DS552: Safety Guide on *Safety Evaluation of Nuclear Installations for External Events Excluding Earthquakes*

- DPP DS553: Safety Guide on *The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste* (revision of GSG-3)

- DPP DS554: Safety Guide on *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (20XX Edition) SSG-26 (Rev. 2)* (revision of SSG-26 (Rev. 1)

4. In 2024, the Agency established a new term for the CSS and for the Safety Standards Committees, with new nominated members from Member States. At its May meeting, the CSS approved the report of the seventh term and developed recommendations for the eighth term. The CSS, as well as the Safety Standards Committees, worked towards the development of the long term plan for the safety standards.

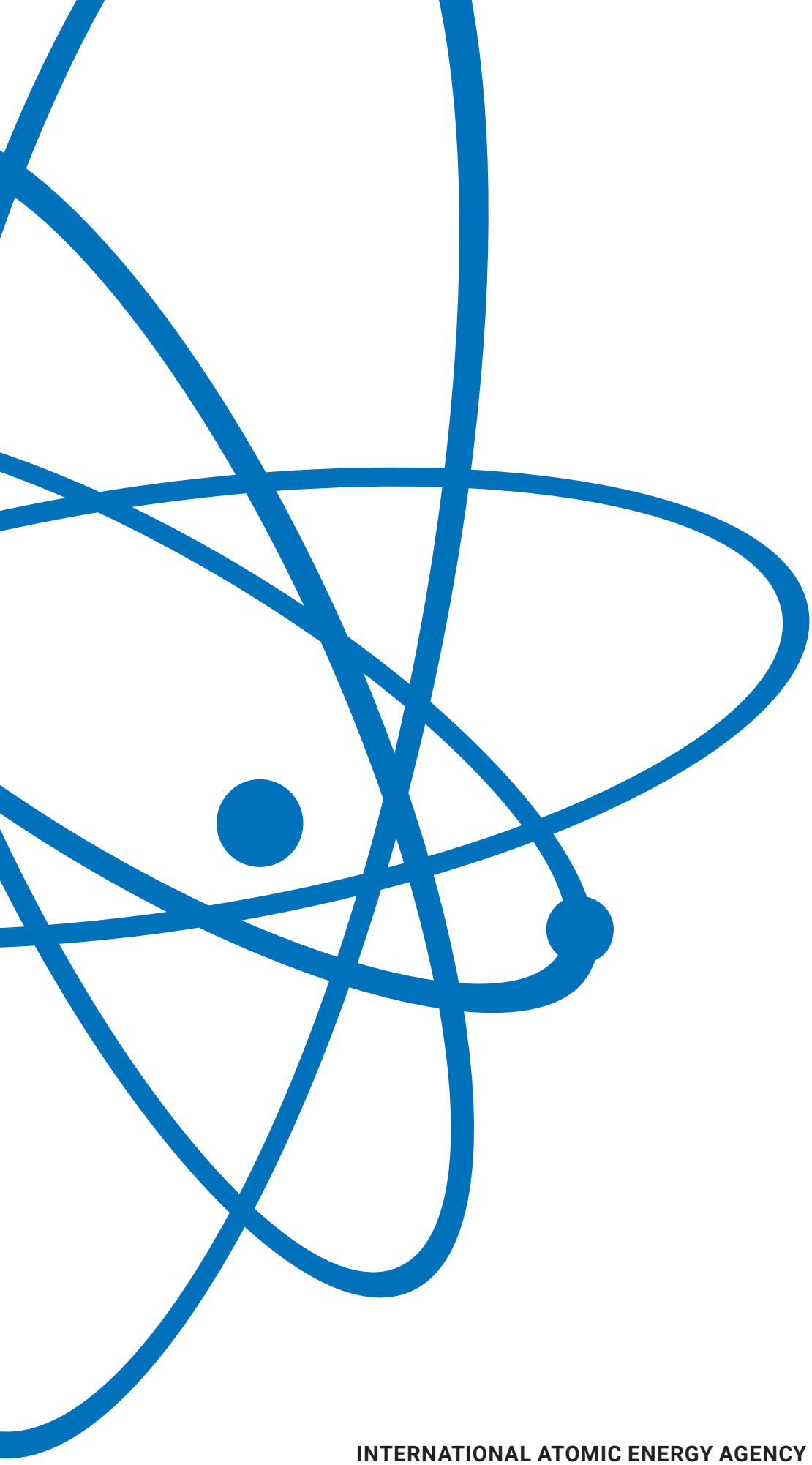
5. The Agency included all newly issued safety standards and nuclear security guidance in the NSS-OUI platform. All IAEA Safety Standards Series and IAEA Nuclear Security Series publications are available in full, are up to date and can be searched as a uniform knowledge base. Innovative technologies are being explored to maintain and improve the user friendliness and search experience of the platform.

6. 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. The NSS-OUI platform will be further used for the systematic review and, as appropriate, revision of Agency safety standards.

7. A third Training Course on the IAEA Safety Standards was held in Vienna in May 2024 to facilitate better understanding and awareness of Agency safety standards and to enhance access to and use of the standards in Member States. The Agency continued its work on translating Agency safety standards into other official languages.

8. The Agency undertook further efforts to translate safety standards into Chinese (52 Safety Guides), French (3 Safety Guides), Russian (9 Safety Guides) and Spanish (5 Safety Guides).

9. In 2024, the Agency completed the set of e-learning modules for all General Safety Requirements and Specific Safety Requirements by launching e-learning courses on Safety of Nuclear Power Plants: Design (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1)), Safety of Nuclear Power Plants: Commissioning and Operation (IAEA Safety Standards Series No. SSR-2/2 (Rev. 1)), Safety of Research Reactors (IAEA Safety Standards Series No. SSR-3), Safety of Nuclear Fuel Cycle Facilities (IAEA Safety Standards Series No. SSR-4), and Disposal of Radioactive Waste (IAEA Safety Standards Series No. SSR-5).



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