


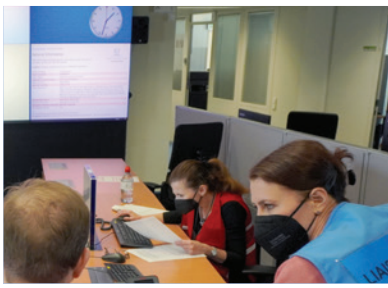




Nuclear Safety Review 2023



IAEA
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Atoms for Peace and Development

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NUCLEAR SAFETY REVIEW 2023

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Nuclear Safety Review 2023
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Foreword

The *Nuclear Safety Review 2023* includes the global trends and the Agency's activities undertaken in 2022 and thereby demonstrates the progress made regarding the priorities for 2022. It also presents priorities for 2023 and beyond, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety, and emergency and preparedness response. The majority of priorities remain unchanged from the previous year due to their long term nature but some have evolved to take into account changing global trends and in response to activities performed.

A draft version of the *Nuclear Safety Review 2023* was submitted to the March 2023 session of the Board of Governors in document GOV/2023/2. The final version of the *Nuclear Safety Review 2023* was prepared in light of the discussions held during the Board of Governors and also of the comments received from the Member States.

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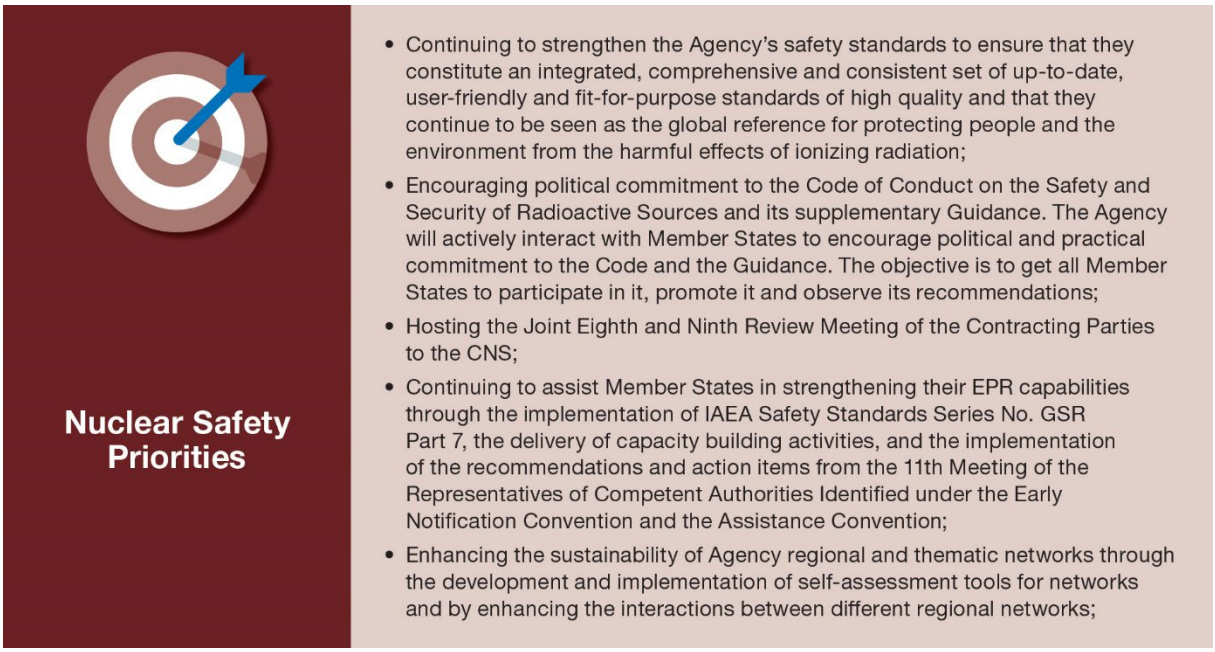
Nuclear Safety Review 2023

Report by the Director General

Executive Overview

1. The *Nuclear Safety Review 2023* reflects the global trends in 2022. It shows that the nuclear community continued to make steady progress in improving nuclear safety throughout the world. It also presents planned Agency activities for 2023 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 2022 can be found in Appendix A. The Agency's safety standards activities in 2022 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.

3. The work on the Agency's safety standards continued to focus on the revision of existing standards rather than the establishment of new ones. Two General Safety Guides and 15 Specific Safety Guides were published in 2022.

4. Broader analysis of peer review and advisory service mission reports shows that these continue to include recommendations relating to leadership, safety management, occupational radiation protection and safety culture.

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

Nuclear Safety Priorities

- Assisting Member States in developing and implementing national policies and strategies concerning the safe management of radioactive waste and spent fuel, the promotion of disposal as the end state for waste, the development of decommissioning safety strategies and plans, and releases to the environment;
- Continuing to assist Member States in their efforts to harmonize and standardize regulatory and industrial approaches in support of the effective global deployment of safe and secure SMRs, through the NHSI and the IAEA Platform on Small Modular Reactors and their Applications;
- Providing consistent support and guidance to embarking countries with regard to ensuring proper site selection, establishing an independent regulatory body, using Agency safety standards, and leveraging international experience and cooperation;
- Continuing the activities of the task force to conduct a review that will assess the Government of Japan's plan to discharge ALPS treated water at Fukushima Daiichi NPP against relevant Agency safety standards. As proposed by the Director General, the Agency's work on the plan will take place before, during and after its implementation; and
- Continuing to provide assistance regarding the safety and nuclear security of Ukraine's nuclear facilities and activities involving radioactive sources, including support and assistance missions and delivery of equipment, in accordance with the technical plan drawn up by the Agency and Ukrainian officials.

6. Many Member States that are considering embarking on a nuclear power programme or on a first research reactor project face difficulties in allocating resources for regulatory capacity building. The Integrated Regulatory Review Service, the Integrated Nuclear Infrastructure Review (INIR)[1] and other peer review and advisory services undertaken in embarking countries continue to identify the need to strengthen regulatory body independence, build regulatory capacity and competence, and establish safety regulations and licensing processes as part of effective legislative and regulatory oversight programmes.

General Safety

The Agency will:

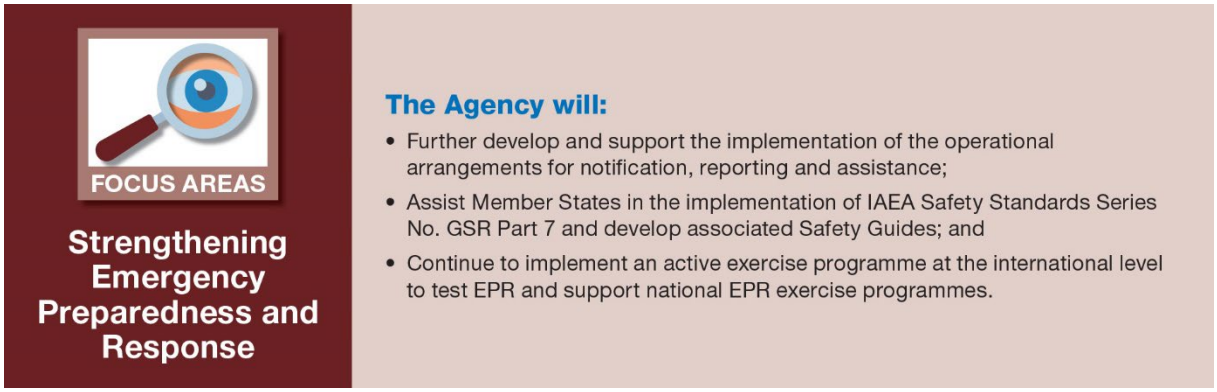
- Strengthen its safety standards and assist with their application;
- Promote adherence to Conventions under its auspices and support their implementation;
- Assist Member States in strengthening their regulatory effectiveness;
- Assist Member States in strengthening leadership and management for safety;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

7. There is continued Member State interest in building and further developing their national systems for EPR, including risk assessment, the use of dose projection tools, and effective communication. Member States continue to seek Agency support in improving the preparation, conduct and evaluation of national emergency exercises.

8. In 2022, the number of Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management increased by two, while there was no increase in the number of Contracting Parties to the Convention on Nuclear Safety (CNS).

[1] INIR is a service provided by the Agency's Department of Nuclear Energy regarding nuclear power programmes. It is reported on here owing to its coordinated delivery with many safety-related elements.

9. In 2022, one further Member State[2] became Party to the Convention on Early Notification of a Nuclear Accident (Early Notification Convention), while three further Member States[3] became Parties to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention). By the end of 2022, 40 States Parties to the Assistance Convention had registered National Assistance Capabilities in the Agency's Response and Assistance Network, of which three States Parties[4] to the Assistance Convention registered National Assistance Capabilities this year.



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

11. International attention continues to be paid to the handling of Advanced Liquid Processing System (ALPS) treated water at Fukushima Daiichi nuclear power plant (NPP).

12. There is increasing interest in Member States in the recording and analysis of the radiological impact on people and the environment from regulated discharges from facilities and activities and due to residual radioactive materials that derives from past unregulated practices or abnormal situations. Agency programmes — such as the Database on Discharges of Radionuclides to the Atmosphere and Aquatic Environment for discharges and the Methods for Radiological and Environmental Impact Assessment programme for exchanging experience regarding radiological assessment methodologies — are responding to this interest.

13. Access to and use of diagnostic imaging procedures utilizing ionizing radiation is growing, leading to higher cumulative individual exposures in Member States and creating a need for greater awareness of the importance of justification of medical exposures and optimization of radiation protection of patients.

14. The intensive use of radioactive sources in medicine, agriculture, industry and research has led to a growing number of disused radioactive sources that require safe and secure management and disposal. Member States require further guidance on the application of the Code of Conduct on the Safety and Security of Radioactive Sources with regard to ensuring financial provisions for the safe management and secure protection of disused radioactive sources. The number of Member States committed to acting in a harmonized manner with the supplementary Guidance on the Import and Export of Radioactive Sources is 128, and the number of States that have committed themselves to implementing the supplementary Guidance on the Management of Disused Radioactive Sources grew to 50 in 2022.

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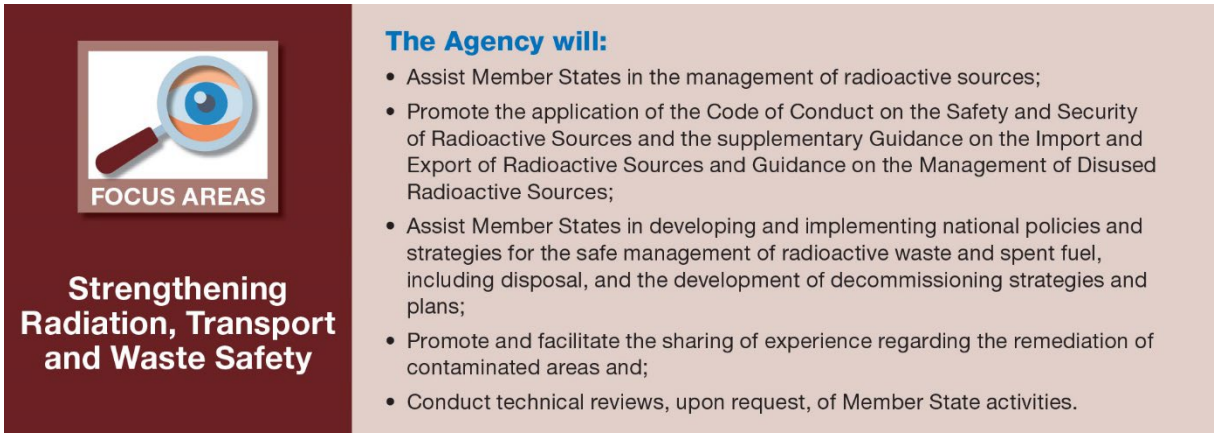
[2] Malawi.

[3] Cambodia, Malawi and Myanmar.

[4] Costa Rica, Lithuania and the Netherlands.

15. The need for capacity in Member States for the release of material and waste from regulatory control has increased. Requests continue for Agency support for safe interim and long term management solutions for radioactive waste. Disposal is the safe long term management solution for waste. The Agency's Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation peer review service continues to be in demand.



16. Operational Safety Review Team (OSART) mission reports continue to identify recommendations and suggestions with regard to strengthening the conduct of safe operations, enhancing continuous improvement, optimizing maintenance activities, strengthening accident management and on-site EPR, and setting, communicating and implementing management expectations.

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

18. Member States are continuing to request Site and External Events Design (SEED) missions, as well as other capacity building services related to this subject.

19. Member States continue to revise severe accident management guidance for existing NPPs to include safety upgrades and non-permanent equipment, and to address multi-unit considerations.

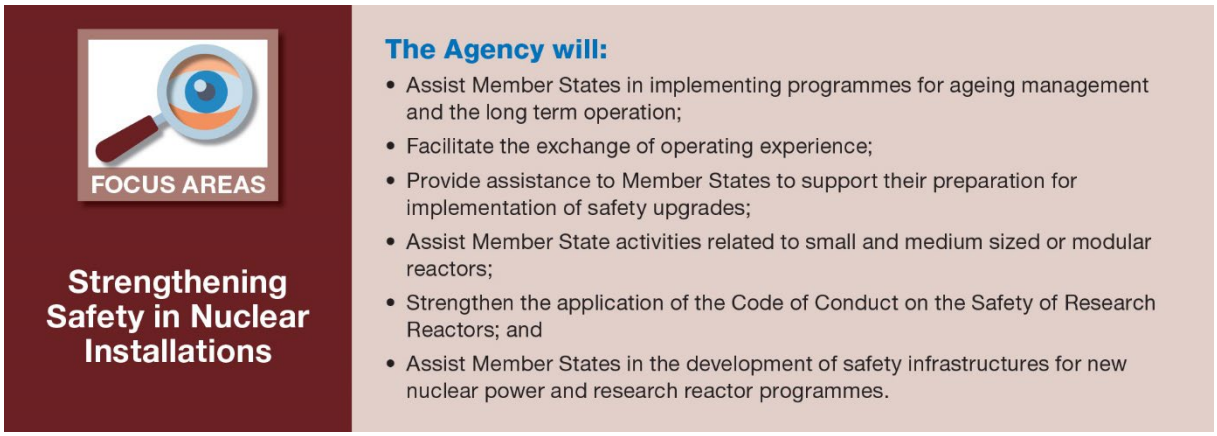
20. The application of Agency safety standards to innovative NPP designs, including small modular reactors (SMRs), is a matter of great interest for Member States. The construction and deployment of transportable NPPs (TNPPs) is also of increasing interest to Member States.

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

22. In response to the growing interest of Member States in the utilization of advanced new reactor technologies, the Agency developed the IAEA Platform on Small Modular Reactors and their Applications (SMR Platform). In addition, the Agency launched the Nuclear Harmonization and Standardization Initiative (NHSI), which reflects Member States' interest in the harmonization of safety requirements and regulatory and licensing approaches as well as in the standardization of industrial approaches for SMRs. Furthermore, some Member States expressed an interest in applying a holistic approach to safety–security–safeguards by design for nuclear installations, in particular for SMRs, in the early stage of the design process without prejudice to Member States' legal commitments, the Agency's Statute and the relevant General Conference resolutions.

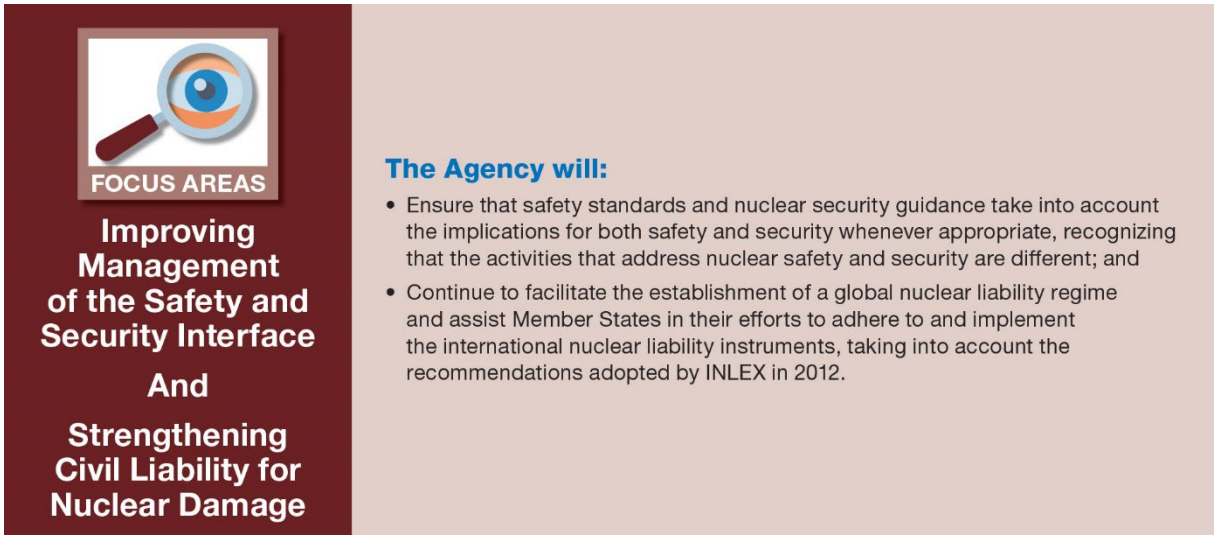
23. Most Member States with operating research reactors are applying the provisions of the Code of Conduct on the Safety of Research Reactors.

24. Analysis of reports provided to the Fuel Incident Notification and Analysis System (FINAS) in 2022 showed the importance of establishing effective ageing management programmes, continued training of personnel, and effective use of operating procedures.



25. Member States continue to attach importance to having in place effective and coherent nuclear liability mechanisms at the national and international levels. Member States continue to request Agency assistance for their efforts to adhere to and implement the international nuclear liability conventions.

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



27. The Agency's priorities for 2023 regarding strengthening nuclear, radiation, transport and waste safety, and EPR, are as follows:

- Continuing to strengthen the Agency's safety standards to ensure that they constitute an integrated, comprehensive and consistent set of up-to-date, user-friendly and fit-for-purpose standards of high quality and that they continue to be seen as the global reference for protecting people and the environment from the harmful effects of ionizing radiation;
- Encouraging political commitment to the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance. The Agency will actively interact with Member States to encourage political and practical commitment to the Code and the

Guidance. The objective is to get all Member States to participate in it, promote it and observe its recommendations;

- Hosting the Joint Eighth and Ninth Review Meeting of the Contracting Parties to the CNS;
- Continuing to assist Member States in strengthening their EPR capabilities through the implementation of IAEA Safety Standards Series No. GSR Part 7, the delivery of capacity building activities, and the implementation of the recommendations and action items from the 11th Meeting of the Representatives of Competent Authorities Identified under the Early Notification Convention and the Assistance Convention;
- Enhancing the sustainability of Agency regional and thematic networks through the development and implementation of self-assessment tools for networks and by enhancing the interactions between different regional networks;
- Assisting Member States in developing and implementing national policies and strategies concerning the safe management of radioactive waste and spent fuel, the promotion of disposal as the end state for waste, the development of decommissioning safety strategies and plans, and releases to the environment;
- Continuing to assist Member States in their efforts to harmonize and standardize regulatory and industrial approaches in support of the effective global deployment of safe and secure SMRs, through the NHSI and the IAEA Platform on Small Modular Reactors and their Applications;
- Providing consistent support and guidance to embarking countries with regard to ensuring proper site selection, establishing an independent regulatory body, using Agency safety standards, and leveraging international experience and cooperation;
- Continuing the activities of the task force to conduct a review that will assess the Government of Japan's plan to discharge ALPS treated water at Fukushima Daiichi NPP against relevant Agency safety standards. As proposed by the Director General, the Agency's work on the plan will take place before, during and after its implementation; and
- Continuing to provide technical support and assistance regarding nuclear safety and security of Ukraine's nuclear facilities and activities involving radioactive sources, including expert missions and delivery of equipment, in accordance with the scope of the technical plan drawn up by the Agency and Ukrainian officials in March 2022 and as needs arise with the evolution of the situation.

Abbreviations

ALPS	Advanced Liquid Processing System
ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
CANDU reactor	Canadian deuterium–uranium reactor
CGULS	Coordination Group for Uranium Legacy Sites
CNS	Convention on Nuclear Safety
ConvEx-1	Level 1 Convention Exercise
ConvEx-2	Level 2 Convention Exercise
ConvEx-3	Level 3 Convention Exercise
CRP	coordinated research project
CSS	Commission on Safety Standards
EduTA	Education and Training Appraisal
EENS	External Events Notification System
EPR	emergency preparedness and response
EPReSC	Emergency Preparedness and Response Standards Committee
EPREV	Emergency Preparedness Review
EPRIMS	Emergency Preparedness and Response Information Management System
FORO	Ibero-American Forum of Radiological and Nuclear Regulatory Agencies
GIF	Generation IV International Forum
GNSSCOM	Global Nuclear Safety and Security Communication Network
GNSSN	Global Nuclear Safety and Security Network
GSR	General Safety Requirements
IEC	Incident and Emergency Centre
iNET-EPR	International Network for Education and Training for Emergency Preparedness and Response
INIR	Integrated Nuclear Infrastructure Review
INLEX	International Expert Group on Nuclear Liability
INSAG	International Nuclear Safety Group
IRMIS	International Radiation Monitoring Information System
IRRS	Integrated Regulatory Review Service

ISCA	Independent Safety Culture Assessment
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
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
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 environmental impact assessment
RISS	Advisory Mission on Regulatory Infrastructure for Radiation Safety and Nuclear Security
RPO	radiation protection officer
SALTO	Safety Aspects of Long Term Operation
SCCIP	Safety Culture Continuous Improvement Process
SEDO	Safety Evaluation of Fuel Cycle Facilities During Operation
SEED	Site and External Events Design
SMR	small and medium sized or modular reactor
TECDOC	IAEA Technical Document
TNPP	transportable nuclear power plant
TSO	technical and scientific support organization
TSR	Technical Safety Review

UAV	unmanned aerial vehicle
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
VVER	water cooled, water moderated power reactor
WINS	World Institute for Nuclear Security
ZNPP	Zaporizhzhya Nuclear Power Plant

Analytical Overview

A. General Safety Areas

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

Trends

1. The work on the Agency's safety standards continued to focus on the revision of existing standards rather than the establishment of new ones. The Secretariat, together with Member States, is working on the establishment of a long term strategy for the future development of safety standards, addressing the set of safety standards in a holistic manner and ensuring coordination with relevant international organizations.

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

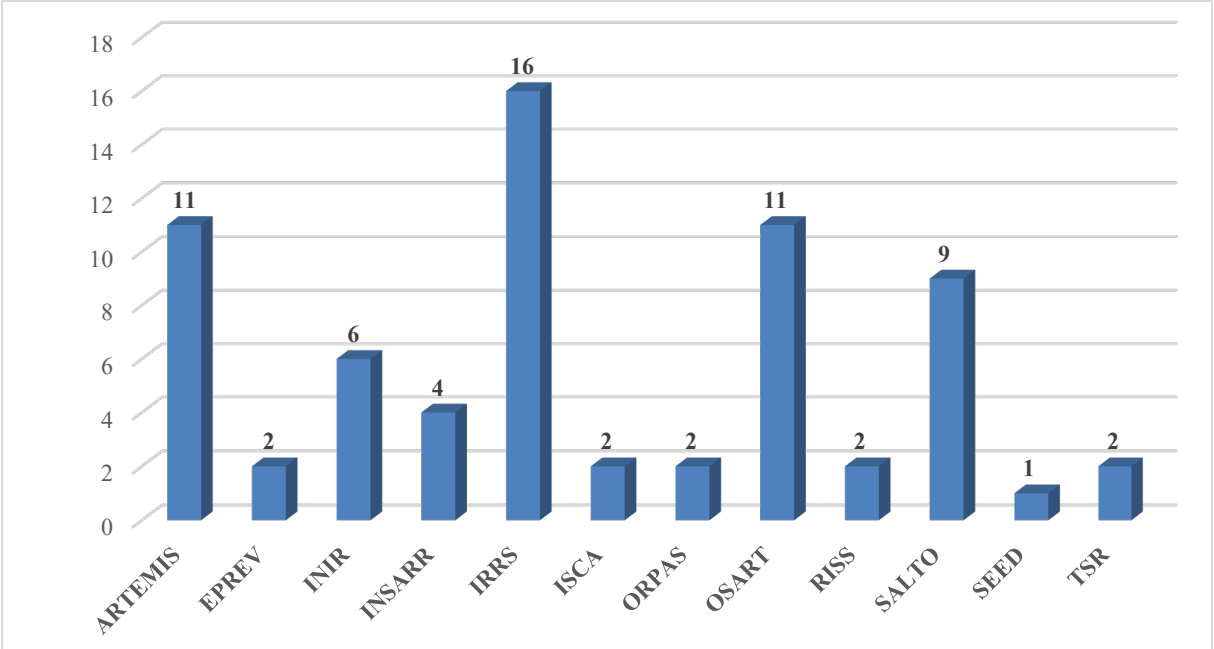


Fig. 1. Number of Member State requests for Agency peer review and advisory services to be conducted over the next two years.

Related activities

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

- Further optimize the process for the development of safety standards, including improving the operational website used by the Safety Standards Committees and the Commission on Safety Standards, and consolidate the long term strategy for their future development;

- Review the safety standards for their applicability to small and medium sized or modular reactors (SMRs) and larger non-water cooled reactors and update them accordingly;

- Continue encouraging Member States to request Agency peer review and advisory services to strengthen their operational safety performance and leadership and management for safety;

- Continue providing Integrated Regulatory Review Service (IRRS) missions according to the recommended ten-year cycle, including IRRS follow-up missions, and continue encouraging Member States to request these missions;

- Encourage Member States to request Technical Safety Review (TSR) services concerning the safety of conceptual reactor designs for SMRs to increase confidence in the safety of their designs or the adequacy of their safety assessments, as well as to identify the path to implement practicable improvements to nuclear safety;

- Continue strengthening Emergency Preparedness Review (EPREV) missions by extending the pool of experts serving as reviewers, facilitating the self-assessment process using the Emergency Preparedness and Response Information Management System (EPRIMS), increasing transparency of findings, and making consistent use of performance indicators to assess the effectiveness and efficiency of missions; and

- Continue encouraging Member States to request Occupational Radiation Protection Appraisal Service (ORPAS) missions to strengthen their legislative and regulatory infrastructure and their practical implementation of occupational radiation protection programmes.

A.2. International Safety Conventions

Trends

4. The Convention on Nuclear Safety (CNS) was adopted on 17 June 1994 and entered into force on 24 October 1996. As of December 2022, there were 91 Contracting Parties to the CNS (see Figure 2).

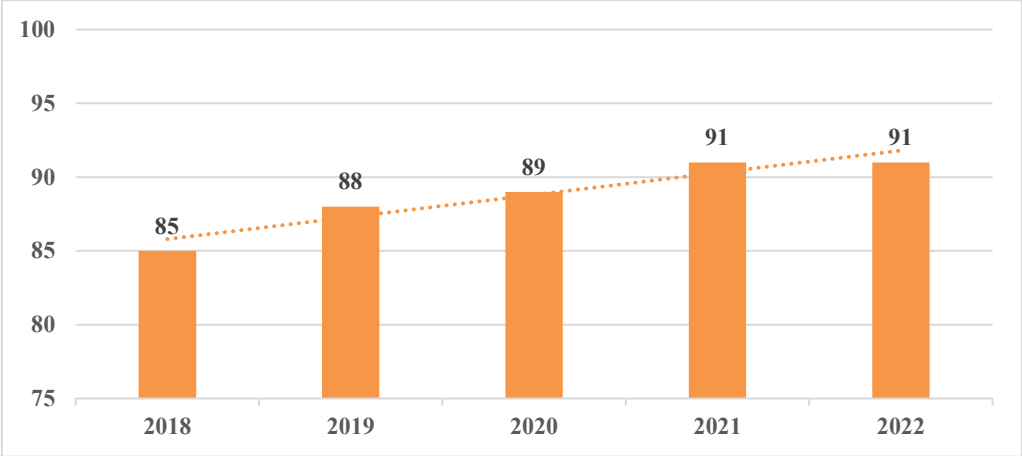


Fig. 2. Number of Contracting Parties to the CNS between 2018 and 2022.

5. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) was adopted on 5 September 1997 and entered into force on 18 June 2001. As of December 2022, there were 88 Contracting Parties to the Joint Convention, an increase of 2 compared to the end of 2021 (see Figure 3).

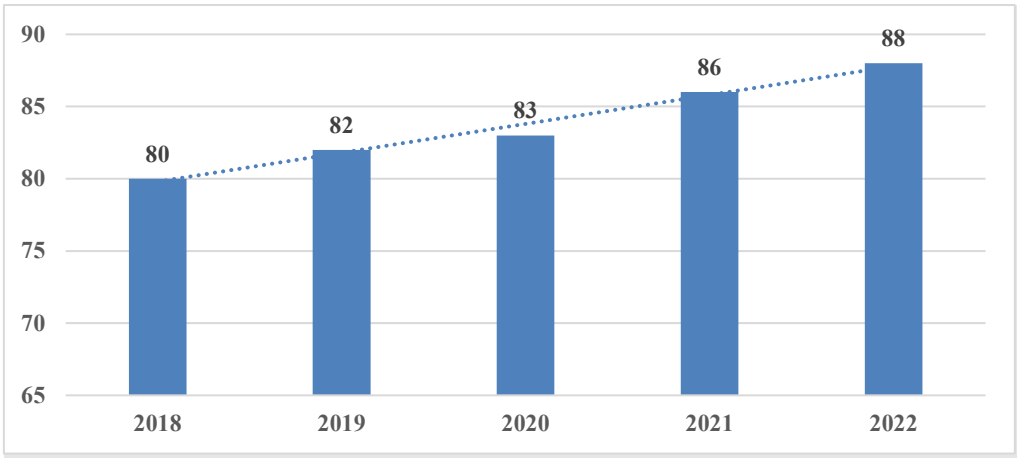


Fig. 3. Number of Contracting Parties to the Joint Convention between 2018 and 2022.

6. The Convention on Early Notification of a Nuclear Accident (Early Notification Convention) was adopted on 26 September 1986 and entered into force on 27 October 1986. As of December 2022, there were 132 States Parties to the Early Notification Convention, an increase of 1 compared to the end of 2021.

7. The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) was adopted on 26 September 1986 and entered into force on 26 February 1987. As of December 2022, there were 127 States Parties to the Assistance Convention, an increase of 3 compared to the end of 2021.

Related Activities

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

- Organize the Joint Eighth and Ninth Review Meeting of the Contracting Parties to the CNS;

- Continue promoting the adherence of Member States to international safety conventions;
- Provide educational workshops for Contracting Parties to ensure effective implementation of the CNS;
- Organize regional and interregional workshops to promote the adherence of Member States to the Joint Convention; and
- Implement the actions adopted at the 11th Meeting of the Representatives of Competent Authorities Identified under the Early Notification Convention and the Assistance Convention, which aim to strengthen emergency preparedness and response (EPR) in Member States.

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

Trends

9. Information provided in the Agency's Radiation Safety Information Management System (RASIMS)[5] indicates that 80% of Member States whose information in the system has been evaluated have a regulatory infrastructure for radiation safety with a 'satisfactory' or 'good' level of compliance with Agency safety standards.

10. The 13 IRRS missions conducted in 2022 highlighted the continued commitment of the Member States concerned to strengthening national legal and governmental infrastructure. The Agency's ongoing analysis of IRRS missions conducted since 2015 shows that many regulatory bodies still experience issues with maintaining regulations for occupational and medical exposure; reviewing and testing emergency plans; long term human resource planning; financial resources; management systems; and the implementation of a graded approach to regulatory processes, including authorization and inspection.

11. There is increasing interest from Member States in the assessment of their radioactive waste and spent fuel management, decommissioning and remediation programmes, as demonstrated by the number of requests for Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) missions. Ten ARTEMIS missions were conducted in 2022 and nine are planned for 2023 concerning Member States' radioactive waste management programmes.

12. Member States are showing increasing interest in performing self-assessments against the requirements of IAEA Safety Standards Series No. GSR Part 7 (*Preparedness and Response for a Nuclear or Radiological Emergency*), using EPRIMS. Data indicates that 15% of Member States conducted or updated one of their self-assessments against GSR Part 7 in 2022.

13. Member States, at the Transport Safety Standards Committee, concluded their review of the 2018 edition of the IAEA Regulations for the Safe Transport of Radioactive Material (IAEA Safety Standards Series No. SSR-6 (Rev. 1)) and requested the Secretariat to initiate its revision.

[5] RASIMS can be found at https://rasims.iaea.org/.

Related Activities

14. 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:

- Organize the International Conference on Effective Nuclear and Radiation Regulatory Systems: Preparing for the Future in a Rapidly Changing Environment, the sixth in a series of conferences on effective nuclear and radiation regulatory systems; and
- Organize workshops on the lessons identified from IRRS missions.

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

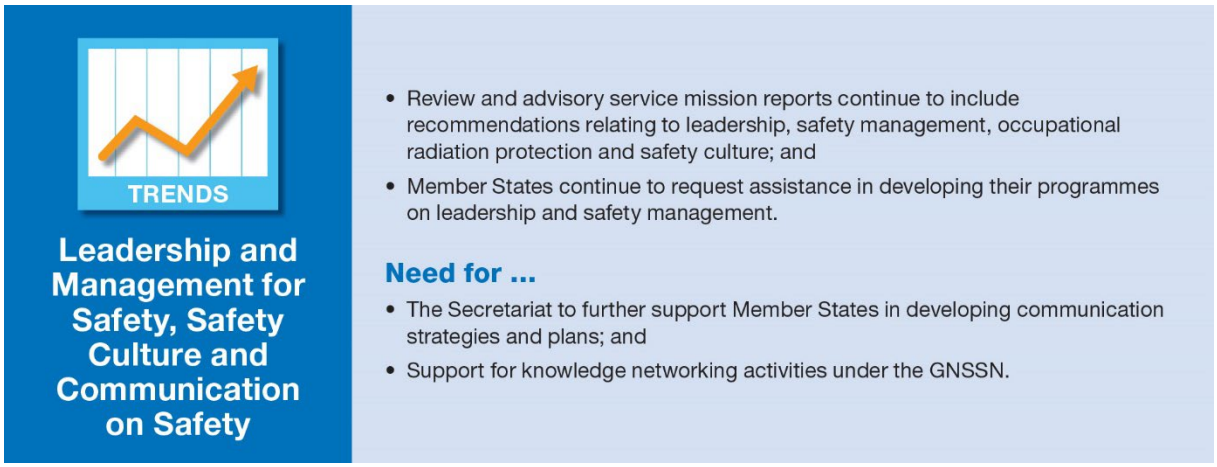
Trends

15. Member States' interest in the Agency's regional networks and thematic networks under the Global Nuclear Safety and Security Network (GNSSN) framework continues to increase.

16. Agency peer review and advisory service mission reports continue to include recommendations relating to leadership, safety management, occupational radiation protection and safety culture.

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

18. Thematic working groups and Technical Meetings have highlighted the need for the Secretariat to further support Member States in developing communication strategies and plans.



Related Activities

19. 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:

- Hold a Technical Meeting on Experience in Development of Leadership and Safety Culture Programmes in Member States;
- Hold a training course on Leadership, Management and Culture for Safety and on the Safety Culture Continuous Improvement Process; and
- Continue to implement the International Schools of Nuclear and Radiological Leadership for Safety.

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

Trends

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

21. Member States have provided information on the current status of their national provisions in order to identify areas where these should be strengthened and they have evaluated the education and training needs at the national level, particularly for personnel with responsibilities for radiation protection and safety (radiation protection officers (RPOs) and qualified experts).

22. The Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radiation Sources continued to be an effective programme through which Member States can train personnel with regulatory or advisory functions in radiation safety. An increasing number of Member States are showing interest in hosting the course, under the auspices of the Agency, for the benefit of other Member States at the regional level.

Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radiation Sources

First held: 1981 in Argentina

Objective: To provide a sound basis in radiation protection and the safety of radiation sources. Includes both theoretical and practical training on the multidisciplinary scientific and technical foundations of international recommendations and standards on radiation protection and their implementation.

Number of participants since 1981: 2067

More information: www.iaea.org/services/training/pgec

600 hours distributed over 20 weeks

10 Regional Training Centres

5 UN languages plus Portuguese

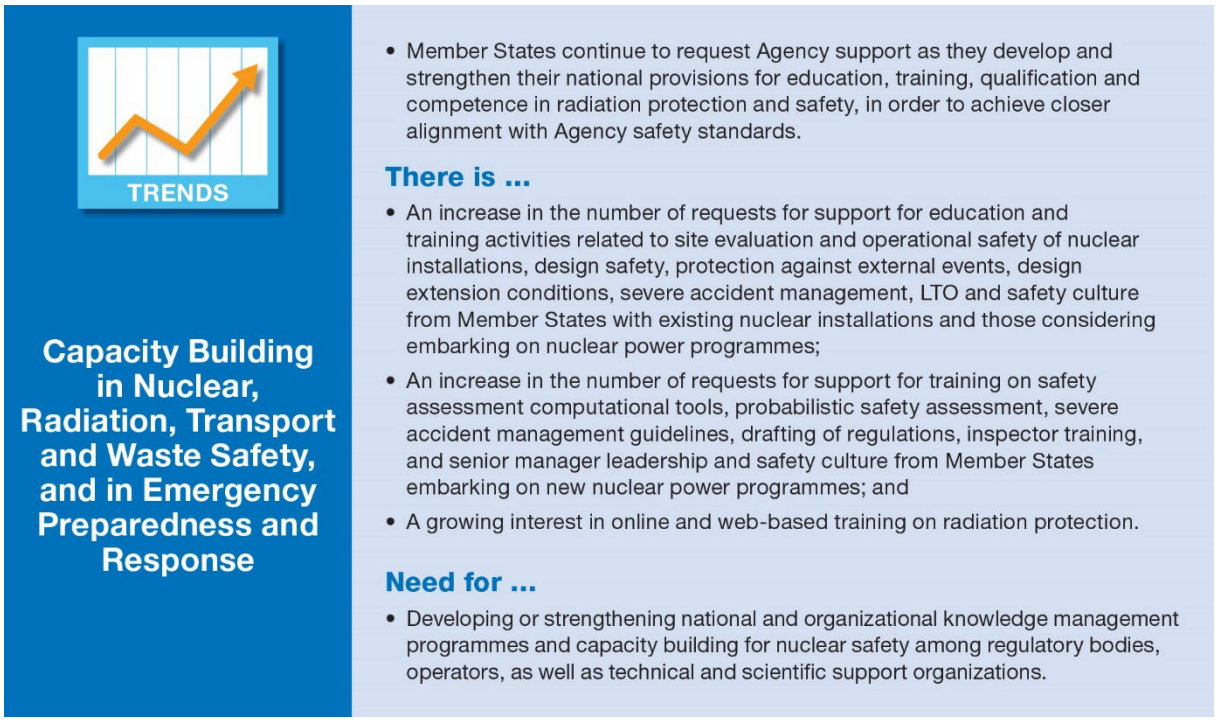
23. In general, Member States' interest in online and web-based training on radiation protection — including radiation protection in medical uses of ionizing radiation, occupational radiation protection, radon, transport and waste safety — which had increased during the COVID-19 pandemic travel restrictions of previous years, has remained high. Member States are also showing increasing interest in accessing e-learning resources on Agency safety standards and on their practical application, as well as in participating in knowledge management networks where they can share their experience of the application of the safety standards in national and international projects.

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

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

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

27. Member State interest in EPR capacity building activities has continued to grow. The International Network for Education and Training for Emergency Preparedness and Response membership grew to 206 in 2022, up from 179 in 2021. Young graduates have shown interest in the opportunity to upgrade their qualifications in EPR: in 2022, the second year of the international master's degree programme in EPR following its pilot implementation in 2021, 3 graduates applied to join the programme.



Related Activities

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

- Support Member States in the development and strengthening of provisions for education, training, qualification and competence in radiation protection and safety, and on the establishment of national strategies in this area;

- Continue enhancing, including by virtual methods, education and training programmes and implementing capacity building activities in the areas of safety assessment and design safety, and operational safety of nuclear power plants (NPPs);

- Continue to provide the PGEC in Radiation Protection and the Safety of Radiation Sources and organize train the trainer events for trainers of RPOs;

- Continue supporting Member States in the development and strengthening of their national competence in the design assessment of transport packaging, radiation protection in transport, and the development of national transport regulations through education and training; and

- Continue delivering EPR capacity building activities in areas such as hazard assessment, protection strategy, emergency planning, medical emergency preparedness and response, and communication with the public in the event of a nuclear or radiological emergency.

A.6. Research and Development for Safety

Trends

29. Much of the recent research and development work undertaken in Member States focused on severe accident phenomena and safety features for design extension conditions to ensure the practical elimination of conditions that can lead to early or large radioactive release should an accident occur.

30. Member States continue to show high interest in research related to EPR, including in the effective use of dose projection tools, as demonstrated by their participation in and contribution to a coordinated research project on this topic.

31. There is increased interest in Member States in the application of rapid characterization techniques for radiological contamination based on the use of unmanned aerial vehicles (UAVs) equipped with radiation detectors.

Related Activities

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

- Continue to encourage research and development on the basis of identified needs, particularly regarding advanced approaches in safety assessment, analysis of design extension conditions, new design features, and equipment qualification in severe accident conditions;
- Continue to conduct research and development activities in support of the safety of advanced/innovative reactors, including carrying out the study on the applicability of Agency safety standards to accident tolerant fuels; and
- Organize training on the application of rapid characterization techniques based on the use of UAVs equipped with radiation detectors.

B. Strengthening Radiation, Transport and Waste Safety

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

Trends

33. There is continued interest and awareness among Member States, including through Agency activities regarding naturally occurring radioactive material (NORM), concerning the need to protect workers and properly manage residues in industrial operations and processes involving NORM, and to apply a graded approach to the use of regulatory and operator resources for these tasks in line with the International Basic Safety Standards (IAEA Safety Standards Series No. GSR Part 3).

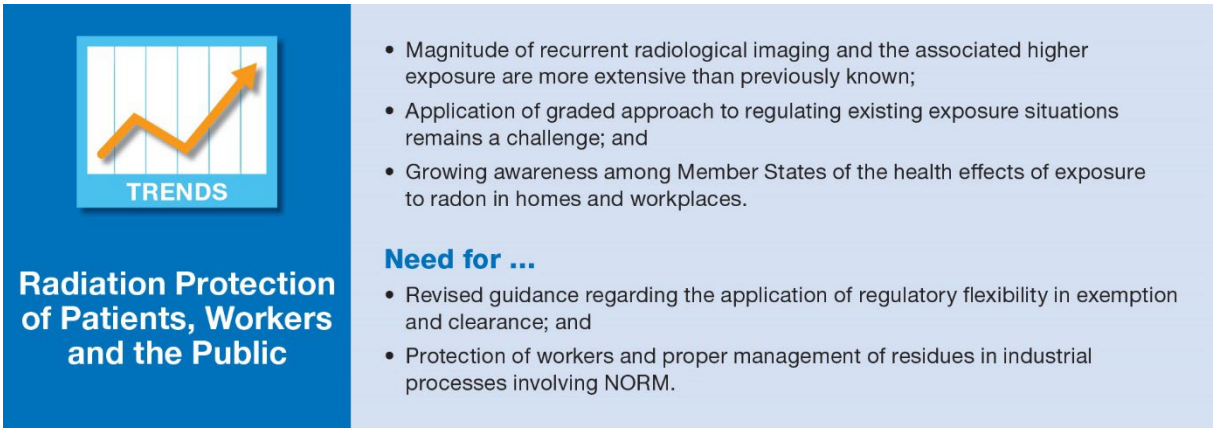
34. Member States continue to request Agency guidance as to how to consistently apply the requirements of GSR Part 3 relating to existing exposure situations to the entire, varied range of activities considered to be existing exposure situations. The application of a graded approach remains challenging for Member States dealing with regulatory control of existing exposure situations, such as in the context of international trade of commodities and criteria for exemption of surface-contaminated non-food commodities.

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

36. The Agency has issued guidance on how to manage exposures due to radionuclides in food and drinking water in non-emergency situations. Member States' requests to promote discussion and potential application of the recently released guidance confirm this to be a subject of significant concern.

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

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



Related Activities

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

- Support Member States in the establishment of regulatory systems for the safe management of NORM;
- Develop new guidance on radiation protection and safety in existing exposure situations;
- Organize regional workshops on the regulatory control of existing exposure situations, radon and non-medical imaging, among others;
- Hold a Technical Meeting on Radiation Protection of Paediatric and Pregnant Patients; and
- Hold a Technical Meeting on Advisory Services for Radiation Protection and Safety for Medical Exposures.

B.2. Control of Radiation Sources

Trends

40. The increased use of sealed radioactive sources in medicine, industry, agriculture and research has resulted in a need to ensure appropriate arrangements for the control of sources and the safe and secure management of disused sealed radioactive sources, including national strategies for managing disused radioactive sources and establishing national programmes and regulatory requirements.

41. Member States continue to request further guidance on the application of paragraph 22(b) of the Code of Conduct on the Safety and Security of Radioactive Sources on ensuring financial provisions for the safe management and secure protection of radioactive sources once they have become disused, as well as on regulatory requirements for the different options in the management of disused sources.

42. In 2022, five additional Member States made a political commitment to implementing the Code of Conduct on the Safety and Security of Radioactive Sources, with the total number increasing to 145. Six Member States notified the Director General of their intention to act in a harmonized manner with the supplementary Guidance on the Import and Export of Radioactive Sources, meaning that the total number of Member States that have done so increased to 129. Four additional Member States nominated points of contact for facilitating the import and export of radioactive sources, bringing the total number of Member States that have done so to 149, and 8 Member States made a political commitment to implementing the supplementary Guidance on the Management of Disused Radioactive Sources, bringing the total that have done so to 52 (see Figure 4).

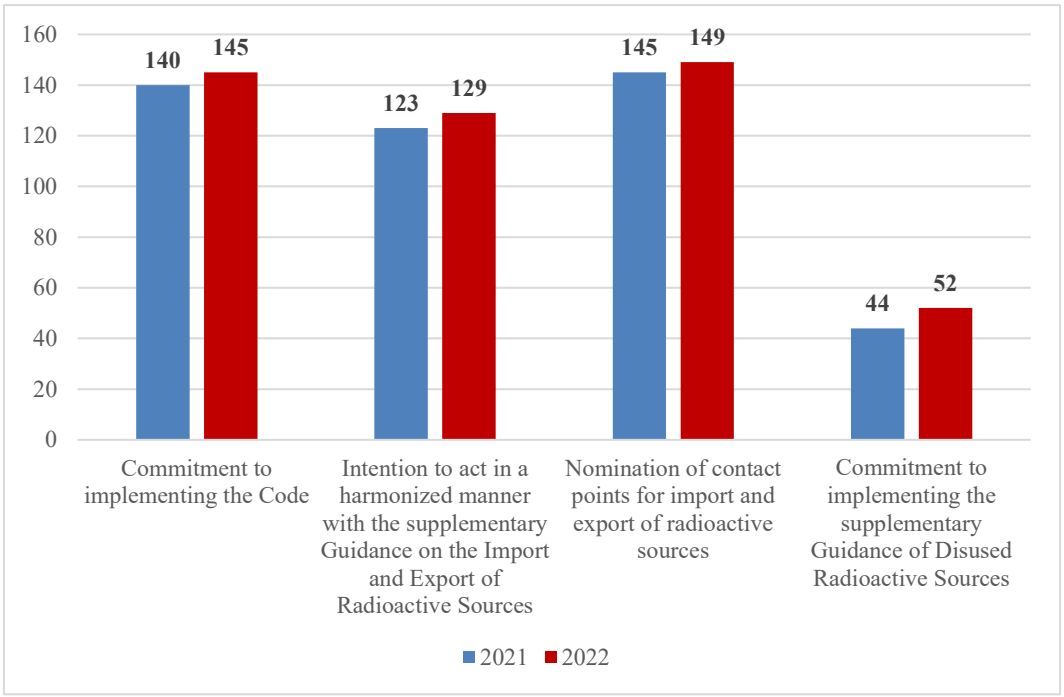
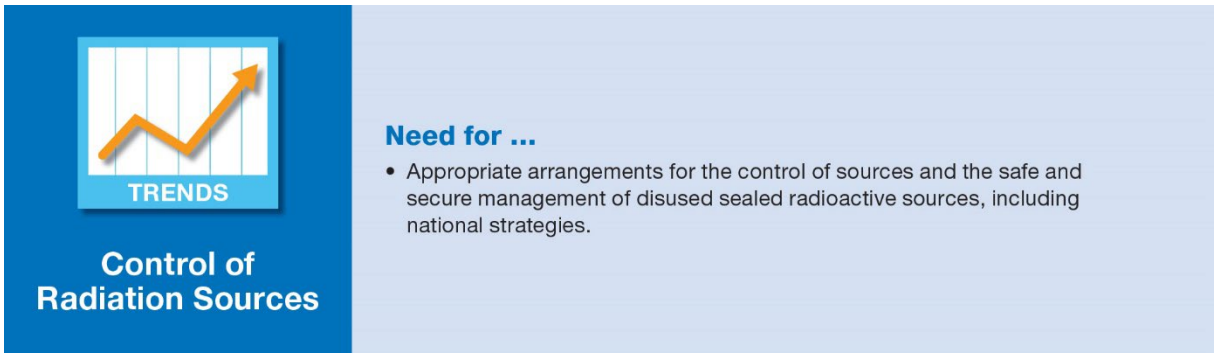


Fig. 4. Member State support for the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary guidance documents.



Related Activities

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

- Organize regional workshops to raise awareness and share experiences of the reuse and recycling of radioactive sources, as one of the recommended options for the safe management of disused sealed radioactive sources;
- Hold a Technical Meeting with all States' points of contact for the Guidance on the Import and Export of Radioactive Sources;
- Hold an Open-Ended Meeting of Technical and Legal Experts for Sharing Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources, and recognize the 20th anniversary of the approval of the Code of Conduct by the Board of Governors; and
- Develop guidance on ensuring financial provisions for the safe management and secure protection of radioactive sources once they have become disused.

B.3. Safe Transport of Radioactive Material

Trends

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

45. Some Member States are increasingly interested in the construction and deployment of TNPPs and their transport (movement), as well as in the transport of nuclear fuel for SMRs. The applicability of Agency safety standards to these cases is an important concern for Member States.

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

Related Activities

47. 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:

- Support the work of the Denial of Shipment Working Group and organize its first meeting in January 2023 and its second meeting in July 2023;
- Continue developing a publication related to design safety, operation safety and deployment and authorization of TNPPs, and, in coordination with the Agency SMRs platform and networks on SMRs and TNPPs, review the applicability of Agency safety standards to the transport of radioactive material associated with innovative reactor technologies;
- Hold a workshop on the Transport Safety Regulatory Programme for Uranium and other Naturally Occurring Radioactive Material Produced by Mining and Milling; and
- Hold the School for Drafting Regulations on Transport Safety in English and French.

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

Trends

48. Demand for the ARTEMIS service continues and the Agency has been requested to organize 11 ARTEMIS missions in 2023 and 2024. In addition, some Member States have requested peer review of pre-operational safety of the deep geological disposal projects.

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

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

51. 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 near surface disposal of very low and low level radioactive waste.

52. Several Member States are increasingly interested in geological disposal of high level radioactive waste and spent fuel when considered as waste. Research, site investigations, licensing and construction activities for geological disposal facilities are progressing in many Member States. In addition, some Member States are pursuing a closed nuclear fuel cycle and some consider spent fuel as a resource rather than waste. Further consideration is needed for strengthened safety in this regard.

53. Member States continue to request assistance in the safe long term management of disused sealed radioactive sources, including in the development of safe and secure storage facilities and borehole disposal facilities.

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

Related Activities

55. 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:

- Continue activities related to the development and implementation of national policies and strategies for the safe management of radioactive waste and spent fuel;
- Continue activities of the International Harmonization and Safety Demonstration Project for Predisposal Radioactive Waste Management;
- Hold Technical Meetings under the International Project on Completion of Decommissioning;
- Continue activities to promote the new guidance on clearance and on the derivation of specific clearance levels for materials suitable for recycling or reuse, or for disposal in landfills;
- Hold Technical Meetings on decommissioning of medical, industrial and research facilities;
- Hold Technical Meetings related to the safety of decommissioning and disposal of radioactive material; and
- Continue implementing activities under the Regulatory Forum for Safety of Uranium Production and NORM to promote application of Agency safety standards and continue providing assistance to Member States upon request.

B.5. Radiation Protection of the Environment and Remediation

Trends

56. International attention continues to be paid to the Agency's review of the handling of Advanced Liquid Processing System (ALPS) treated water at Fukushima Daiichi NPP and the associated plan to discharge the ALPS treated water into the sea. Member States have consistently highlighted the importance of the Agency's independence and technical expertise in this process and have called for the Agency's continued involvement and transparency.

57. With continued concern regarding radiologically contaminated areas owing to past practices and the need for remediation of such areas for protection of human health and the environment, there is

continued interest in identification and characterization of contaminated areas. Where remediation is justified and is planned to be implemented, Member States are seeking Agency support in establishing open communication with interested parties. Member States with remediation projects at their final stage are requesting support and guidance from the Agency on planning and implementing long term post-remediation management, particularly where remediated sites cannot be released from regulatory control owing to the potential socioeconomic development of surrounding populated areas.

58. Observations from Agency missions have shown that the use of a wide range of nuclear techniques and applications worldwide and activities such as uranium mining and milling and NORM industries have resulted in a growing need to analyse and evaluate the radiological implications of radionuclides being released to the environment. This includes Member State 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.

Related Activities

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

- Continue reviewing the safety related aspects of handling ALPS treated water at Fukushima Daiichi NPP, including the conduct of additional review missions and the publication of technical reports, leading up to the beginning of the discharge of ALPS treated water at the plant before, during and after its implementation. The Agency will also continue conducting sampling campaigns and providing independent analysis of source and environmental samples;

- Continue organizing events of the International Working Forum on Regulatory Supervision of Legacy Sites and the Coordination Group for Uranium Legacy Sites to address safety aspects of remediation of legacy sites, such as characterization, safety assessment, environmental impact assessment, regulatory supervision, monitoring and long term post-remediation management; and

- Continue implementing the Methods for Radiological and Environmental Impact Assessment (MEREIA) programme, which focuses on the application and applicability of assessment models and methodologies in the wide context of radiological and environmental impact

assessment. A key element is the development of young professionals as part of the capacity building and knowledge management objectives of MEREIA.

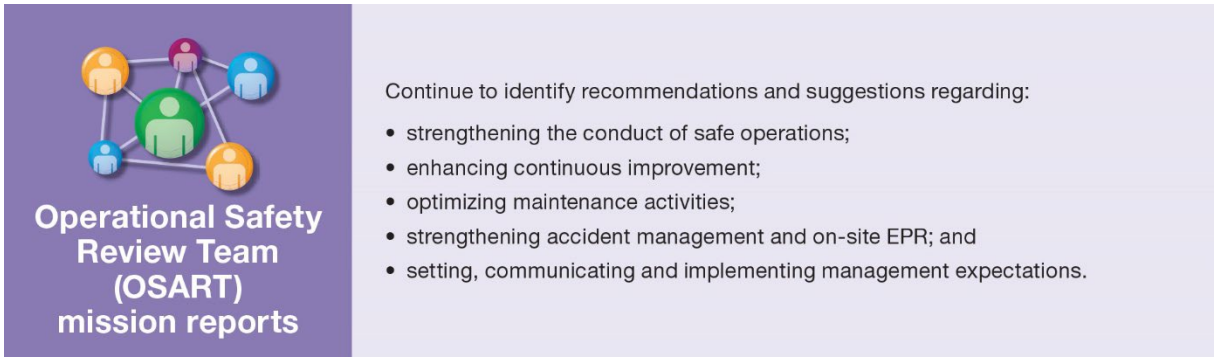
C. Strengthening Safety in Nuclear Installations

C.1. Nuclear Power Plant Safety

C.1.1. Operational Safety

Trends

60. Operational Safety Review Team (OSART) missions continue to identify recommendations and suggestions regarding strengthening the conduct of safe operations, enhancing continuous improvement, optimizing maintenance activities, strengthening accident management and on-site EPR, and setting, communicating and implementing management expectations.



61. Analysis of data from 52 reports submitted in the International Reporting System for Operating Experience in 2022 indicated a continuing need to learn from events related to human performance, equipment reliability, operation and maintenance fundamentals' improvement, leadership improvement, management and oversight of processes and practices.

62. Nuclear power reactors around the world have programmes to address LTO and ageing management. In 2022, 73% of the 422 operating power reactors have been in operation for 30 years or more and 25% have been in operation for more than 40 years (see Figure 5).

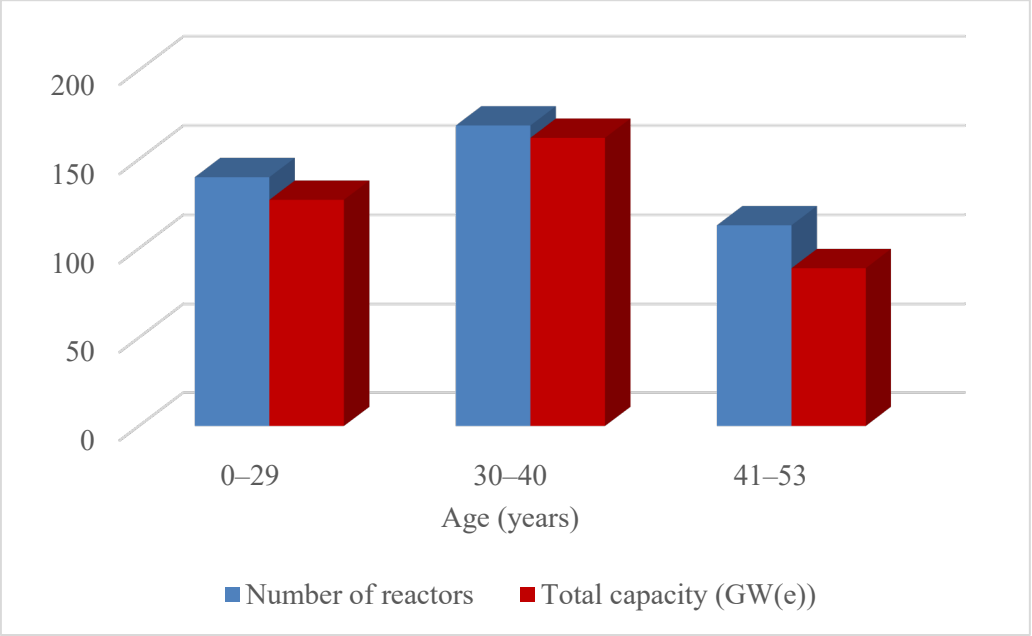


Fig. 5. Age distribution of all 422 operating power reactors in 2022 based on information from the Power Reactor Information System on 6 December 2022.

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

Related Activities

64. 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 operating experience of NPPs 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, together with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development, a Technical Meeting to Exchange Experience on Recent Events in Nuclear Power Plants;
- Continue proposing, on the basis of the outcomes of the OSART, specific missions to support the identification of actions to improve NPP performance;
- Continue providing SALTO missions to assist in the continuous improvement of NPPs' management of LTO;
- Continue providing Peer Review of Operational Safety Performance Experience missions to evaluate and support NPPs with regard to performance improvement using operating experience; and
- Continue providing OSART missions to review NPPs and to continuously improve their safety performance in line with Agency safety standards.

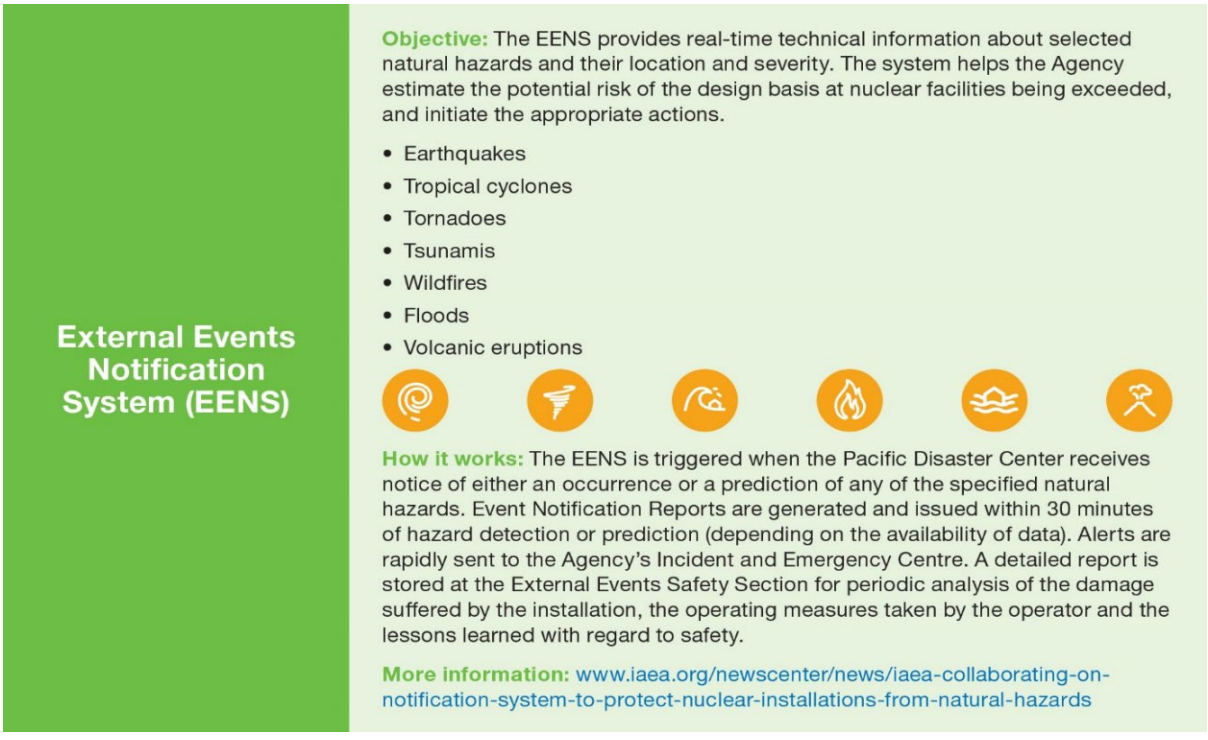
C.1.2. Site Safety and External Hazards

Trends

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

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

67. There is also an increased interest in the assessment of combinations of hazards as well as hazards at multi-unit sites. The Agency has issued documents and guidelines on these topics, and services will be offered in the near future. Member States continue to express interest in the development and operation of software systems and procedures able to provide real-time alert concerning all types of external events jeopardizing the safety of nuclear installations. The first delivery of the External Events Notification System (EENS) in September 2022, configured at present for two priority hazards — earthquakes and cyclones — was welcomed by Member States at a recent meeting with senior regulators.



Related Activities

68. 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:

- Support Member States in enhancing site and installation design safety with respect to external hazards, including hazards resulting from human activity and with special reference to the effects of climate change, through the development of safety standards and technical guidelines for their application, with special emphasis on siting needs of SMR reactors;
- Continue expanding the EENS to include additional modules covering further hazards and disseminate it more broadly to Member States; and
- Continue providing site review missions (SEED) for SMRs to support proper application of a graded approach to siting, compatible with deployment time and costs while remaining firmly in line with the safety requirements, and continue encouraging Member States to request such missions.

C.1.3. Design Safety and Safety Assessment

Trends

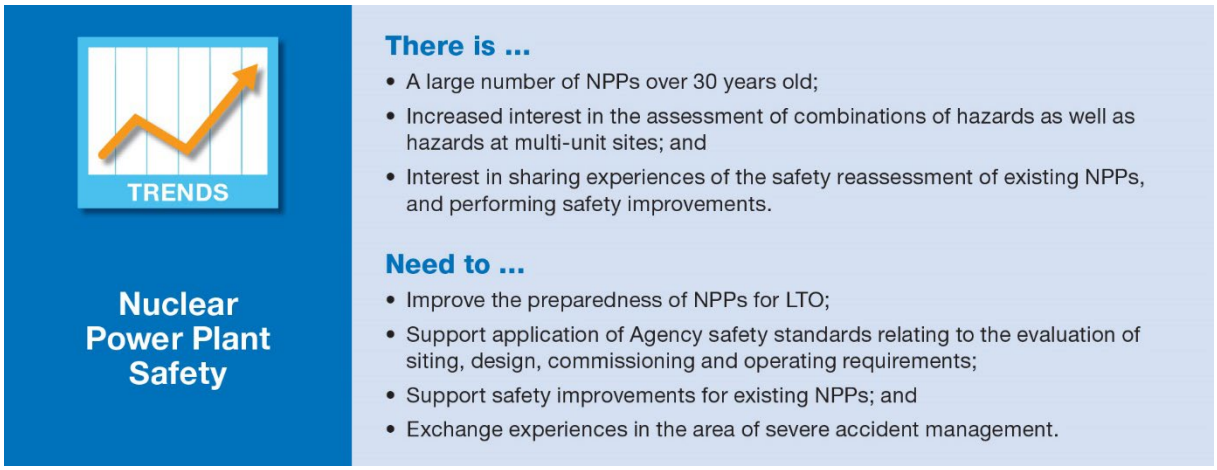
69. Member States continue to express interest in sharing experiences of the safety reassessment of existing NPPs regarding best practices in performing reasonably practicable safety improvements for preventing accidents, mitigating the consequences of an accident should one occur, and avoiding significant radioactive releases.

70. There is a growing interest in the harmonization of safety requirements and licensing approaches, and in the sharing of knowledge, with respect to the design and safety evaluation of new NPPs, including innovative designs. Member States continue to request assistance in the review of safety assessments of new reactor designs and express interest in advanced safety assessment techniques in areas such as the reliability of digital instrumentation and passive systems, human reliability assessment, the use of insights from safety analysis for security purposes, and risk analysis in a multi-unit and multi-source context or for multi-module interactions.

71. Member States increasingly use periodic safety reviews (PSRs) for justifying 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 for justifying LTO.

72. Member States continue to revise severe accident management guidance for existing NPPs to include safety upgrades and non-permanent equipment, and to address multi-unit considerations. For new NPPs, severe accident management guidance is acknowledged as an important contributor to the practical elimination of conditions leading to early radioactive releases or large radioactive releases.

73. Member States express an interest in receiving peer reviews of accident management programmes as well as sharing experiences of the development of accident management programmes for advanced and innovative reactors.



Related Activities

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

- Continue to organize meetings and TSR peer review services;
- Continue to develop technical documentation to assist Member States in the application of the Agency's safety standards on safety assessment and design in support of safety improvements for existing NPPs and to address emerging topics in the design safety of new NPPs;
- Continue to facilitate the exchange of experience in the area of severe accident management and develop supporting technical documentation;
- Continue promoting and supporting capacity building and national human resource development in the area of severe accident management; and
- Revise the Safety Guide on *Periodic Safety Review for Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-25).

C.2. Safety of Small Modular Reactors

Trends

75. More than 80 different designs of SMR are at various stages of development and deployment. The interest of Member States in SMRs has been reflected in their growing participation in Agency activities related to SMRs, particularly in the review of the applicability of Agency safety standards to SMRs. The Agency conducted four webinars on various matters of SMR safety, which attracted high attendance from Member States.

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

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

Related Activities

78. The Agency will assist Member State activities related to SMRs, particularly 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:

- Implement the newly launched Nuclear Harmonization and Standardization Initiative to reflect Member States' interest in the harmonization of safety requirements and regulatory and licensing approaches for SMRs;
- Implement a plan of work to systematically review and revise Agency safety standards in support of the licensing and safe and secure deployment of emerging SMR technologies;
- Continue developing publications related to the safety assessment, design safety, regulation and operation of SMRs, to collate Member States' experience of the practical application of safety standards and help build their capability in the safety of SMRs;
- Continue supporting Member States in strengthening their capabilities on safety assessment and regulation of SMRs;
- Continue delivering regional educational workshops on the regulation of SMRs in embarking countries or countries expanding nuclear programmes; and
- Continue the activities under the IAEA Platform on Small Modular Reactors and their Applications, as well as continuing to provide secretarial functions for the SMR Regulators' Forum.

C.3. Research Reactor Safety

Trends

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

80. Around 28 Member States are planning or implementing modification and refurbishment projects to address ageing of the structures, systems and components of research reactors. Member States have shown increased awareness and have improved their management of the interface between safety and security when planning and implementing these projects.

Related Activities

81. The Agency will provide assistance to Member States to support their preparation for implementation of safety upgrades resulting from safety assessments of research reactors, managing 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:

- Organize the International Conference on Research Reactors: Achievements, Experience and the Way to a Sustainable Future;
- Assist Member States in their efforts to build capacity to fully implement the provisions of the Code of Conduct on the Safety of 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.

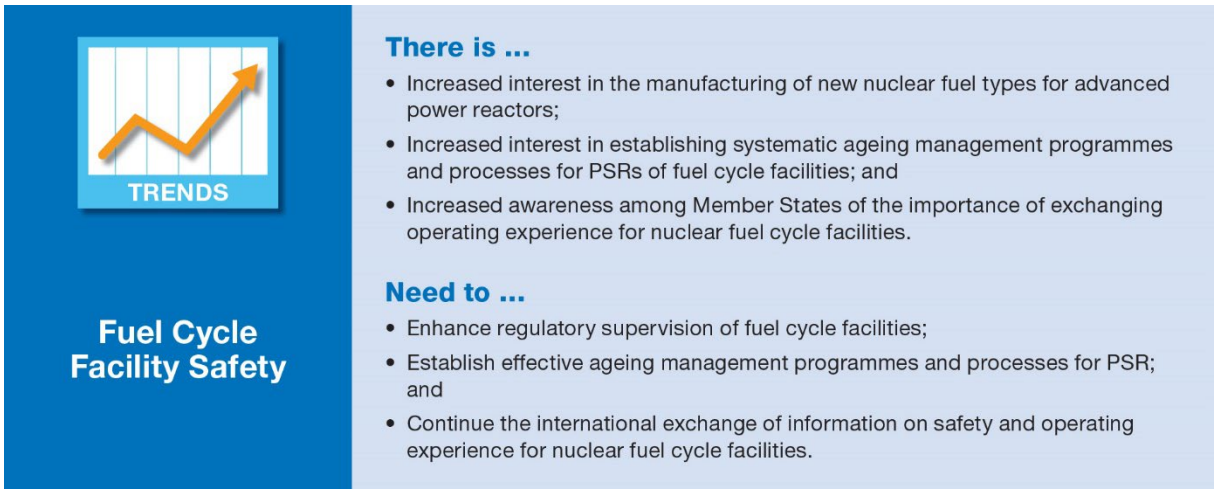
C.4. Fuel Cycle Facility Safety

Trends

82. In 2022, 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 303. The main lessons learned were on the importance of establishing effective ageing management programmes, continuing training of personnel, and using operating procedures effectively. More than 80% of the world's nuclear fuel cycle facilities are currently part of the system.

83. There is increased work on developing and manufacturing new nuclear fuel types for advanced nuclear power reactors, including construction of new fuel cycle facilities.

84. An increasing number of Member States are interested in establishing systematic ageing management programmes and processes for PSRs of fuel cycle facilities, including the development of corresponding regulatory competencies.



Related Activities

85. The Agency will provide assistance to Member States to support their efforts to enhance regulatory supervision, manage operating experience feedback, and manage the human factors in the design and operation of fuel cycle facilities. The Agency will continue to facilitate the exchange of operating experience and is planning to undertake the following related activities:

- Assist Member States in building and implementing their operating experience feedback programmes for the safe operation of nuclear fuel cycle facilities;
- Support Member States in developing safety programmes including regulatory supervision for non-radiological hazards at nuclear fuel cycle facilities; and
- Assist Member States in improving the considerations of human factor aspects in the safety of the design and operation of nuclear fuel cycle facilities.

C.5. Safety Infrastructure for Embarking Countries

C.5.1. Nuclear Power Programmes

Trends

86. About 30 Member States are considering or planning a new nuclear power programme, 25 of which have included the nuclear power option in their energy strategies. Furthermore, new NPPs or additional units are planned in 13 Member States that are non-vendor countries and are expanding their existing nuclear power capacity after several decades of dormant construction activity.

87. The IRRS, Integrated Nuclear Infrastructure Review service and other peer review and advisory services continued to identify the need to strengthen regulatory body independence, build regulatory capacity and competence, and establish safety regulations and licensing processes as part of effective legislative and regulatory oversight programmes.

88. It has been observed that there is a tendency to invite an IRRS mission only in Phase 3, although — according to *Establishing the Safety Infrastructure for a Nuclear Power Programme* (IAEA Safety

Standards Series No. SSG-16 (Rev. 1)) — a regulatory body is expected to be almost fully functional at the end of Phase 2. Therefore, countries embarking on a nuclear power programme are expected to host an IRRS mission in both Phase 2 and Phase 3. As a possible alternative to an IRRS mission, embarking countries in Phase 2 are offered the option of hosting an expert mission that covers only the relevant Phase 1 and Phase 2 actions of SSG-16 (Rev. 1), under the assumption that an IRRS mission will take place in Phase 3.

Related Activities

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

- Promote IRRS missions in countries embarking on a nuclear power programme. For countries in Phase 2, promote IRRS missions covering the tailored module dedicated to reviewing the establishment of the safety infrastructure for a nuclear power programme, or, as a possible alternative, an expert mission to review only the establishment of the regulatory infrastructure against the relevant Phase 1 and Phase 2 actions of SSG-16 (Rev. 1), under the assumption that an IRRS mission will take place in Phase 3; and
- Continue to assist embarking countries with the development of nuclear power programmes through enhancement of their technical capabilities in the areas of siting and site evaluation, safety review, design safety and safety assessment, and authorization.

C.5.2. Research Reactor Programmes

Trends

90. About 30 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 to conduct research and development to support industry and national programmes such as those for medical radioisotope production.

Related Activities

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

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

D. Strengthening Emergency Preparedness and Response

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

Trends

92. Effective information exchange and emergency communication remain a priority for Member States. In 2022, the Agency was informed by competent authorities, or became aware through earthquake alerts or media reports, of 181 events involving or suspected to involve nuclear or radiological facilities or activities. This number of events remains significant, in line with the trend of recent years (see Figure 6). In 2022, the Agency received ten requests for information about events from official contact points, an increase from two requests in the previous year.

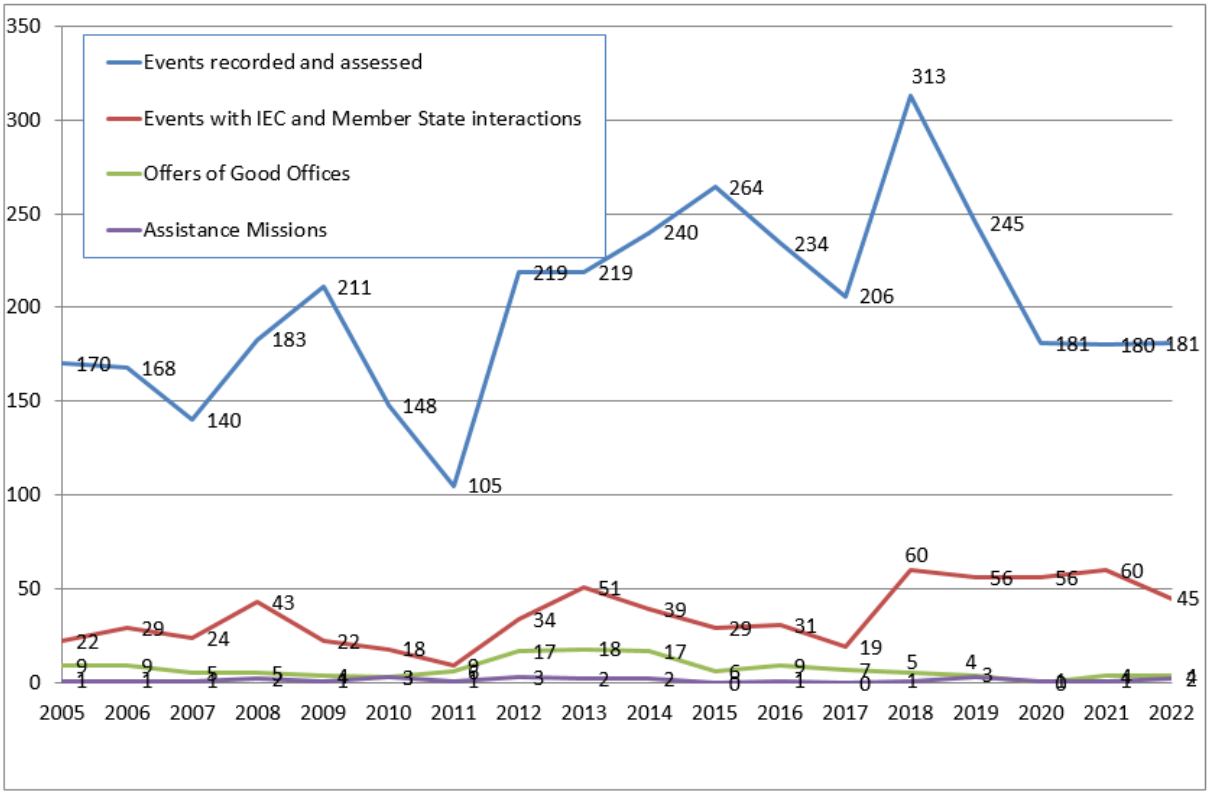


Fig. 6. Number of events involving or suspected to involve nuclear or radiological facilities or activities about which the Agency was informed by competent authorities, or of which it became aware through earthquake alerts or media reports.

93. To date, 40 of the 127 States Parties to the Assistance Convention have registered National Assistance Capabilities[6] in the Agency's Response and Assistance Network (RANET). New or updated registrations were received from Denmark, France, Hungary, the Republic of Korea, Lithuania, Mexico, the Netherlands, Norway, Spain, Sri Lanka, the United Kingdom and the United States of America.

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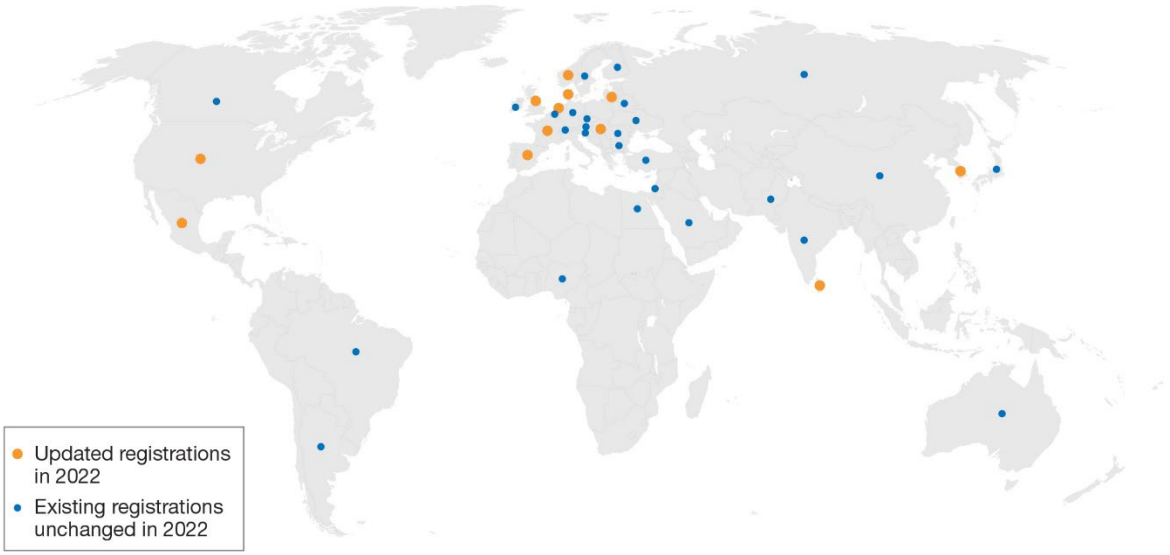
[6] States Parties to the Assistance Convention are obliged to, "within the limits of their capabilities, identify and notify the Agency of experts, equipment and materials which could be made available for the provision of assistance to other States Parties in the event of a nuclear accident or radiological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



RANET 2022:

- One further Member State became Party to the Assistance Convention.
- To date, 40 of the 127 States Parties to the Assistance Convention have registered National Assistance Capabilities in RANET.
- Updated registrations were received from **Denmark, France, Hungary, the Republic of Korea, Lithuania, Mexico, the Netherlands, Norway, Spain, Sri Lanka, the United Kingdom** and **the United States of America.**

94. The number of nominated contact points for the coordination of activities related to the International Radiation Monitoring Information System (IRMIS) continues to grow. In 2022, four Member States nominated or updated their contact point. The number of Member States using IRMIS for the regular sharing of radiation monitoring data increased to 46 in 2022, with an additional four Member States providing radiation monitoring routinely.

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

Related Activities

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

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

D.2. Harmonization of Arrangements for Preparedness and Response

Trends

97. Member States continue requesting training events on strategy development and management of preparedness and response to combined events. The interest in the harmonization of national EPR arrangements in line with GSR Part 7 remains high, as evidenced by the fact that GSR Part 7 consistently appears in the ten most accessed publications on the Agency's website.

98. Member States continued to increase their use of EPRIMS (see Figure 7). As of 2022, 129 Member States have appointed national EPRIMS coordinators, with a total of 552 users. The number of published modules also increased to 1980 in 2022, up from 1815 in 2021. Regular analysis of the information uploaded to EPRIMS allowed the Agency to assess progress made in technical cooperation projects and identify global trends in national EPR arrangements based on Agency safety standards.

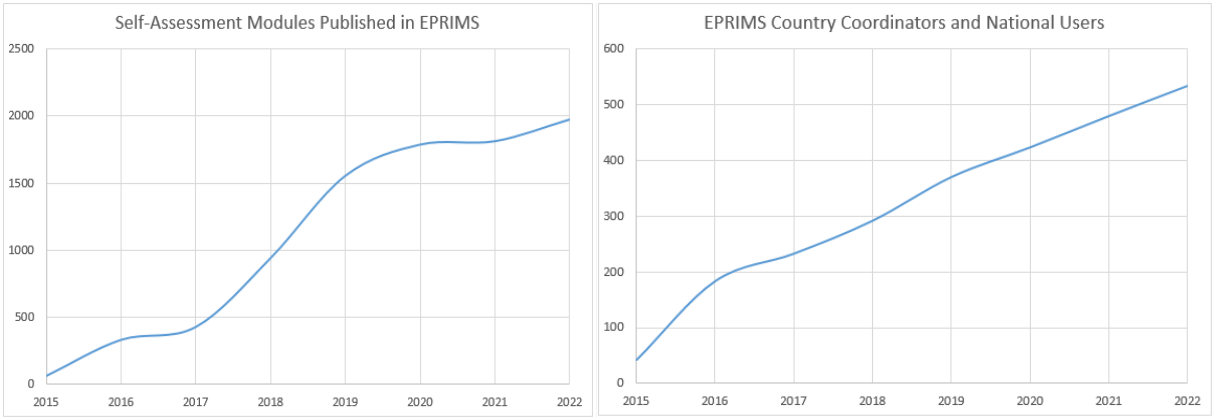


Fig. 7. The use of EPRIMS continued to increase in 2022.

99. An analysis of Member State EPRIMS self-assessments in 2022 shows the lowest level of implementation for Requirement 18 (terminating a nuclear or radiological emergency), followed by Requirement 12 (managing the medical response in a nuclear or radiological emergency), Requirement 5 (protection strategy for a nuclear or radiological emergency), and Requirement 26 (quality management programme for emergency preparedness and response). The requirements with the highest level of implementation continue to be those related to EPR infrastructure (see Figure 8).

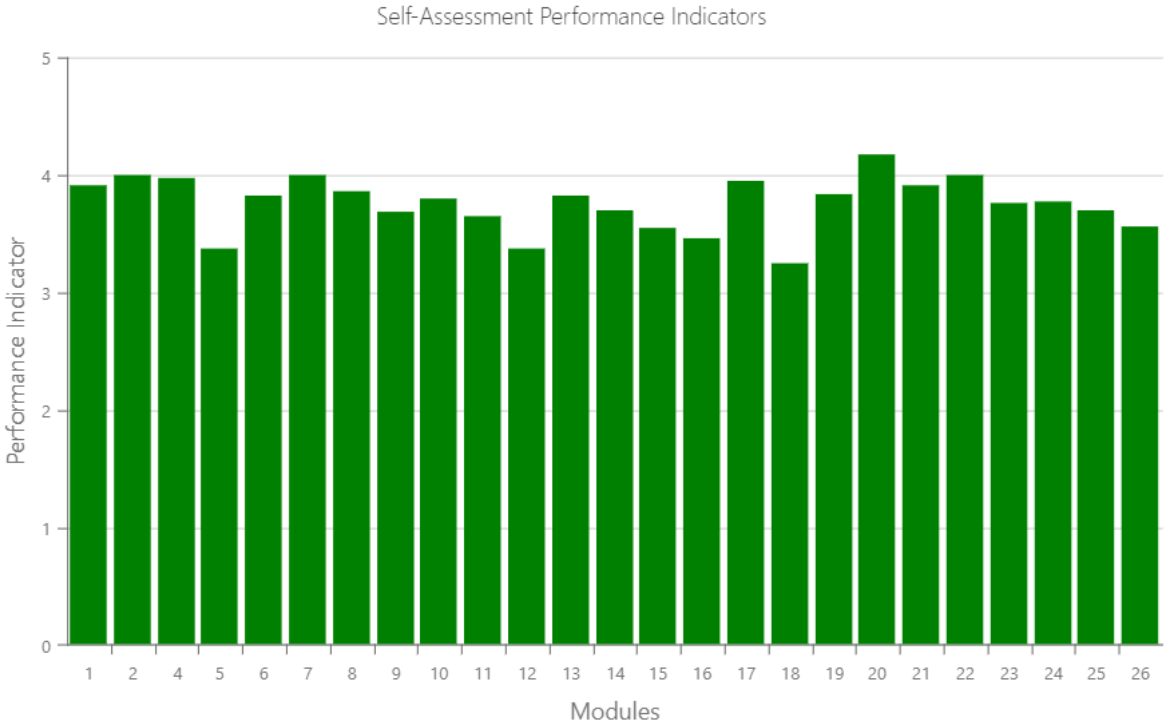


Fig. 8. GSR Part 7 requirements and their ratings according to self-assessment of countries.

100. 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 applicability of EPR concepts from the Agency's safety standards to new reactor types.

101. Member States, particularly those embarking on a nuclear power programme, continue to express interest in performing self-assessments in EPRIMS and hosting EPREV missions.

Related Activities

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

- Continue to develop EPRIMS as a tool to support Member States' self-assessment against GSR Part 7, and to improve navigation, user experience and the management of data stored and plotted;
- Continue to enhance the safety standards in EPR, including 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
- Organize a Technical Meeting to discuss the first draft of a new General Safety Guide under development on *Protection Strategy for a Nuclear or Radiological Emergency* (DS534) and of the revision of GSG-2.

D.3. Testing Readiness for Response

Trends

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

104. The participation of Member States in Level 2 Convention Exercises (ConvEx-2) continues to be high (see Figure 9).

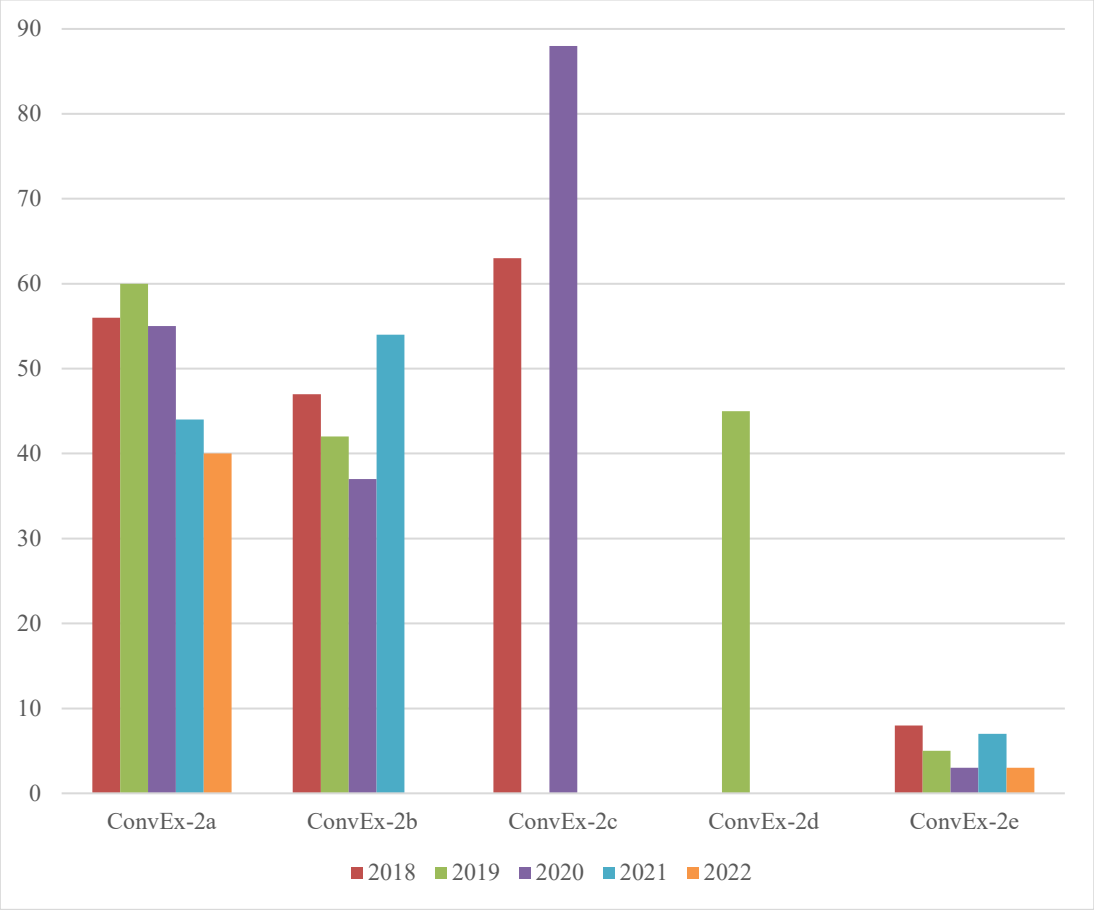


Fig. 9. Participation of Member States and international organizations in ConvEx-2.

105. The percentage of emergency contact points that confirmed a test message via the Unified System for Information Exchange in Incidents and Emergencies website during communication tests was stable at 49% in 2021 and 2022.

Related Activities

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

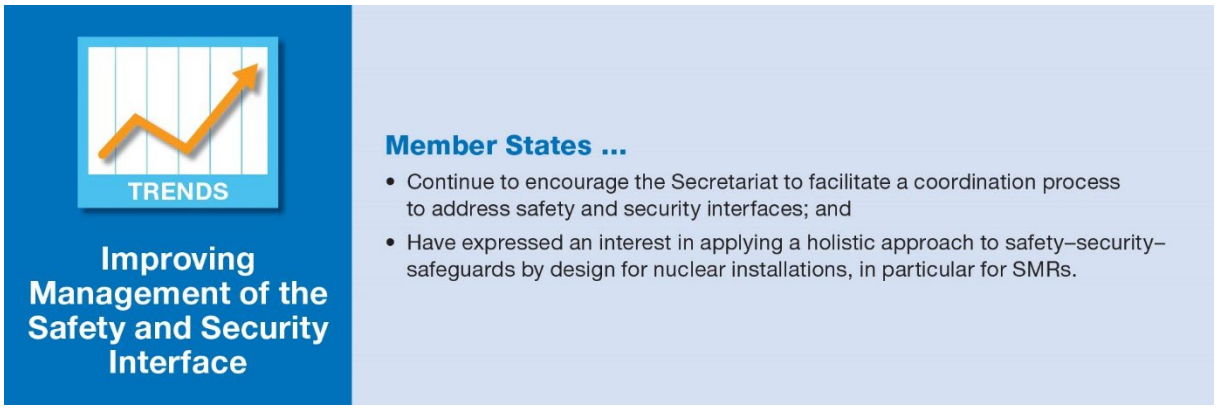
E. Improving Management of the Safety and Security Interface

Trends

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

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

109. Some Member States expressed an interest in considering the application of a holistic approach to safety–security–safeguards by design for nuclear installations, in particular for SMRs, in the early stage of the design process, without prejudice to Member States' legal commitments, the Agency's Statute and the relevant General Conference resolutions. Some Member States also expressed interest in sharing experience in the development of technical publications and the organization of education and training activities.



Related Activities

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

- Continue developing a joint Safety Guide and Implementing Guide, to be published in both the IAEA Safety Standards Series and the IAEA Nuclear Security Series, on managing the interfaces between nuclear and radiation safety and nuclear security;
- Continue to work on developing a Safety Guide on the safety demonstration of innovative technology in power reactor designs, which will include specific consideration of interfaces between safety, nuclear security and safeguards;
- Continue incorporating safety, nuclear security and safeguards interfaces as a topical field for the TSR service (TSR on safety–security–safeguards by design);
- Continue to support Member States in managing the interface between nuclear safety and nuclear security for nuclear installations, radioactive sources and transport by developing new guidance, revising relevant safety standards and holding training activities; and

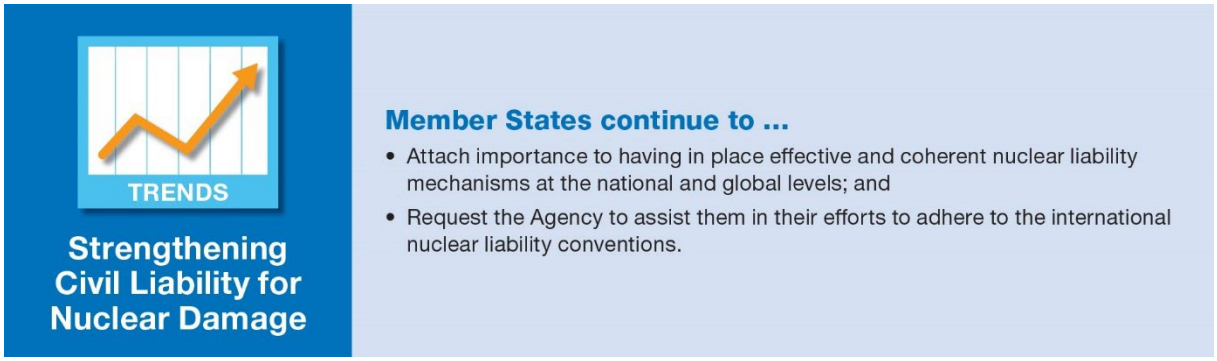
- Continue implementing the Regulatory Infrastructure Development Projects as a mechanism to include safety and nuclear security elements in all legal and regulatory framework-related activities.

F. Strengthening Civil Liability for Nuclear Damage

Trends

111. 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.

112. Member States continue to request the Agency to assist them in their efforts to adhere to the international nuclear liability conventions, taking into account the recommendations on how to facilitate the achievement of a global nuclear liability regime that were adopted by the Agency's International Expert Group on Nuclear Liability (INLEX) in 2012[7].



Related Activities

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

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

G. Technical Support and Assistance to Ukraine

Trends

114. On 24 February 2022, the Agency, through its Incident and Emergency Centre, was notified of the imposition of martial law on the territory of Ukraine and of an alert at Chornobyl NPP. From that date, the Agency closely monitored the situation at Ukraine's nuclear facilities as well as activities involving radioactive sources, focusing on the implications for nuclear safety and security, and issued regular reports and public statements. The Agency issued two Summary Reports on Nuclear Safety, Security and Safeguards in Ukraine[8] and provided two detailed reports to the Agency's Board of Governors on the situation in Ukraine (GOV/2022/52 and GOV/2022/66).

115. The situation at the Zaporizhzhya nuclear power plant (ZNPP) continues to be dangerous, precarious and challenging with the seven indispensable pillars for ensuring nuclear safety and security during an armed conflict ('Seven Pillars') being compromised at the site at all times. This situation underscores the need to agree on arrangements to ensure that the plant is protected.

116. Discussions aimed at agreeing on arrangements to ensure that the ZNPP is protected, with the ultimate aim of preventing a nuclear accident, were intensified; within the reporting period, efforts still needed to be made with regard to reaching an agreement and commitment by the concerned parties as soon as possible.

117. The continued presence of Agency nuclear safety and security experts at the ZNPP has enabled progress in terms of gradually improving and deepening the understanding of the situation and related nuclear safety and security issues at the site. Ever since its establishment, the Agency team present at the site has been able to share observations and report on the nuclear safety and security situation in an impartial and independent manner, which proved essential during the reporting period.

118. The operating staff at the ZNPP continued to show endurance and resilience in keeping the facility safe and secure amid the armed conflict. The difficulties for personnel at the ZNPP significantly intensified during the reporting period, with their crucial work having to be carried out under increasingly difficult conditions, with potentially severe consequences for nuclear safety and security and for their own well-being. The Director General repeatedly called for the concerned parties to put an end to the enormous pressure being placed on the Ukrainian operating staff.

119. The Agency continued to provide technical support and assistance to Ukraine in nuclear safety and security. The Agency conducted nine in-person missions to Ukraine to help stabilize the situation, closely assess nuclear safety and security and assess corresponding needs. Seven deliveries of donated and procured equipment to various organizations were carried out during the reporting period. The Agency agreed with Ukrainian officials that a continuous Agency presence would also be established at Khmelnytskyy, Rivne, South Ukraine and Chornobyl NPPs.

120. The continued commitment of Member States and close cooperation with the Agency are essential to ensure nuclear safety and security in Ukraine under all circumstances and to provide assistance efficiently.

121. The Agency has begun an internal review of challenges in the application of Agency safety standards and nuclear security guidance in armed conflict situations. The review will cover nuclear safety and security considerations for all nuclear and radiation facilities and activities. It will analyse the issues and challenges faced at nuclear facilities in terms of the practical application of Agency safety

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[8] Available at: https://www.iaea.org/sites/default/files/22/04/ukraine-report.pdf and https://www.iaea.org/sites/default/files/22/09/ukraine-2ndsummaryreport_sept2022.pdf

standards and nuclear security guidance during armed conflicts, using the knowledge and experience gathered in Ukraine since February 2022, and how these issues and challenges might be addressed.

Related Activities

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

- Continue close collaboration and technical exchanges and dialogue with Ukrainian counterparts with the aim of better understanding the nuclear safety and security situation and the needs in the area;
- Continue sharing information with Member States, international organizations and the public on the nuclear safety and security situation in Ukraine;
- Continue delivery of technical support and assistance to Ukraine including, but not limited to, delivery of nuclear safety and security-related equipment and conduct of expert missions;
- Continue working closely with Member States and international organizations to ensure effective coordination in the provision of assistance and to secure necessary funding;
- Pursue efforts to help stabilize the situation at the ZNPP, e.g. through the continued presence of Agency staff, and to agree on arrangements to ensure that the plant is protected; and
- Complete the analysis of Agency safety standards and nuclear security guidance and arrive at findings regarding challenges in their application in an armed conflict.

Appendix A

Agency Activities in 2022

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 2022, including all safety standards issued in 2022, is provided in Appendix B.

2. The Agency's peer review and advisory services continued to be provided upon request. The Agency conducted 58 peer review and advisory services across all safety areas in 2022 (see Figure A).

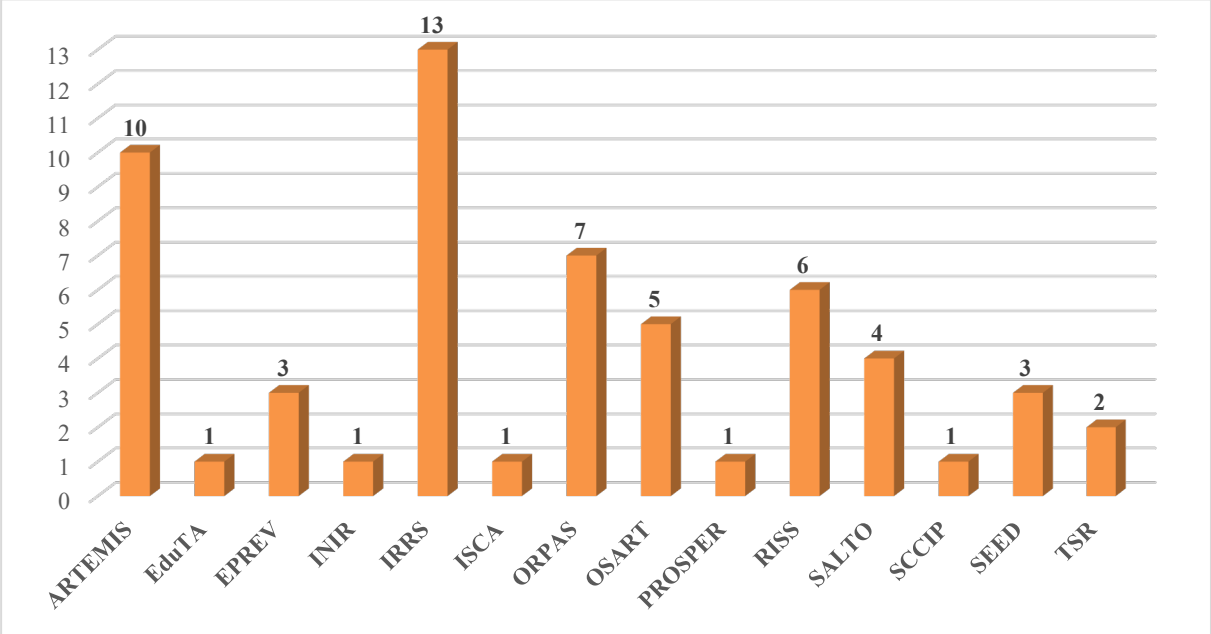


Fig. A. Number of peer review and advisory services conducted in 2022.

3. The Agency conducted a support mission based on the new Peer Review of Operational Safety Performance Experience methodology in Argentina in December 2022 to enhance Argentina's operational safety performance improvement programme.

4. In October 2022, the Agency held the second phase of the Education and Training Appraisal in Nigeria.

5. The Agency conducted a Technical Safety Review (TSR) of the periodic safety review (PSR) documentation for Koeberg nuclear power plant (NPP) in South Africa in October 2021–May 2022. In addition, the Agency conducted a TSR of the probabilistic safety assessment documentation for Laguna Verde NPP in Mexico in March–November 2022.

6. The Agency performed three Site and External Events Design (SEED) missions — two to NPPs in the Czech Republic in May 2022, and one to Romania in August 2022.

7. In 2022, the Agency carried out ten Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) missions and one ARTEMIS follow-up mission.

8. The Agency developed guidance on the conduct of Integrated Regulatory Review Service (IRRS) and ARTEMIS missions in a back-to-back manner. This guidance was used for the first time in Slovenia, where an IRRS mission held in April 2022 was followed by an ARTEMIS mission in May 2022. IRRS–ARTEMIS missions were also conducted in a back-to-back manner in Slovakia in September, Finland in October, and Sweden in November 2022.

9. In October 2022, the Agency organized a Technical Meeting on the ARTEMIS guidelines, where participants from Member States provided comments and feedback that could be used in a potential revision of the guidelines.

10. The Agency conducted three Occupational Radiation Protection Appraisal Service (ORPAS) missions and four ORPAS follow-up missions in 2022. Moreover, a regional training course for potential ORPAS reviewers was conducted in Arusha, Tanzania, in August 2022.

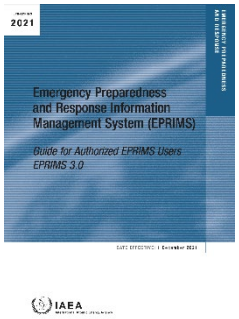
11. The Agency conducted six Advisory Missions on Regulatory Infrastructure for Radiation Safety and Nuclear Security to the Democratic Republic of the Congo in March–April, Seychelles in May, Djibouti, Gabon and Uruguay in September, and Bolivia in November 2022.

12. Two Emergency Preparedness Review (EPREV) follow-up missions, to Hungary in July and Slovenia in October 2022, were performed to review and assess the progress made in these countries in addressing the recommendations and suggestions identified during the initial EPREV missions conducted in 2016 and 2017 to Hungary and Slovenia respectively. The Agency also carried out an EPREV mission to Morocco in October–November 2022.

13. A hybrid Technical Meeting on Peer Review and Advisory Services in Nuclear Safety and Security was held in May 2022 to continue assessing and strengthening the overall structure, effectiveness and efficiency of peer review and advisory services.

14. The report of the President of the International Conference on a Decade of Progress After Fukushima-Daiichi: Building on the Lessons Learned to Further Strengthen Nuclear Safety was published on the Agency's website and the proceedings of the conference are under preparation.

15. The Agency conducted an Independent Safety Culture Assessment mission to Brazil in October 2022 and a Safety Culture Continuous Improvement Process workshop in Poland in November–December 2022.



16. The Agency published the *Emergency Preparedness and Response Information Management System (EPRIMS): Guide for Authorized EPRIMS Users EPRIMS 3.0* (EPR-EPRIMS 2021) in March 2022 to provide EPRIMS users in Member States with an accessible and comprehensive guide to using the system and to supplement regular training and workshops.

17. A Workshop on Self-assessment of Emergency Arrangements and Use of Emergency Preparedness and Response Information Management System (EPRIMS) was held in Vienna in April 2022 to provide an overview of the Agency's safety standards in emergency preparedness and response (EPR), highlight the importance of self-assessment

against Agency safety standards, and present EPRIMS as a tool to support such self-assessment and sharing of information.

A.2. International Safety Conventions

18. The Agency held the Seventh 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 (Joint Convention) in Vienna in June–July 2022, to present, discuss and review National Reports, and to address the measures taken by Contracting Parties to implement the obligations of the Joint Convention.

19. The Fourth Extraordinary Meeting of the Contracting Parties to the Joint Convention was held in Vienna in May 2022 to discuss possible ways to improve the procedural mechanisms of the Joint Convention, taking into account the growing number of Contracting Parties and with a view to identifying and eliminating technical discrepancies between existing procedural documents of the Joint Convention.

20. In 2022, the Agency held three virtual training workshops to provide participants with tools and assistance for developing their first National Reports under the Joint Convention. The workshops for Congo in January, jointly for Syrian Arab Republic and Zimbabwe were held in January and the workshop for Malawi was held in May-June.

21. The Agency held an interregional workshop in Vienna in September and a regional workshop in Phuket, Thailand, in December 2022 to promote the adherence of Member States to the Joint Convention.

22. The Agency held a hybrid Educational Workshop on the Convention on Nuclear Safety in May 2022 to provide participants with guidelines on the identification of the main articles of the Convention on Nuclear Safety (CNS) to be reported on and the drafting of National Reports. A Workshop for Permanent Mission Representatives on the Convention on Nuclear Safety was held in October 2022 to provide assistance and educational information on the CNS, its review process and fulfilling obligations under the CNS. An Educational Workshop on the Convention on Nuclear Safety to provide information on meeting the obligations under the Convention on Nuclear Safety was held in December 2022. At all workshops, there was a special focus on developments in the CNS peer review process after the Fukushima Daiichi accident, including on the implementation of the principles of the Vienna Declaration on Nuclear Safety.

23. Two meetings of the CNS Working Group were held in July and November 2022 to discuss proposals with a focus on contingency planning and business continuity, as well as other proposals aiming to improve the CNS review process.

24. In June 2022, the Agency held the 11th Meeting of the Representatives of Competent Authorities Identified under the Early Notification Convention and the Assistance Convention to share information on national EPR arrangements and challenges; to discuss the implementation of the Convention on Early Notification of a Nuclear Accident (Early Notification Convention), the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention), and the safety requirements contained in the Agency's safety standards dealing with notification and information exchange, the provision of international assistance (in particular with regard to education and training on EPR), and communication with the public; to familiarize participants with the latest EPR documents and tools; to discuss the arrangements and challenges involved in the Agency's assessment and prognosis process; to exchange information on international EPR cooperation; and to learn from past emergencies and exercises.

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

25. The Agency held two virtual Interregional Workshops for Radiation Safety Information Management System Coordinators in March and April 2022, to assist Radiation Safety Information Management System (RASIMS) national coordinators in providing information on radiation safety infrastructure using the RASIMS 2.0 platform.

26. Two Regional Workshops for Radiation Safety Information Management System Coordinators from the African region were held in Vienna in September and November 2022 to assist national coordinators in completing a national radiation safety regulatory infrastructure profile and to facilitate discussions with Agency technical officers on topics relating to the information provided in the RASIMS platform.

27. The Agency held a hands-on inspector training event for the competency development of regulatory bodies in performing inspections of NPPs at Zwentendorf NPP in Austria in May 2022 and a Technical Meeting on Member States' Experience in the Development and Implementation of a Regulatory Enforcement Policy in Vienna in August 2022.

28. The Agency held two Workshops on the Development of Regulatory Infrastructure for Radiation Safety and Security of Radioactive Material in Vienna in April 2022, one for the Africa region and one for the Caribbean region, to review and discuss regulatory responsibilities concerning the control of radiation sources and the need to establish and enhance national regulatory infrastructure for countries in the Africa and Caribbean regions.

29. The Agency continued to support the implementation of the programme on nuclear and radiological safety of the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO). In July 2022, on the occasion of the 25th anniversary of FORO, celebrated in Madrid, the Portuguese Environment Agency joined FORO, becoming its 11th member. In addition, two joint Agency–FORO publications on safety culture in organizations, facilities and activities with sources of ionizing radiation (IAEA-TECDOC-1995) and on the creation and development of competences of regulators of medical and industrial applications (IAEA-TECDOC-2005) were issued in April and September 2022 respectively, in Spanish.

30. The Agency held four Self-Assessment of Regulatory Infrastructure for Safety workshops — in India in February, Poland in March, the Czech Republic in May and Egypt in October 2022.

31. During 2022, the Agency continued to promote and facilitate cooperation among Member States with regard to establishing and developing technical and scientific capabilities to support regulatory functions, including through regional technical and scientific support organization (TSO) networks and the TSO Forum.

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

32. The Agency, in cooperation with Tokai University, Japan, held the first virtual International School of Nuclear and Radiological Leadership for Safety in February–March 2022. In addition, the Agency held three Schools of Nuclear and Radiological Leadership for Safety in Egypt in October, Mexico in November, and Pakistan in December 2022.

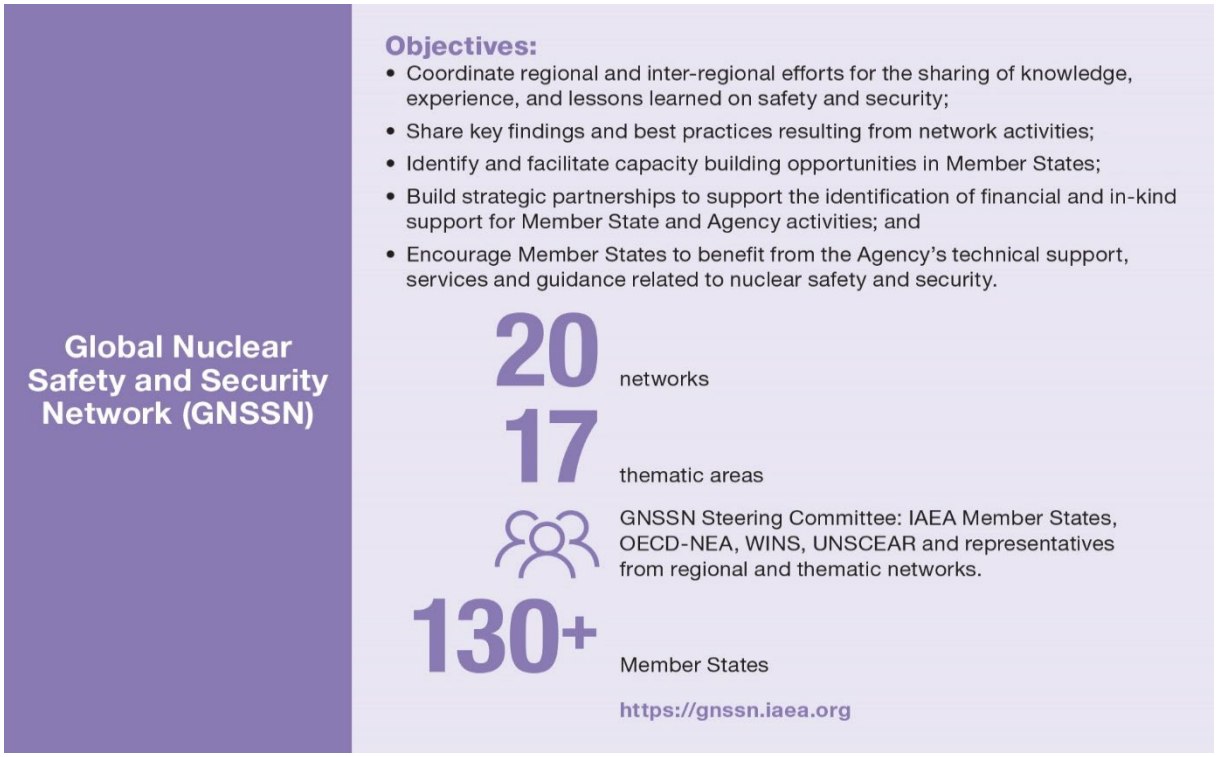
33. The Agency published *Leadership, Management and Culture for Safety in Radioactive Waste Management* (IAEA Safety Standards Series No. GSG-16) in January 2022.

34. The Agency held a Technical Meeting on draft General Safety Guide DS513 on *Leadership, Management and Culture for Safety* in Vienna in April 2022, for preliminary consultation on the draft text with Member States.

35. In November 2022, the Agency held the Sixth Global Nuclear Safety and Security Communication Network (GNSSCOM) Steering Committee Meeting in Vienna to review the outcomes and activities of the network in 2022 and to review and approve the work plan for 2023. In addition, under the activities of the GNSSCOM, two virtual Regional Workshops on Developing Communication Plans were held — in June 2022 for the Africa region and in November 2022 for the Asia and the Pacific region — in order to improve participants' practical skills and knowledge in developing organizational communication plans to build public trust in nuclear safety.

36. In July 2022, the Agency held the 18th Global Nuclear Safety and Security Network (GNSSN) Steering Committee meeting in Vienna, where discussions among representatives of regional and thematic networks associated with the GNSSN took place in order to foster further cooperation and conceptualize joint projects and activities, taking into account in particular the current challenges faced by these networks.

37. The Agency held a Training Course on Leadership, Management and Culture for Safety in Vienna in August 2022.



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

38. Two regional workshops were held in Athens in May and Kigali in November 2022 for Member States in the Europe and Africa regions respectively, to support strengthening the regulatory framework on education, training, qualification and competence, and to evaluate the training needs for qualified experts in radiation protection and radiation protection officers.

39. The Agency held eight Postgraduate Educational Courses in Radiation Protection and the Safety of Radiation Sources, in Algeria, Argentina, Ghana, Greece, Jordan, Malaysia and Morocco in a number of languages.

40. Two regional training courses for trainers of radiation protection officers (RPOs) were held in Bosnia & Herzegovina in September 2022 and in Jordan in November 2022 for Member States in the European and Asia & the Pacific regions respectively. The objective of the training courses was to train on the role, duties and competence needs for RPOs at medical and industrial facilities; on how to design and deliver a training programmes. A virtual regional training course was held in April 2022 for Member States in the Africa region.

41. In September 2022, the Agency held a regional workshop on the Systematic Assessment of Regulatory Competence Needs in Vienna. In 2022, the Agency signed Practical Arrangements that formalize cooperation in the area of education and training in radiation protection and safety with the Malaysian Nuclear Agency and Brazil's National Nuclear Energy Commission.

42. In October 2022, the Agency held, in Vienna a Technical Meeting of International Reporting System for Operating Experience National Coordinators on Recent Events in Nuclear Power Plants for the users of the International Reporting System for Operating Experience to exchange information on recent events at NPPs.

43. The Agency held a Joint IAEA–World Association of Nuclear Operators Technical Meeting to Share Operating Experience in Istanbul, Türkiye, in November 2022 to exchange operating experience from water cooled, water moderated power reactors (VVERs).

44. The Agency held the first Annual Meeting of the International Network for Education and Training for Emergency Preparedness and Response (iNET-EPR) in a virtual manner in May 2022 to discuss Member States' experience of capacity building activities related to emergency preparedness and response (EPR) and to develop the action plan for iNET-EPR.

45. In 2022, the following EPR training activities were held: over 20 regional and interregional training events, including the Regional School of Radiation Emergency Management in Morocco in July and Brazil in November 2022, and seven webinars on topics including protection strategy, basic and advanced medical response, hazard assessment and EPRIMS, involving over 1400 participants.

A.6. Research and Development for Safety

46. The Agency held a virtual Technical Meeting on Ex-Vessel Molten Corium Behaviour and Coolability in June 2022 to exchange information on recent advances in understanding of ex-vessel behaviour of molten corium, including molten corium–concrete interaction and cooling of molten corium, and to identify future research and development needs to improve the quality of modelling and simulation.

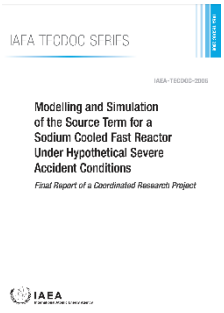
47. In October 2022 the Agency held a virtual Technical Meeting on Advanced Technologies and Systems for Containment Preservation in Accident Conditions. The objective of the meeting was to present and discuss recent advances in technological solutions and active and passive systems applied to preserve containment integrity during design basis accidents and design extension conditions with core melting, as well as to harmonize international understanding and identify major issues and future directions for research and development for advanced active and passive systems used for containment preservation.

48. A hybrid Technical Meeting on the Safety of High Temperature Gas Cooled Reactors and Molten Salt Reactors was held in May 2022, to discuss challenges related to the safety approach in the design and the safety analysis of such reactor types, exchange perspectives on design safety with the Generation IV International Forum (GIF) and establish a mechanism to coordinate the work of Agency and the GIF in this area.

49. The Agency held the Tenth Joint IAEA–GIF Technical Meeting/Workshop on the Safety of Liquid Metal Cooled Fast Reactors in June–July 2022 at the ENEA Brasimone Research Centre, Italy. The purpose of the event was to enhance the synergies between the GIF's programme of work on the Safety Design Criteria/Safety Design Guidelines for sodium cooled fast reactors and lead-cooled fast reactors and the Agency's programme of work on developing safety standards concerning the design safety of NPPs, in particular SSR-2/1 (Rev. 1) and its supporting Safety Guides.

50. The Agency held a Technical Meeting on Safety and Performance Aspects in the Development and Qualification of High Burnup Nuclear Fuels for Water-Cooled Reactors in Vienna in November 2022 to discuss current achievements and challenges in the deployment of high burnup fuels in the current water cooled reactor fleet.

51. In order to share the experiences of Member States, the approaches they used and the challenges they faced, a Technical Meeting on Experiences in Using Probabilistic Safety Assessment in the Design of Nuclear Power Plants and a Technical Meeting on the Software Reliability of Digital Instrumentation and Control Systems for Nuclear Power Plant Safety were held in Vienna, in April and December 2022 respectively.



52. The Agency published *Modelling and Simulation of the Source Term for a Sodium Cooled Fast Reactor Under Hypothetical Severe Accident Conditions* (IAEA-TECDOC-2006) in September 2022.

53. The Agency continued conducting the coordinated research project (CRP) "Developing a phenomena identification and ranking table (PIRT) and a validation matrix, and performing a benchmark for In-Vessel Melt Retention" and held the second Research Coordination Meeting in Vienna in November 2022, where participants discussed the current status of the project and agreed on the outcomes of several project activities.

54. Following the conclusion of a CRP on developing the technical basis for emergency planning zones for SMR deployment, the Agency held a consultancy meeting in July 2022 to develop a TECDOC to set down key CRP findings. The TECDOC is expected to be published in 2023.

B. Strengthening Radiation, Transport and Waste Safety

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

55. The Agency organized the International Conference on Occupational Radiation Protection: Strengthening Radiation Protection of Workers — Twenty Years of Progress and the Way Forward, the third in a series of conferences on occupational radiation protection, in Geneva, Switzerland, in September 2022. The conference identified emerging issues in the area of occupational radiation protection and covered topics such as the implementation of safety standards with regard to occupational radiation protection, commitment to safety culture and exchange of operating experiences. A 'call for action' document was drafted as an outcome of the conference.

56. The Agency, in association with the Radiation Protection Symposium North-West Europe, organized the Tenth International Symposium on Naturally Occurring Radioactive Material in Utrecht, Netherlands, in May 2022 to provide a forum for the industrial, technical and scientific communities and regulatory bodies involved in the management of naturally occurring radioactive material (NORM) and to disseminate scientific information, research and knowledge with a focus on the use of residues from industrial operations and processes involving NORM.

57. The Agency held the Annual Meeting of the Regulatory Forum for Safety of Uranium Production and Naturally Occurring Radioactive Materials (REGSUN) in a virtual manner in June 2022 to review the progress made in activities that had been identified as 'high priority' at the 2021 Annual Meeting.

58. In August 2022, the Agency held two regional workshops on the management of existing exposure situations — in Brazil for the Latin America region and in Thailand for the Asia region — in order to gather national and regional experiences regarding the challenges and potential gaps in existing national guidance, with a view to collecting information for the development of new guidance on radiation protection and safety in existing exposure situations that had been requested by Member States.

59. The Agency hosted a Technical Meeting on Establishing Efficient Regulatory Control for Protection Against Radon in Workplaces in April 2022 to discuss and obtain expert advice on protection against radon in different exposure situations and in the event of combined sources of exposure, and on the enforcement of regulatory control. The input provided will be considered for the development of the draft Safety Guide on *Protection of Workers against Exposure due to Radon*.

60. In March 2022, the Agency held a virtual Technical Meeting on Radiation Protection in Fluoroscopically Guided Interventional Procedures to review existing guidance and resources for the prevention and management of unintended medical exposures in fluoroscopically guided interventional procedures; to evaluate the status of the Safety in Radiological Procedures reporting system; and to review new aspects of occupational radiation protection in fluoroscopically guided interventional procedures.

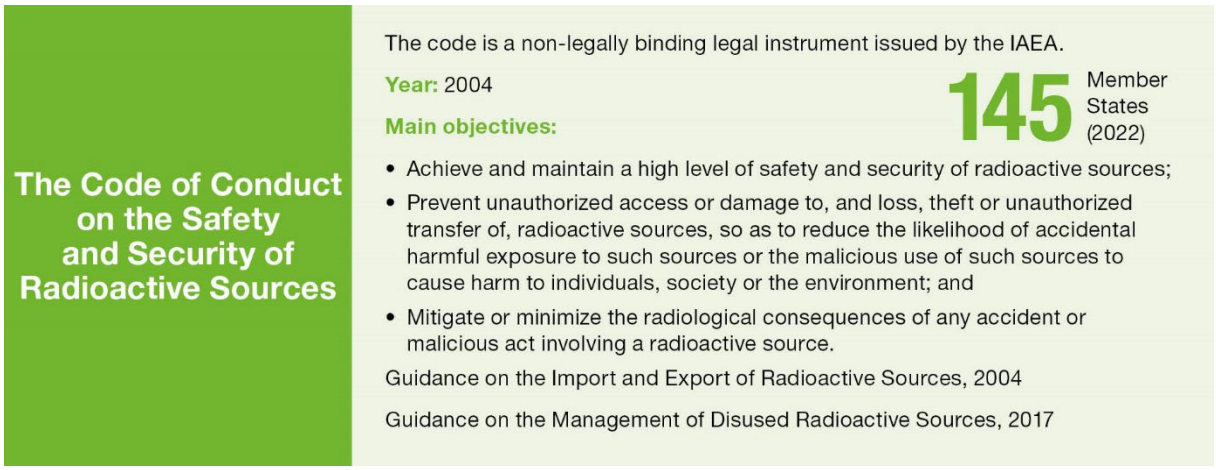
61. The Agency held a nine-day pilot mission to Estonia in March 2022 to assess practical aspects of radiation protection in medicine, comparing national practices to the relevant requirements established in GSR Part 3 and the recommendations provided in *Radiation Protection and Safety in Medical Uses of Ionizing Radiation* (IAEA Safety Standards Series No. SSG-46).

B.2. Control of Radiation Sources

62. The Agency held the International Conference on the Safety and Security of Radioactive Sources: Accomplishments and Future Endeavours in Vienna in June 2022, where participants discussed experiences and anticipated future developments related to establishing and maintaining a high level of safety and security of radioactive sources throughout their life cycle.

63. The Agency continued its efforts to raise awareness among the Member States of the need for them to express political commitment to the Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary guidance, and the benefits of doing so. Technical Meetings to create awareness of the need for political commitment to the Code and its supplementary guidance and to provide comprehensive information on the benefits of political commitment to the Code were held in Vienna in May and August 2022 for Member States in Latin America and the Caribbean, Asia and Africa that had not yet expressed political support for the Code.

64. The Agency held a consultancy meeting in Vienna in August 2022 to complete the template on best practice and financial provisions regarding the implementation of the Code.



B.3. Safe Transport of Radioactive Material

65. The Agency continued its efforts to identify and address issues related to denials of shipment of radioactive material. As a result, a Denial of Shipment Working Group was established and started its work to propose ways to resolve the problem.

66. The Agency prepared a draft proposal to foster discussions on regulating TNPPs, with the intention of revising the *Regulations for the Safe Transport of Radioactive Material* (IAEA Safety Standards Series No. SSR-6 (Rev. 1)). This proposal was submitted to the Transport Safety Standards

Committee's Technical Expert Group on Package Performance and Assessment. A working group on TNPPs was established and a position paper on the terminology, design and applicability of existing transport safety standards is under development. In addition, the Agency is developing a publication on design safety and security considerations for TNPPs.

67. The Agency continued working on the Arabic and French versions of modules 0–4 of the transport safety e-learning platform, to reflect IAEA Safety Standards Series No. SSR-6 (Rev. 1). In addition, the first version of modules 5–9 in English is under revision.

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

68. The Agency continued the development of a draft Safety Guide on national policies and strategies for the safety of radioactive waste and spent fuel management, decommissioning and remediation. Two consultancy meetings were organized for the development of the draft in January and May 2022.

69. The Agency held the Fifth Technical Meeting on the International Project on Decommissioning of Small Medical, Industrial and Research Facilities in Brussels in May 2022 to foster the exchange of experiences and lessons learned related to the decommissioning of small facilities.

70. The Agency held the Sixth Technical Meeting on the International Project on Completion of Decommissioning in Caernarfon, United Kingdom, in June 2022 to advance the development of practical guidance on completion of decommissioning and release of sites from regulatory control through technical discussions and a site visit to the Trawsfynydd Nuclear Power Station in Wales in the United Kingdom.

71. The Agency held a Training Course for the Field Testing of the Training Module on Safety Assessment for Decommissioning in Rome in February 2022 and a Technical Meeting on the Field-Testing of the Training Module on Decommissioning Planning and Project Management in Stockholm in June 2022.

72. The Agency held a virtual Technical Meeting on Guidance on Preparing for and Conducting Regulatory Reviews and Assessments of Geological Disposal Programmes in April 2022 and a Technical Meeting on Proportionate Regulation and Licensing of Different Types of Radioactive Waste Disposal Facilities in Vienna in May 2022.

73. The Agency held in Vienna an Annual Meeting of the Regulatory Forum for Safety of Uranium Production and Naturally Occurring Radioactive Materials (REGSUN) in June 2022.

74. The Agency held a Technical Meeting on the Protection of Groundwater in In Situ Recovery for Uranium Production in Vienna in December 2022.

B.5. Radiation Protection of the Environment and Remediation

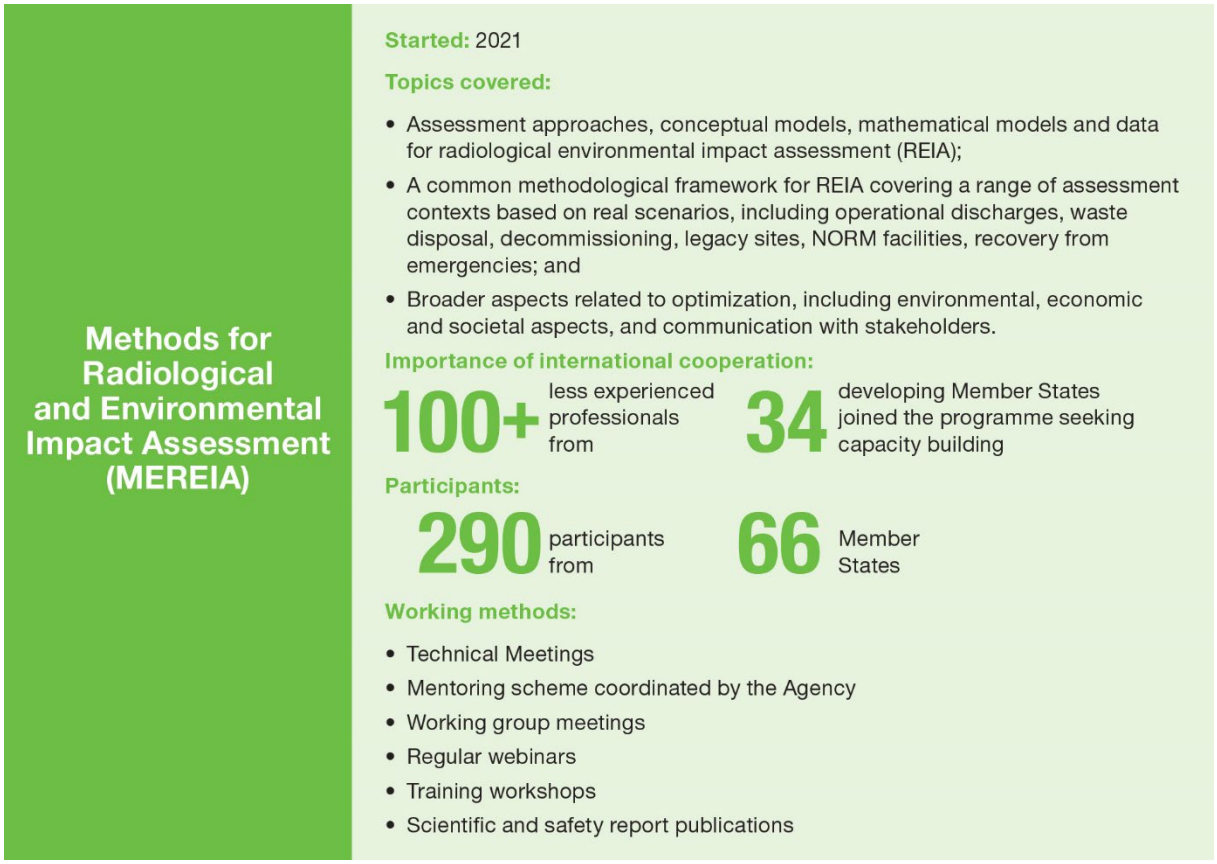
75. The Agency task force set up to review safety related aspects of handling ALPS treated water at Fukushima Daiichi NPP conducted three review missions in Japan, published three technical reports in April, June and December 2022, and significantly advanced its review. The Agency also initiated independent sampling and analysis of the samples. The Agency will use third-party laboratories to independently corroborate the data published by the Tokyo Electric Power Company and Japanese authorities.

76. In May 2022, the Agency held, in a virtual manner, the Annual Meeting of the Coordination Group for Uranium Legacy Sites (CGULS) to further the exchange of information and technical coordination activities of Member States and international organizations participating in the CGULS.

Several training workshops were held in Central Asia on water monitoring and airborne mapping of radioactive contamination at uranium legacy sites.

77. The Agency held the Technical Meeting of the International Working Forum on Regulatory Supervision of Legacy Sites on Long-Term Post-Remediation Management in Vienna in October 2022, and the Joint Workshop of the International Working Forum on Regulatory Supervision of Legacy Sites and the Coordination Group for Uranium Legacy Sites on Challenges to Remediation and Regulatory Supervision of Legacy Sites in Africa, which took place in South Africa in November 2022.

78. The Agency held a Technical Meeting on Methods for Radiological and Environmental Impact Assessment (MEREIA) in Vienna in November 2022. Moreover, a series of webinars were held throughout 2022 for the development of young professionals as part of the capacity building and knowledge management objectives of the MEREIA programme. Two TECDOCs were published on 'Harmonization and intercomparison of models for tritium releases to the atmosphere (TECDOC-1991) and 'Assessment of radioactive contamination and effectiveness of remedial measures in urban environments' (TECDOC-2001).



79. A new Database on Discharges of Radionuclides to the Atmosphere and Aquatic Environment was developed in 2022 to visualize associated discharge data. A Technical Meeting with Member States was held in April 2022 to agree on the scope and content of the database and the discharge data that will be collected.

C. Strengthening Safety in Nuclear Installations

C.1. Nuclear Power Plant Safety

C.1.1. Operational Safety

80. The Agency released *Member States' Experiences and Insights from Maintaining Safety, Security and Reliable Nuclear Industry Operations During the Covid-19 Pandemic* (IAEA Technical Reports Series No. 491) as an Agency preprint in October 2022.

81. The Agency, in cooperation with the Ministry of Economy, Trade and Industry of Japan, and seven institutes and international organizations, organized the Fifth International Conference on Nuclear Power Plant Life Management in Vienna in November–December 2022. The main objective of the Conference was to provide a forum for information exchange on national and international practices as well as regulatory approaches related to plant life management for long term operation, considering the sustainability, safety and efficiency of NPPs.

C.1.2. Site Safety and External Hazards

82. The Agency held the first SEED review mission on SMRs, reviewing site selection and evaluation in Romania in August 2022. Feedback from the mission was utilized to develop a special SEED module tailored to SMR-type reactors, with special emphasis on the application of a graded approach to siting and design taking into consideration the safety features of those reactors.

83. In 2022, the Agency continued delivering capacity building activities related to the site safety review for nuclear installations, including standard training material as well as workshops tailored to countries' needs on the basis of self-assessment, sample documents and tools, standard review guidelines, handbooks and webinars, tools for capacity metrics and feedback to experts.

84. The Agency deployed a new system for the real-time assessment of external events jeopardizing the safety of nuclear installations, damage assessment and dissemination of lessons learned.

85. In November 2022, the Agency held the CANDU Senior Regulators' Meeting in Islamabad to enhance the safety of NPPs using Canada deuterium–uranium (CANDU) reactors through the sharing of operational and regulatory experience among the regulatory bodies of countries with CANDU NPPs.

86. The Agency held the 16th Technical Meeting of the CANDU Owners Group and the IAEA on the Exchange of Operational Safety Experience of Pressurized Heavy Water Reactors in Romania in September 2022.

C.1.3. Design Safety and Safety Assessment

87. The Agency held the International Conference on Topical Issues in Nuclear Installation Safety: Strengthening Safety of Evolutionary and Innovative Reactor Designs in Vienna in October 2022. The Conference issued recommendations in the areas of robust safety demonstration, harmonization and standardization, international collaboration, experimental data and tools, and integrated use of deterministic and probabilistic considerations for evolutionary and innovative reactor designs.

88. A Technical Meeting on Experiences in Using Probabilistic Safety Assessment in the Design of Nuclear Power Plants was held in Vienna in April 2022, to share experiences of the development of probabilistic safety assessment models that could be instrumental in supporting the use of probabilistic safety assessment for justification and optimization of design safety for innovative technologies, including those used for SMRs.

89. The Agency held a Technical Meeting on Safety, Security and Safeguards by Design for Small Modular Reactors in Vienna in June 2022, where participants shared national experiences and practical examples concerning the implementation of a safety–security–safeguards approach to design and potential solutions aimed at mitigating conflicting interfaces between safety, security and safeguards. Particular emphasis was placed on safety–security–safeguards by design for SMRs and on specific challenges and opportunities connected with the new features of SMR technologies.

90. The Agency continued developing two EPR Series documents that will help Member States implement effective EPR arrangements for the response to a severe accident at an NPP. The draft of the document provisionally entitled *Considerations for Implementing an On-Site Emergency Preparedness and Response Plan for Nuclear Power Plants* will provide guidance and practical examples concerning how to develop such on-site EPR plans for NPPs. The draft of the document provisionally entitled *Classification, Assessment and Prognosis During Nuclear Power Plant Emergencies* will provide guidance and tools for emergency classification at NPPs, as part of the assessment and prognosis of a nuclear emergency at an NPP.

91. The Agency held two regional workshops, on risk-informed decision making in Prague in September 2022 and on severe accident management and analysis of off-site consequences in Budapest in October 2022, where participants exchanged national experiences, discussed current issues and challenges and charted the path forward for further developments in these topical areas.

C.2. Safety of Small Modular Reactors

92. The Agency launched the Nuclear Harmonization and Standardization Initiative to support the effective global deployment of safe and secure advanced nuclear reactors, with a particular focus on SMRs.

93. The Agency finalized the draft Safety Report on the *Applicability of Safety Standards to Non-Water-Cooled Reactors and Small Modular Reactors* concerning the entire lifetime of these reactors. The impact of areas of novelty on the applicability and completeness of the Agency's safety standards was assessed in the draft publication, and gaps and areas for additional consideration were identified. The draft publication also considers the interface between safety, security and safeguards in the design of these technologies.

94. The Agency ensured internal coordination of all SMR related activities through the organization of ten meetings of the SMR Platform Implementation Team and five meetings of the SMR Platform Steering Committee; a summary of the activities of the SMR Platform has been made available to Member States through the SMR Platform Annual Report and a dedicated Informal Technical Briefing.

95. The Agency completed the development of a medium term strategy on SMRs and an online portal outlining the Agency's activities on SMRs. The Agency is also developing a repository of knowledge on the safety and security of SMRs and innovative technologies, including a technology-specific compilation of examples, case studies and good practices.

96. The SMR Regulators' Forum met twice in 2022. In April 2022 the meeting was held virtually and in November 2022 was held in hybrid format. As usual, the meetings were split into meetings of the Steering Committee to provide guidance to the technical working groups and to the Secretariat; break out technical working groups meetings to continue working on the regulatory common positions of the Forum. In November meeting, the licensing working group led the discussions of the NHSI Regulatory Track - Working Group on Regulators leveraging other regulatory reviews.

C.3. Research Reactor Safety

97. The Agency held a Workshop on Self-Assessment of Research Reactor Safety in Vienna in May–June 2022 to provide a forum for exchanging experiences of performing self-assessments, discussing the Member States' self-assessment reports and identifying safety improvements together with actions to be implemented by Member States.

98. In June 2022, the Agency conducted a virtual Regional Workshop on Managing the Interface Between Safety and Security for Research Reactors, where participants exchanged knowledge, information and experiences regarding strategies aimed at promoting a coordinated approach for managing the interface between nuclear safety and security at research reactors.

99. The Agency held a Regional Workshop on Regulatory Supervision of Research Reactors in Africa in Rabat in August 2022. The workshop provided participants with practical knowledge and information, based on the relevant Agency safety standards, about regulatory review and assessment of safety submissions in the licensing process of research reactors.

100. A Technical Meeting on Operation, Maintenance and Ageing Management for Research Reactors was held in Vienna in November 2022. The meeting provided a forum for the exchange of information and experience related to good practices for operation, maintenance and implementation of ageing management practices for research reactors.

101. In 2022, nine safety standards on the operation of research reactors were finalized by the Agency and endorsed for publication by the Commission on Safety Standards (CSS).

102. The Agency held a Training Workshop for Reviewers in Future Integrated Safety Assessment of Research Reactors Missions in Vienna in October 2022. The workshop provided information and guidance for participants who might take part in future missions of this type and who are not yet fully familiar with their methodology and conduct.

C.4. Fuel Cycle Facility Safety

103. The Agency held a Technical Meeting on the Periodic Safety Review of Nuclear Fuel Cycle Facilities in Vienna in June 2022 to discuss and exchange national experience regarding the PSR of nuclear fuel cycle facilities.

104. The Agency, in cooperation with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), organized a Technical Meeting for National Coordinators of the Joint IAEA–OECD/NEA Fuel Incident Notification and Analysis System in Paris in September 2022, where participants from Member States exchanged information on incidents submitted to the system database and discussed the implementation of corrective actions arising from these and other such incidents.

105. In October 2022, the Agency held a Workshop on Managing the Interface Between Nuclear Safety and Security for Nuclear Fuel Cycle Facilities in Vienna, where participants from Member States shared knowledge, experience and practical information related to the management of the interface between safety and security for nuclear fuel cycle facilities.

106. The Agency held a Technical Meeting on the Safety of Fuel Manufacturing for Advanced Reactors in Vienna in November 2022, where participants discussed and exchanged information and experience concerning the safety aspects of manufacturing fuels for advanced reactors, including SMRs.

C.5. Safety Infrastructure for Embarking Countries

C.5.1. Nuclear Power Programmes

107. During bilateral discussions, the Agency encouraged countries embarking on a nuclear power programme in Phase 2 to host an IRRS mission covering the tailored module dedicated to reviewing the establishment of safety infrastructure, or to host an expert mission to review the establishment of regulatory infrastructure.

108. In 2022, the Agency continued to develop a series of handbooks (TECODOCs) under the auspices of the Generic Roadmap project; namely on: (i)initiating safety infrastructure for a nuclear power programme; (ii) on planning, management, and conduct of regulatory safety review and assessment for nuclear power plant; (iii) establishing the infrastructure for the safety assessment and design safety of a nuclear power; and (iv) on site selection and site evaluation.

109. The Agency held a Meeting of the Steering Committee of the Regulatory Cooperation Forum (RCF) and Support Meeting, in Vienna in June 2022 to review the status of regulatory infrastructure development in countries receiving support from the Regulatory Cooperation Forum (RCF) and to foster the exchange of experience. In addition, the Agency held the RCF Plenary Meeting in Vienna in September 2022 to facilitate experience-sharing among RCF members and to promote awareness of RCF activities for non-RCF members. Moreover, the Agency held Task Team Meetings of the RCF in Vienna in February and November 2022 to monitor and evaluate the implementation of the RCF Strategic Plan and related activities.

110. The Agency developed guidance for the conduct of an expert mission to embarking countries in Phase 2 as defined in *Establishing the Safety Infrastructure for a Nuclear Power Programme* (IAEA Safety Standards Series No. SSG-16 (Rev. 1)), as an alternative to an IRRS mission, assuming that an IRRS mission will take place in Phase 3.

111. In 2022, the Agency developed a Technical Report on *Regulatory Oversight of the Interfaces Between Nuclear Safety and Nuclear Security in Nuclear Power Plants*.

112. The Agency held national workshops on specific aspects of safety assessment and on the regulatory review of accident analysis for VVER-1200-type reactors in Cairo in September and October 2022. The Agency also held a Regional Workshop on the Application of Level 1 Probabilistic Safety Assessment in Bangkok in September 2022.

113. The Agency held two Regional Educational Workshops on SMR regulatory challenges in Sydney in November 2022 and in Buenos Aires in December 2022 respectively.

C.5.2. Research Reactor Programmes

114. The Agency held a virtual Training Workshop on Technical Requirements in the Bidding Process for a New Research Reactor in Vienna in July 2022. The workshop provided the participating Member States with practical information and knowledge on developing the technical requirements for the bidding process of a new research reactor project, taking into account operation and utilization of the new research reactor and the relevant safety requirements, and guidance on the criteria for bid evaluation.

115. The Agency held a Training Workshop on the Preparation of a Feasibility Study for a New Research Reactor Project: Experiences and Challenges in Vienna in December 2022, where participants shared practical information and knowledge on the preparation of a feasibility study for a new research

reactor project, taking into account operation and utilization of the new research reactor and the relevant safety requirements.

116. The Agency held a National Training Course on Human Resource Development Planning for a research reactor programme in Dakar in December 2022.

117. The Agency provided assistance to the Philippines on the regulatory body support needed to review the commissioning programme of the Philippines' Subcritical Assembly for Training, Education and Research, in Vienna in March 2022.

118. The Agency conducted a safety advisory mission on the review of the commissioning programme and operation licence application for Saudi Arabia's low power research reactor in Vienna in October 2022.

119. In September 2022, the Agency held the Tenth Annual Meeting of the Regional Advisory Safety Committee for Research Reactors in Asia and the Pacific in Sydney, Australia.

D. Strengthening Emergency Preparedness and Response

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

120. In February, April and November 2022, the Agency delivered one virtual and two hybrid Workshops on Arrangements for Notification, Reporting and Assistance in Nuclear or Radiological Incidents and Emergencies.

121. The Agency conducted two virtual Workshops on Emergency Preparedness and Response Arrangements for Effective Communication with the Public, in January and May 2022, to provide fundamental information and practical guidance to officers acting within a command-and-control system concerning public communications during a nuclear or radiological emergency.

D.2. Harmonization of Arrangements for Preparedness and Response

122. In April 2022, the Agency held a Workshop on Self-assessment of Emergency Arrangements and Use of Emergency Preparedness and Response Information Management System (EPRIMS) to familiarize Member State representatives with EPRIMS functionalities, where updated training materials were used. In addition, a fictitious Member State — 'EPRIMSland' — was input into the tool to serve as an example of the level and type of information to be provided in a country profile and in the self-assessment modules.

123. Actions to further increase transparency, promote the exchange of information, and improve Member States' EPRIMS user experience were carried out in 2022. These included refining the EPRIMS self-assessment modules and enhancing EPRIMS features and functions to better support EPREV peer review services and its reports.

124. In 2022, the Agency continued to observe and contribute to the work of international working groups in EPR and to identify ways to support the implementation of the relevant Agency safety standards with the aim of harmonizing EPR arrangements.

125. As part of the actions taken under the Emergency Preparedness and Response Standards Committee (EPReSC), three working groups were formed to review EPR-related safety standards and EPR publications to determine if specific topics were sufficiently addressed in the existing EPR documents and, where applicable, to make proposals. The outcomes from these working groups were presented at the 15th EPReSC meeting, in November 2022, and are expected to contribute to the establishment of a medium-term plan for the development and revision of the relevant Safety Guides.

126. The Technical Meeting on Revision of the Safety Guide on *Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency* was postponed to 2023.

D.3. Testing Readiness for Response

127. In May 2022, the Agency held a Technical Meeting to Evaluate the ConvEx-3 (2021) Exercise hosted by the United Arab Emirates in 2021, and to consolidate the lessons identified. The host State, participating States and international organizations presented their evaluations of the exercise. ConvEx-3 exercises are full-scale exercises designed to evaluate international emergency response arrangements and capabilities for a severe nuclear or radiological emergency over several days, regardless of its cause.

E. Improving Management of the Safety and Security Interface

128. In March and October 2022, the Agency hosted regular meetings of the International Nuclear Safety Group (INSAG) to discuss current and emerging safety issues and identify needs for new INSAG publications. The Agency's Advisory Group on Nuclear Security and INSAG together worked on a joint report entitled *A Systems View of Nuclear Security and Nuclear Safety: Identifying Interfaces and Building Synergies*.

129. In June 2022 the Agency organised a Workshop on Managing the Interface Between Nuclear Safety and Security for Research Reactors for Asia and the Pacific region in Vienna.

130. In October 2022 a Workshop on Managing Interface Between Safety and Security for Nuclear Fuel Facilities was organised in Vienna.

131. The Agency held a Regional Workshop on the Interface Between Nuclear Safety and Security in cooperation with the Jordan Atomic Energy Commission in Amman in October 2022.

132. In 2022, the Regulatory Infrastructure Development Projects assisted participating countries in the Latin America and the Caribbean and the Africa regions to enhance their regulatory framework for the radiation safety and security of radioactive material. In particular, areas of policy and strategy, regulations, establishment of an integrated management system, national inventory and registry of radiation sources, and physical protection of radioactive sources were addressed while engaging senior management, developing the capacities of regulatory bodies, and assessing the status of national regulatory frameworks through advisory missions.

133. In October 2022, the Agency issued the *IAEA Nuclear Safety and Security Glossary, 2022 (Interim) Edition*, containing terminology used in Agency safety standards and nuclear security guidance.

134. The Safety Standards Committees, Nuclear Security Guidance Committee and CSS approved a document preparation profile for a draft publication on *Management of the interfaces between nuclear*

and radiation safety and nuclear security, which will be a joint publication in both the IAEA Safety Standards Series, as a Safety Guide, and the IAEA Nuclear Security Series, as an Implementing Guide.

135. The Agency continued working on a Technical Report that aims to assist Member States in using a safety analysis approach to support nuclear security at nuclear installations. The report is planned to be published in 2023.

F. Strengthening Civil Liability for Nuclear Damage

136. The 22nd regular meeting of the International Expert Group on Nuclear Liability (INLEX), which took place in Vienna in September 2022, provided a forum to present new developments in Member States and activities by the Secretariat in the field of civil liability for nuclear damage, as well as to discuss future outreach activities. In addition, INLEX discussed liability issues concerning nuclear fusion installations, operators' right of recourse under the nuclear liability conventions and the exclusion of operators' liability for on-site property damage.

137. The Agency organized a Workshop for Diplomats on Civil Liability for Nuclear Damage in conjunction with INLEX in Vienna in September 2022.

138. The Agency held the second meeting of the Contracting Parties and Signatories to the Convention on Supplementary Compensation for Nuclear Damage (CSC) in Vienna in May–June 2022 to foster dialogue among Contracting Parties and Signatories on CSC implementation matters, as well as to promote participation in the CSC worldwide.

139. In the context of the Agency's legislative assistance programme, assistance was provided to 16 Member States in the development of national legislation, including on civil liability for nuclear damage.

Appendix B

The Agency's Safety Standards Activities in 2022

1. The Agency issued 2 General Safety Guides and 15 Specific Safety Guides after endorsement by the Commission on Safety Standards (CSS):

- *Remediation Strategy and Process for Areas Affected by Past Activities or Events*, IAEA Safety Standards Series No. GSG-15
- *Leadership, Management and Culture for Safety in Radioactive Waste Management*, IAEA Safety Standards Series No. GSG-16
- *Seismic Hazards in Site Evaluation for Nuclear Installations*, IAEA Safety Standards Series No. SSG-9 (Rev. 1)
- *Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report*, IAEA Safety Standards Series No. SSG-20 (Rev. 1)
- *Safety in the Utilization and Modification of Research Reactors*, IAEA Safety Standards Series No. SSG-24 (Rev. 1)
- *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2018 Edition)*, IAEA Safety Standards Series No. SSG-26 (Rev. 1)
- *Criticality Safety in the Handling of Fissile Material*, IAEA Safety Standards Series No. SSG-27 (Rev. 1)
- *Preparedness and Response for a Nuclear or Radiological Emergency Involving the Transport of Radioactive Material*, IAEA Safety Standards Series No. SSG-65
- *Format and Content of the Package Design Safety Report for the Transport of Radioactive Material*, IAEA Safety Standards Series No. SSG-66
- *Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-70
- *Modifications to Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-71
- *The Operating Organization for Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-72
- *Core Management and Fuel Handling for Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-73
- *Maintenance, Testing, Surveillance and Inspection in Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-74
- *Recruitment, Qualification and Training of Personnel for Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-75

- *Conduct of Operations at Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-76
- *Protection Against Internal and External Hazards in the Operation of Nuclear Power Plants*, IAEA Safety Standards Series No. SSG-77

2. The CSS met twice in 2022. It endorsed for submission for publication the following draft Safety Guides:

- DS509a: *Commissioning of Research Reactors*
- DS509b: *Maintenance, Periodic Testing and Inspection of Research Reactors*
- DS509c: *Core Management and Fuel Handling for Research Reactors*
- DS509d: *Operational Limits and Conditions and Operating Procedures for Research Reactors*
- DS509e: *The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors*
- DS509f: *Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors*
- DS509g: *Ageing Management for Research Reactors*
- DS509h: *Instrumentation and Control Systems and Software Important to Safety for Research Reactors*
- DS511: *Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors*
- DS517a: *Safety of Conversion Facilities and Uranium Enrichment Facilities*
- DS517b: *Safety of Uranium Fuel Fabrication Facilities*
- DS517c: *Safety of Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities*
- DS520: *Hazards Associated with Human Induced External Events in Site Evaluation for Nuclear Installations*
- DS470: *Radiation Safety of Radiation Sources Used in Research and Education*
- DS499: *Application of the Concept of Exemption*
- DS500: *Application of the Concept of Clearance*
- DS521: *Radiation Protection Programmes for the Transport of Radioactive Material*
- DS523: *Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants*

3. In 2022, the CSS also approved the following document preparation profiles for safety standards:

- DPP DS532: Safety Requirements on *Safety of Nuclear Power Plants: Commissioning and Operation* (revision of SSR-2/2 (Rev. 1))
- DPP DS533/NST067: New joint Safety Guide/Implementing Guide on *Management of the Interfaces Between Nuclear and Radiation Safety and Nuclear Security*

- DPP DS534: New Safety Guide on *Protection Strategy for a Nuclear or Radiological Emergency*
- DPP DS535: Safety Guide on *Periodic Safety Review for Nuclear Power Plants* (revision of SSG-25)
- DPP DS537: New Safety Guide on *Safety Demonstration of Innovative Technology in Power Reactor Designs*
- DPP DS538: New Safety Guide on *Long Term Post-Remediation Management of Areas Affected by Past Activities or Events*
- DPP DS539: Safety Guide on *Licensing Process for Nuclear Installations* (revision of SSG-12)
- DPP DS540: Safety Guide on *Radiation Safety in Industrial Radiography* (revision of SSG-11)

4. The CSS meetings in 2022, held in April and in October, were the fifth and sixth meetings of its seventh term. The CSS, as well as the Safety Standards Committees, discussed the medium term plan for the safety standards and a concept paper for development of the long term strategy for the safety standards.

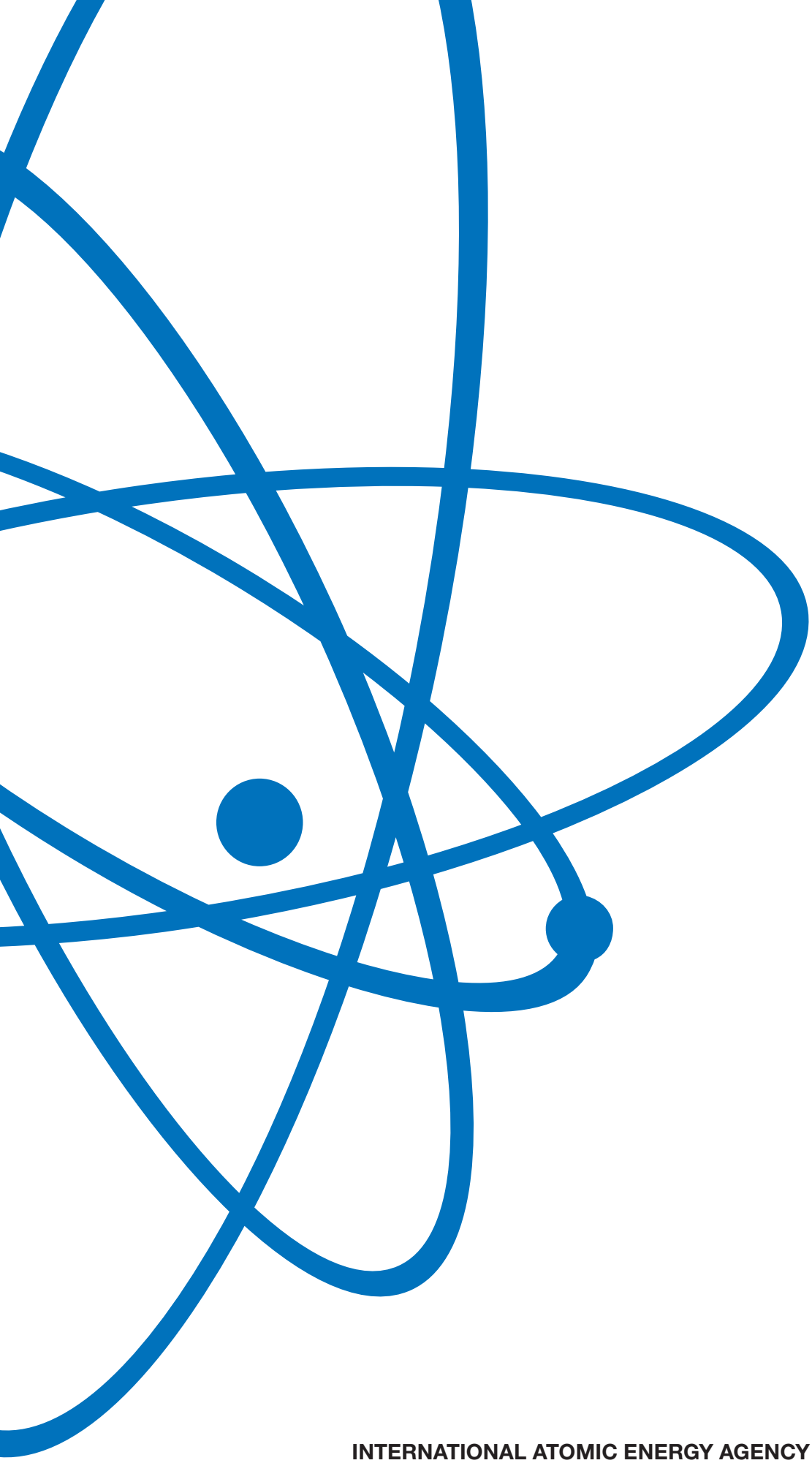
5. The CSS held two round-table discussions on the safety implications of the situation in Ukraine. The Secretariat is conducting a review of challenges to the application of the safety standards and nuclear security guidance during an armed conflict.

6. The Agency included all newly issued safety standards and nuclear security guidance in the Nuclear Safety and Security Online User Interface (NSS-OUI) platform. All IAEA Safety Standards Series and IAEA Nuclear Security Series publications are available in full, are up to date and can be searched as a uniform knowledge base. The overall search mechanism of the platform was made more user-friendly in 2022.

7. The Agency issued the *IAEA Nuclear Safety and Security Glossary, 2022 (Interim) Edition*, which defines and explains technical terms used in Agency safety standards and nuclear security guidance and other safety and security-related Agency publications, and provides information on their usage. The terminology in the Glossary is available in a dedicated knowledge organization server and was used to tag the defined terms in the Agency's Safety Requirements publications, with embedded links to the relevant glossary definitions. This web-based version of the Glossary can also be used independently as an additional resource.

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

9. In 2022, the Agency launched its first dedicated training course on the Agency's safety standards. The course trains participants on the process of developing and revising Agency safety standards, and on how countries can contribute to their development. The Agency also launched an e-learning course on the safety standards, in all official languages of the Agency, to provide participants with a better and clearer understanding of the basis of the safety standards, how they are developed, and how they are used and applied in the peaceful applications of nuclear technology.



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