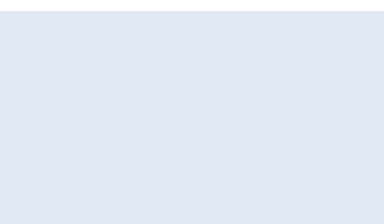
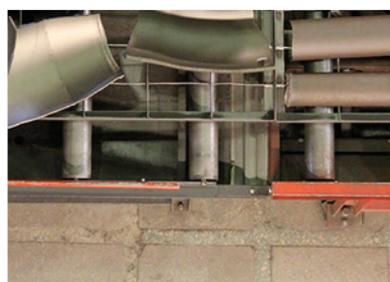


# Nuclear Safety Review 2021



**IAEA**

International Atomic Energy Agency  
*Atoms for Peace and Development*

GC(65)/INF/5

# NUCLEAR SAFETY REVIEW 2021

GC(65)/INF/5

Nuclear Safety Review 2021  
IAEA/NSR/2021  
Printed in the IAEA in Austria  
July 2021

# Foreword

The *Nuclear Safety Review 2021* includes the global trends and the Agency's activities undertaken in 2020 and thereby demonstrates the progress made regarding the priorities for 2020. It also presents priorities for 2021 and beyond, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety. 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 2021* was submitted to the March 2021 session of the Board of Governors in document GOV/2021/3. The final version of the *Nuclear Safety Review 2021* 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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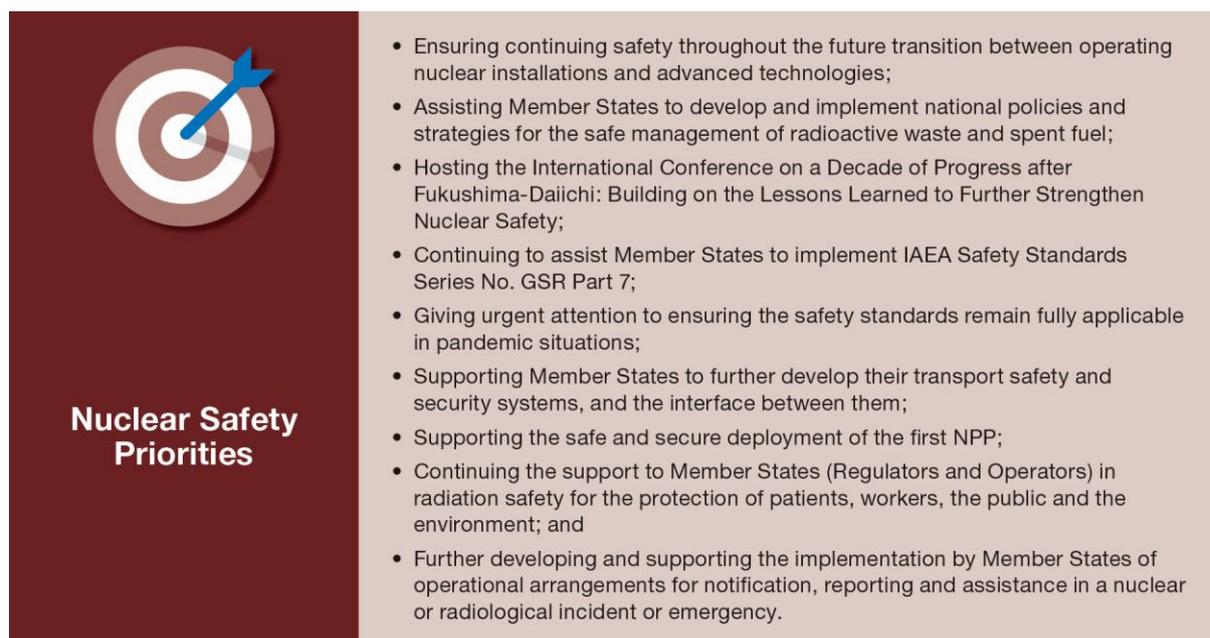
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# Nuclear Safety Review 2021

*Report by the Director General*

## Executive Overview

1. The *Nuclear Safety Review 2021* reflects the global trends in 2020. 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 2021 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 2020 can be found in Appendix A.

The graphic consists of a dark red vertical bar on the left containing a white target icon with a blue arrow hitting the bullseye. Below the icon, the text 'Nuclear Safety Priorities' is written in white. To the right of this bar, a light beige background contains a bulleted list of ten items.

**Nuclear Safety Priorities**

- Ensuring continuing safety throughout the future transition between operating nuclear installations and advanced technologies;
- Assisting Member States to develop and implement national policies and strategies for the safe management of radioactive waste and spent fuel;
- Hosting the International Conference on a Decade of Progress after Fukushima-Daiichi: Building on the Lessons Learned to Further Strengthen Nuclear Safety;
- Continuing to assist Member States to implement IAEA Safety Standards Series No. GSR Part 7;
- Giving urgent attention to ensuring the safety standards remain fully applicable in pandemic situations;
- Supporting Member States to further develop their transport safety and security systems, and the interface between them;
- Supporting the safe and secure deployment of the first NPP;
- Continuing the support to Member States (Regulators and Operators) in radiation safety for the protection of patients, workers, the public and the environment; and
- Further developing and supporting the implementation by Member States of operational arrangements for notification, reporting and assistance in a nuclear or radiological incident or emergency.

2. During 2020, a number of Agency activities were affected by national and international measures taken to limit the spread of COVID-19. In many cases, solutions were developed to continue activities remotely. However, in some cases, events planned for this period needed to be postponed and will be further addressed in next year's Nuclear Safety Review. The Agency published *The IAEA and the COVID-19 Pandemic* (document GC(64)/INF/6) to report on the experiences of the Agency and experiences of Member States reported to the Agency regarding COVID-19. An update of this report will be provided to the March 2021 meeting of the Board of Governors.

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

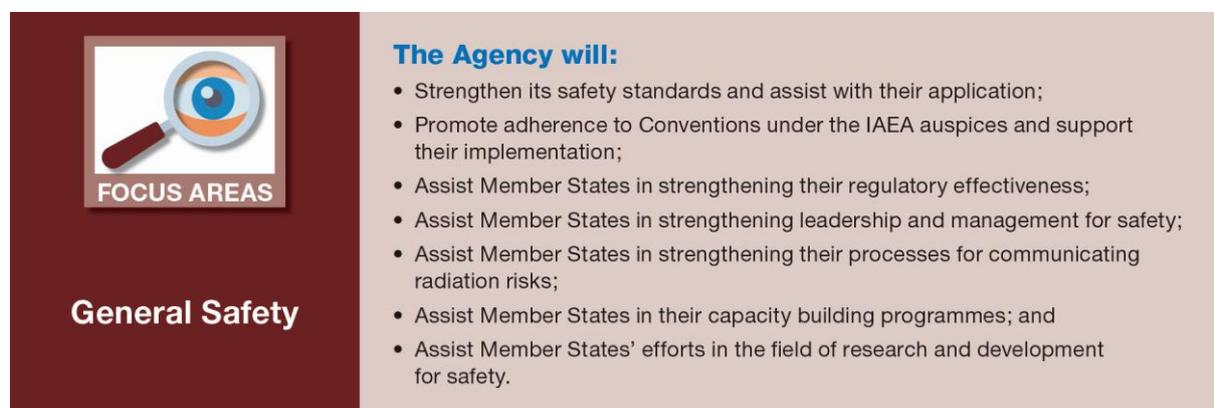
4. The work on the Agency's safety standards continued to focus on the revision of existing standards rather than the establishment of new ones. One General Safety Guide and nine Specific Safety Guides were published in 2020.

5. Analysis of Agency activities shows a need in some Member States for continued technical support for establishing and developing a sustainable regulatory framework for radiation safety. Moreover, a continued need for guidance and training for Radiation Protection Officers and qualified experts has been indicated.

6. Broader analysis of peer review and advisory service mission reports show that these continue to include recommendations relating to leadership, safety management, and safety culture. In addition, Agency activities have highlighted the need for the Secretariat to further support Member States in developing communication strategies and plans, as well as establishing a global community of practice to discuss and share experiences, regarding leadership and management for safety.

7. Member States continue to express an interest in the lessons arising from the Fukushima Daiichi accident with regard to site and design safety. They are also interested in sharing experiences of the safety reassessment of existing nuclear power plants (NPPs), performing reasonably practicable safety improvements for preventing accidents as needed, and, should an accident occur, mitigating its consequences and avoiding significant radioactive releases.

8. Member States continue to request support regarding their knowledge management programmes for nuclear safety and in developing or strengthening national capacity building programmes. Some Member States encounter difficulties in recruiting competent staff. 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.



**General Safety**

**FOCUS AREAS**

**The Agency will:**

- Strengthen its safety standards and assist with their application;
- Promote adherence to Conventions under the IAEA 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.

9. Member States with little experience in regulating the management of residues containing naturally occurring radioactive material have expressed a need for Agency support in establishing regulatory and safety infrastructure. There is also a need for revised guidance regarding the application of regulatory flexibility in exemption and clearance.

10. Improved access to and increasing use of diagnostic imaging procedures utilizing ionizing radiation are creating a need for greater awareness of the importance of justification of medical exposure, optimization of radiation protection, and safety of associated exposures to protect patients from risks related to ionizing radiation. The outcomes of the International Conference on Radiation Safety: Improving Radiation Protection in Practice in November 2020 also show that Member States are aware of the importance of having a strong ethical basis to the application of radiation protection principles.

11. An increasing number of radioactive sources are becoming disused. There is a growing need for Member States to have appropriate arrangements for the control of sources and the safe and secure

management of disused<sup>1</sup> sealed radioactive sources, including the building of national disposal facilities. In addition, Member States require further guidance on the application 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 disused radioactive sources. The number of Member States committing to implement the supplementary Guidance on the Import and Export of Radioactive Sources and the supplementary Guidance on the Management of Disused Radioactive Sources grew by 6 in 2020.

12. The need for more flexible provisions in Member States for the release of material and waste from regulatory control has increased. Requests continue for Agency support for interim safe 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 (ARTEMIS) peer review service continues to be in demand.

13. Agency missions have shown that there is a growing need to analyse and evaluate the radiological implications of radionuclides being released to the environment. Member States continue to request Agency assistance in remediation activities.



**Strengthening  
Radiation, Transport  
and Waste Safety**

**The Agency will:**

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

14. Operational Safety Review Team (OSART) mission reports 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.

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

16. Analysis of data from reports in the International Reporting System for Operating Experience (IRS) indicated a continuing need to: learn from events related to human performance; improve operation and maintenance fundamentals; and improve leadership, management and oversight of processes and practices.

17. Requests from Member States continue to be high for Site and External Events Design (SEED) missions and other capacity building services related to this subject. In addition, the application of Agency safety standards to innovative designs of NPPs, including Small and Medium Sized or Modular Reactors (SMRs), is a matter of great interest for Member States. Transportable NPPs are of increasing interest to some Member States.

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<sup>1</sup> Radioactive sources are defined as 'disused' when they are no longer used for the practice for which they were authorized.

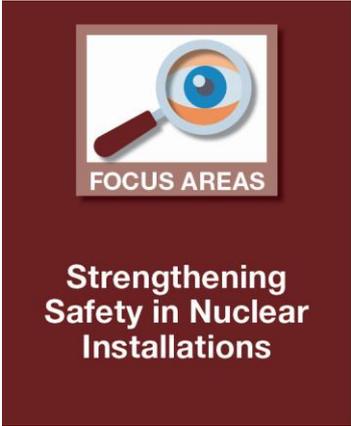
18. Member States continue to revise severe accident management guidance for existing NPPs to include safety upgrades and non-permanent equipment, and to address multi-unit considerations.

19. More than 70 SMR designs are in various stages of development and some concepts are close to deployment. The regulatory bodies in the Small Modular Reactors Forum acknowledge the need to enhance their international cooperation on SMR regulation. Several Member States are considering requesting Technical Safety Review (TSR) services for SMR designs.

20. 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.

21. Analysis of reports provided to the Fuel Incident Notification and Analysis System (FINAS) in 2020 showed the importance of establishing effective ageing management programmes, continuing training of personnel, and effectively using operating procedures.

22. The Integrated Regulatory Review Service (IRRS), Integrated Nuclear Infrastructure Review (INIR)<sup>2</sup> 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.



**The Agency will:**

- Assist Member States in implementing programmes for ageing management and the long term operation;
- Facilitate the exchange of operating experience;
- Provide assistance to Member States to support their preparation for implementation of safety upgrades;
- Assist Member State activities related to small and medium sized or modular reactors;
- Strengthen the application of the Code of Conduct on the Safety of Research Reactors; and
- Assist Member States in the development of safety infrastructures for new nuclear power and research reactor programmes.

23. In 2020, two further Member States became Parties to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) and one further Party to the Assistance Convention registered National Assistance Capabilities in the Agency's Response and Assistance Network (RANET). The Agency held the Tenth Meeting of the Representatives of Competent Authorities identified under these Conventions virtually. The number of Member States using the International Radiation Monitoring Information System (IRMIS) for the regular sharing of simulated emergency radiation monitoring data has remained steady in 2020.

24. Member States are increasingly requesting support in strengthening national and regional EPR arrangements. Many requests relate to the need for assistance and advice in implementing the requirements established in IAEA Safety Standards Series No. GSR Part 7, including requests for the development of new Safety Guides, for the revision of existing Safety Guides, and for training and exercises.

25. The number of published Emergency Preparedness and Response Information Management System (EPRIMS) self-assessment modules increased to 1289 in 2020 from 1205 in 2019. The regular

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<sup>2</sup> INIR is a service provided by the IAEA Department of Nuclear Energy regarding nuclear power programmes. It is reported here due to its coordinated delivery with many safety related elements.

analysis of new information uploaded to EPRIMS allowed the Agency to assess progress made in technical cooperation projects and to identify global trends in national EPR arrangements based on Agency safety standards. These trends are similar to previous years: the lowest level of implementation is shown for Requirements 5 (protection strategy) and 18 (terminating a nuclear or radiological emergency), which were new in GSR Part 7. The Agency therefore developed new guidance to further support Member States' implementation of these requirements. The requirements with the highest level of implementation are those related to EPR infrastructure.



FOCUS AREAS

### Strengthening Emergency Preparedness and Response

#### The Agency will:

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

26. Member States continue to attach importance to having in place effective and coherent nuclear liability mechanisms at the national and global level. Member States continue to request the Agency to assist them in their efforts to adhere to the international nuclear liability conventions.

27. The number of contracting parties to the Convention on Nuclear Safety (CNS) increased by one, and to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) by one, during 2020. Due to the measures imposed by COVID-19, the Organizational Meeting for the Seventh Review Meeting of the Contracting Parties to the Joint Convention was postponed and held virtually, and the Seventh Review Meeting of the Joint Convention was also postponed. The Eighth Review Meeting of the CNS was postponed.



FOCUS AREAS

### Improving Management of the Safety and Security Interface And Strengthening Civil Liability for Nuclear Damage

#### 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 security are different; and
- Continue to facilitate the establishment of a global nuclear liability regime and assist Member States in their efforts to adhere to and implement the international nuclear liability instruments, taking into account the recommendations adopted by INLEX in 2012.

28. The Agency's priorities for 2021 regarding strengthening nuclear, radiation, transport and waste safety, and EPR are as follows:

- Ensuring continuing safety throughout the future transition between operating nuclear installations and advanced technologies, involving the safe and secure operation of existing facilities while implementing a safety, security and licensing framework for new technologies including SMRs;

- Assisting Member States to develop and implement national policies and strategies for the safe management of radioactive waste and spent fuel, for the promotion of disposal as the end state for waste, the development of decommissioning safety strategies and plans, and releases to the environment;
- Hosting the International Conference on a Decade of Progress after Fukushima-Daiichi: Building on the Lessons Learned to Further Strengthen Nuclear Safety;
- Continuing to assist Member States to implement IAEA Safety Standards Series No. GSR Part 7 through capacity building activities, including iNET-EPR elearning, webinars and exercises;
- Giving urgent attention to ensuring the safety standards remain fully applicable in pandemic situations;
- Supporting Member States to further develop their transport safety and security systems, and the interface between them, to further strengthen global transport safety and security regulatory infrastructures;
- Supporting the safe and secure deployment of the first NPP, including the capacity for undertaking the key steps required for site selection, assessment of design safety and security, and oversight of construction and commissioning;
- Continuing the support to Member States (Regulators and Operators) in radiation safety for the protection of patients, workers, the public and the environment, through capacity building activities with a focus on the development of computer-based guidance, learning courses and webinars; and
- Further developing and supporting the implementation by Member States of operational arrangements for notification, reporting and assistance in a nuclear or radiological incident or emergency, including through implementation of the conclusions of the 10th meeting of the Representatives of Competent Authorities identified under the Early Notification Convention and the Assistance Convention.

## Abbreviations

ADSEC	Advisory Group on Nuclear Security
AMRAS	Advisory Missions on Regulatory Infrastructure for Radiation Safety
ANSN	Asian Nuclear Safety Network
ARTEMIS	Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
ATF-TS	Testing and Simulation for Advanced Technology and Accident Tolerant Fuels
CGULS	Coordination Group for Uranium Legacy Sites
CLP4NET	Cyber Learning Platform for Network Education and Training
CNS	Convention on Nuclear Safety
CRP	Coordinated Research Project
CSC	Convention on Supplementary Compensation for Nuclear Damage
CSS	Commission on Safety Standards
EDUTA	Education and Training Appraisal
EPR	Emergency Preparedness and Response
EPREV	Emergency Preparedness Review
EPR-IEComm	Operations Manual for Incident and Emergency Communication
EPRIMS	Emergency Preparedness and Response Information Management System
EUCAS	European and Central Asian Safety Network
FINAS	Fuel Incident Notification and Analysis System
FUMAC	Fuel Modelling in Accident Conditions
GNSSN	Global Nuclear Safety and Security Network
IACRNE	Inter-Agency Committee on Radiological and Nuclear Emergencies
IEC	Incident and Emergency Centre
IGALL	International Generic Ageing Lessons Learned
iNET-EPR	International Network for Education and Training in EPR
INIR	Integrated Nuclear Infrastructure Review
INLEX	International Expert Group on Nuclear Liability
INSAG	International Nuclear Safety Group
INSARR	Integrated Safety Assessment of Research Reactors
IRMIS	International Radiation Monitoring Information System

IRRS	Integrated Regulatory Review Service
IRS	International Reporting System for Operating Experience
ISCA	Independent Safety Culture Assessment
ISEMIR	Information System on Occupational Exposure in Medicine, Industry and Research
IWP	Integrated Work Plan
LTO	Long Term Operation
MODARIA	Modelling and Data for Radiological Impact Assessment
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
ORPNET	Occupational Radiation Protection Networks
OSART	Operational Safety Review Team
PGEC	Postgraduate Educational Course
PIRT	Phenomena Identification and Ranking Table
PROSPER	Peer Review of Operational Safety Performance Experience
PSR	Periodic Safety Review
RANET	Response and Assistance Network
RASIMS	Radiation Safety Information Management System
RAT	Reactor Assessment Tool
RCF	Regulatory Cooperation Forum
RISS	Advisory Missions on Regulatory Infrastructure for Radiation Safety and Security of Radioactive Material
RPO	Radiation Protection Officers
SAFRON	Safety in Radiation Oncology
SALTO	Safety Aspects of Long Term Operation
SAMG-D	Severe Accident Management Guideline Development
SARIS	Self-Assessment of Regulatory Infrastructure for Safety
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	Technical Document
TNPP	Transportable Nuclear Power Plant
TSR	Technical Safety Review
USIE	Unified System for Information Exchange in Incidents and Emergencies

## 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, noting that the revision of the Safety Requirements publications to include lessons from the March 2011 Fukushima Daiichi nuclear accident has been completed. The revision of the related Safety Guides continues to be a focus.



2. The impact of COVID-19 on nuclear safety has been discussed by the International Nuclear Safety Group (INSAG) and the Commission on Safety Standards, and a gap analysis exercise is underway to determine any necessary strengthening of safety standards. This will be a priority for the Agency.

3. The Agency's peer review and advisory services continued to be provided to Member States upon request. Although Member State requests for these services remains high, the majority of reviews requiring site visits were postponed until 2021 owing to the COVID-19 pandemic travel restrictions (see Figure 1). Some missions were implemented as virtual events.

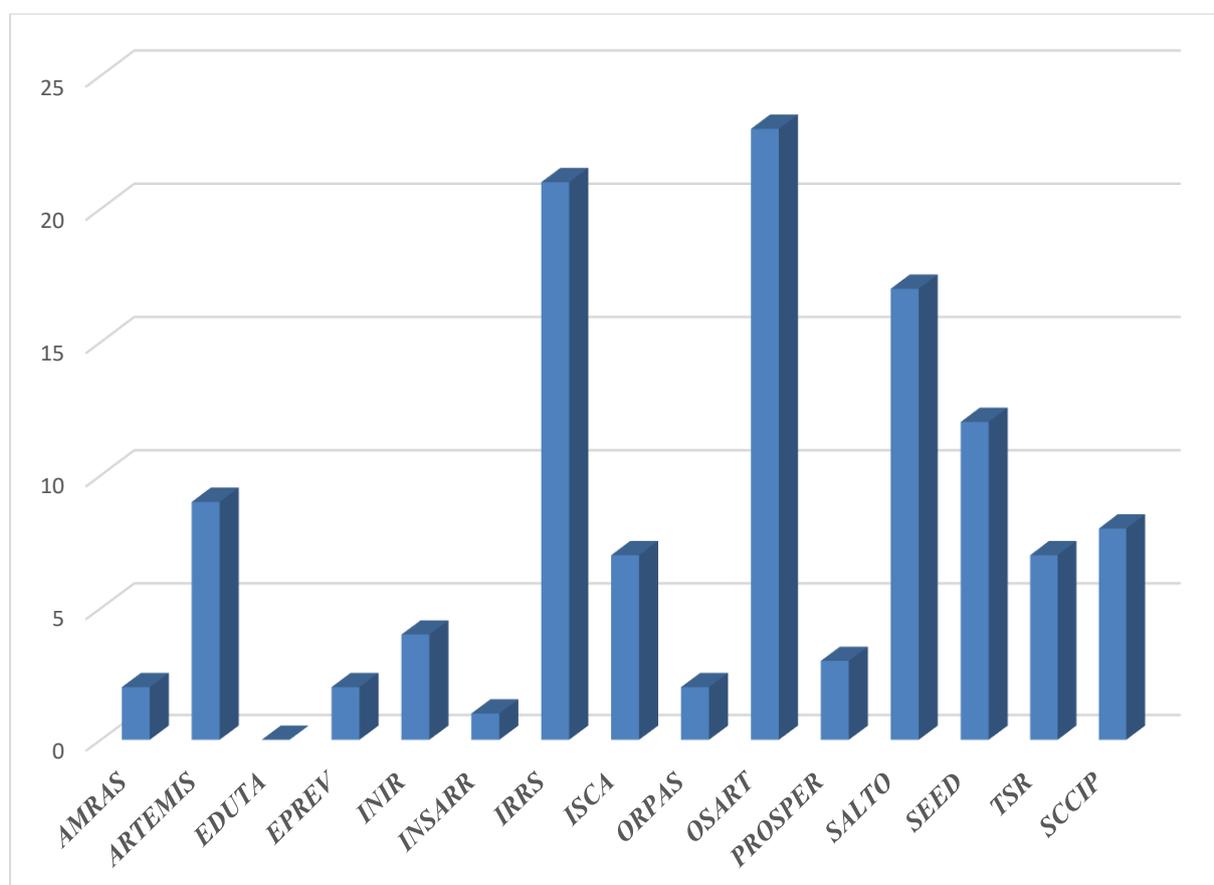


Fig. 1. Number of Member States requests for the Agency's peer review and advisory services to be conducted over the next two years.

## Related Activities

**4. The Agency will continue strengthening its safety standards using lessons from the Fukushima Daiichi accident 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 activities:**

- Organize the International Conference on a Decade of Progress after Fukushima-Daiichi: Building on the Lessons Learned to Further Strengthen Nuclear Safety. This will be a priority for the Agency;
- Conclude the gap analysis study to consider if the safety standards require strengthening following the experiences of COVID-19;
- Continue to encourage Member States to request Agency peer review and advisory services to strengthen their operational safety performance and leadership and management for safety;
- Continue collecting and analysing lessons from the implementation of the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) review service by organizing a feedback workshop. The outcomes of the feedback workshop will form the basis of a new version of the guidelines and the self-assessment to be made available by the end of 2021;
- Launch the new Self-Assessment of Regulatory Infrastructure for Safety (SARIS) online tool for Member State use, including regional and national events to train Member States on the new tool and remote technical support;

- Initiate activities on the pilot application of the Technical Safety Review (TSR) service for Small and Medium Sized or Modular Reactors (SMRs); and
- Continue activities to further increase the effectiveness of the Emergency Preparedness Review (EPREV), including development of guidance for EPREV hosts and streamlining the conduct of the mission with the more active use of virtual tools.

## **A.2. International Safety Conventions**

### **Trends**

5. The Convention on Nuclear Safety (CNS) was adopted on 17 June 1994 and entered into force on 24 October 1996. As of December 2020, there were 89 Contracting Parties to the CNS, an increase of one compared to the end of 2019.

6. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention) was adopted on 5 September 1997 and entered into force on 18 June 2001. As of December 2020, there were 83 Contracting Parties to the Joint Convention, an increase of one compared to the end of 2019.

### **Related Activities**

*7. The Agency will promote universal adherence to the CNS and the Joint 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 activities:*

- Continue to prepare for the postponed Seventh Review Meeting of the Joint Convention and the postponed Eighth Review Meeting of the CNS;
- Develop training material, including e-learning modules, to further promote the Joint Convention;
- Continue to cooperate and provide assistance to the International Maritime Organization and the contracting parties of various international and regional conventions related to the prevention of radioactive pollution and the sustainable use of the marine environment and its resources; and
- Organize educational workshops to ensure effective implementation of the CNS.

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

### **Trends**

8. Analysis of the twelve Advisory Missions on Regulatory Infrastructure for Radiation Safety (AMRAS) undertaken in 2019 showed that there is a need in some Member States for continued technical support for establishing and developing a sustainable regulatory framework for radiation safety.

9. The three Integrated Regulatory Review Service (IRRS) missions undertaken in 2020 highlighted the continued commitment of these Member States to strengthening national legal and governmental infrastructure. The Agency's ongoing analysis of missions conducted since 2015 show that many regulatory bodies still experience issues in relation to long term human resource planning, management

systems, and the implementation of a graded approach to regulatory processes, including authorization and inspection.

10. The Agency initiated a survey of radiation safety regulatory bodies in order to identify the impacts of the COVID-19 pandemic on the safety of facilities using radiation sources and on their regulatory oversight. Early analysis suggests that some companies may close as a result of the economic impact of the pandemic and there could be an increased risk of radioactive sources becoming orphaned.

11. The Agency noted continued interest among many Member States in updating national Emergency Preparedness and Response (EPR) frameworks, including EPR regulations, and harmonizing national arrangements with *Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSR Part 7). Interest in Agency support to better define EPR arrangements for new reactors (including SMRs) was observed to be high in the virtual Technical Meeting on Next Generation Reactors and EPR. Emergency Preparedness and Response Information Management System (EPRIMS) continued to help Member States and the Secretariat learn about the key needs and efforts in this field. Data indicate that 10% of Member States conducted or updated self-assessments against GSR Part 7 during 2020.

12. The number of requests for Occupational Radiation Protection Appraisal Service (ORPAS) missions remains high and consultation with several Member States continued concerning the future of ORPAS missions. This indicates a continual need for guidance and training for Radiation Protection Officers (RPOs) and qualified experts, as well as an extension of the monitoring scope of technical service providers to strengthen occupational radiation protection.



**There is ...**

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

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

**There are ...**

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

**Need for ...**

- Continued technical support for establishing and developing a sustainable regulatory framework for radiation safety;
- Training for radiation protection officers and qualified experts, and extension of the monitoring scope of technical service providers to strengthen occupational radiation protection.

#### Related Activities

***13. 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 activities:***

- Prepare a report on the results of the survey on the impact of the COVID-19 pandemic on regulatory activities for the safety of radiation sources, and provide an update of *The IAEA and the COVID-19 Pandemic* document to the March 2021 meeting of the Board of Governors and the General Conference in September 2021;

- Publish a Technical Document (TECDOC) to provide guidance on the application of a graded approach in regulations for the safety of radiation sources;
- Organize a Technical Meeting on Managing Regulatory Experience for the Oversight of a First NPP; and
- Conduct a follow-up Technical Meeting on Next Generation Reactors and EPR.

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

##### **Trends**

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

15. An increasing number of Member States are requesting assistance in developing their programmes on leadership and safety management, as well as in conducting safety culture self-assessments. This includes requests for the International School of Nuclear and Radiological Leadership for Safety.

16. Thematic working groups and Technical Meetings have highlighted the need for the Secretariat to further support Member States in developing communication strategies and plans, as well as establishing a global community of practice to discuss and share experiences.



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

- Review and advisory service mission reports continue to include recommendations relating to leadership, safety management and safety culture;
- There has been an increase in the number of Member States requesting assistance in developing their programmes on leadership and safety management.

**Need for ...**

- The Secretariat to further support Members States in developing communication strategies and plans;
- Establishing a global community of practice to discuss and share experiences.

##### **Related Activities**

***17. The Agency will assist Member States in strengthening leadership and management for the safety of nuclear 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 activities:***

- Continue to organize workshops and Technical Meetings to support Member States in sharing good practices in communication;
- Continue to make available workshops and training in leadership, management, and safety culture, and the International School of Nuclear and Radiological Leadership for Safety, and will continue with the programme of work on improving safety culture and the self-assessment of safety culture; and

- Continue with the development of a Safety Guide on leadership and management for safety and encourage all Member States to actively contribute.

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

### **Trends**

18. As noted during regional workshops and meetings of the IAEA Steering Committee on Education and Training in Radiation, Transport and Waste Safety, Member States continue to request Agency support in the development and strengthening of national provisions for education, training, qualification and competence in radiation protection and safety, in order to achieve closer alignment with Agency safety standards. In particular, Member States requested assistance to establish or revise national requirements, especially for personnel with responsibilities in radiation protection and safety), to establish and develop a national strategy in line with IAEA Safety Report Series No. 93, *A Methodology for Establishing a National Strategy for Education and Training in Radiation, Transport and Waste Safety*, and to design a national education and training programme in radiation protection and safety.

19. The Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources continued to be in high demand as it has become the established instrument for many Member States to build and maintain the competence of young professionals who may become senior managers or high-level decision makers with responsibilities related to radiation protection and safety.

20. The demand for train-the-trainer events for RPOs has continued to be very high and, as travel restrictions prevent in person training, there is an increasing interest in the use of online and web-based training. In general, there is a growing interest in online and web-based training on radiation protection, including radiation protection in medical uses of ionizing radiation, occupational radiation protection and radon.

21. Information provided by Member States to the Steering Committee on Regulatory Capacity Building and Knowledge Management shows that the implementation of the strategic approach to education and training in nuclear safety and the work of the Steering Committee and the Secretariat are on track as scheduled in the work programme; building and sustaining capacity in nuclear safety has high importance and the Agency should continue to keep this topic as a priority area; and the umbrella approach defines four areas – education and training, human resource development, knowledge management, and knowledge networks – as contributing to building and sustaining capacity in nuclear safety.

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

23. 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.

24. Some Member States encounter difficulties in recruiting competent staff, which may be attributed to the absence of appropriate national infrastructure and/or a lack of coordination of national education and training resources.

25. The number of Member States that expressed interest in cooperation to strengthen EPR capacity building activities has grown. In the absence of in-person events, the use of virtual methods has increased, for which there is a great deal of interest, as evidenced by the high number of participants. The Agency implemented in 2020 for the area of EPR: 10 training events (5 in-person and 5 virtual) at a national level with a total of around 400 attendees; 8 training events at regional level (2 in-person and 6 virtual) with a total of over 280 attendees from 147 Member States; and 100 webinars with a total of over 12000 attendees.

26. Member States continue to express a need for support in developing or strengthening their: national and organizational knowledge management programmes for nuclear safety, national capacity building programmes based on Agency guidance, and technical and scientific capacity including technical and scientific support organizations.



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

- Member States continue to request Agency support in the development and strengthening of national provisions for education, training, qualification and competence in radiation protection and safety, with the view of closer alignment with Agency safety standards.

#### There is ...

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

#### Need for ...

- Support in developing or strengthening national and organizational knowledge management programmes for nuclear safety, in developing or strengthening national capacity building programmes based on Agency guidance, and support in developing or strengthening technical and scientific capacity including technical and scientific support organizations.

#### Related Activities

***27. The Agency will assist Member States in their capacity building programmes, including education and training 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 activities:***

- Revise and update the *Strategic Approach to Education and Training in Radiation, Transport and Waste Safety 2011–2020*, and the *Strategic Approach to Education and Training in Nuclear Safety 2013–2020*;
- Continue enhancing, including by virtual methods, education and training programmes and implementing capacity building activities in the areas of safety assessment and design safety;

- Organize the first annual meeting of the International Network for Education and Training in EPR (iNET-EPR) platform to discuss initiatives and share experiences, analyse the development of postgraduate EPR courses and enable knowledge networking; and
- Complete the first phase of the project on a masters degree programme in EPR.

## **A.6. Research and Development for Safety**

### **Trends**

28. 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. Strong interest of Member States in the topic is reflected through a broad participation in the Coordinated Research Project (CRP) on In-Vessel Melt Retention Benchmark launched in 2020.

29. An increasing interest in research related to EPR is demonstrated by two new CRPs relating to the effective use of dose projection tools and public communication for EPR.

### **Related Activities**

**30. *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 the results. The Agency is planning to undertake the following activities:***

- Continue to carry out 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;
- Continue to encourage research and development based on needs identified, particularly regarding advanced approaches in safety assessment, analysis of design extension conditions, new design features, and equipment qualification in severe accident conditions; and
- Continue to carry out CRPs, including on Developing a Phenomena Identification and Ranking Table (PIRT) and a Validation Matrix, and Performing a Benchmark for In-Vessel Melt Retention, as well as organizing the Fourth Research Coordination Meeting for the CRP on Development of Approaches and Methodologies for Determining Emergency Planning Zones for SMRs and the Coordination Meeting of the CRP Effective Use of Dose Projection Tools in the Preparedness and Response to Nuclear and Radiological Emergencies.

## **B. Strengthening Radiation, Transport and Waste Safety**

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

#### **Trends**

31. The outcomes from the International Conference on Radiation Safety: Improving Radiation Protection in Practice in November 2020 show that Member States are increasingly: recognizing the need to apply the principles of justification and optimization in circumstances where actions are being considered to reduce radiation exposure; seeking advice and guidance from the Agency in relation to

managing exposure due to radon in homes and workplaces; aware of the importance of having a strong ethical basis to the application of radiation protection principles.



**International  
Conference on  
Radiation Safety**

**Member States are increasingly ...**

- Recognizing the need to apply the principles of justification and optimization in circumstances where actions are being considered to reduce radiation exposure;
- Seeking advice and guidance from the Agency in relation to managing exposure due to radon in homes and workplaces;
- Aware of the importance of having a strong ethical basis to the application of radiation protection principles.

32. There is an increasing awareness among Member States of the need to protect workers and properly manage residues in industries involving Naturally Occurring Radioactive Material (NORM), and to apply a graded approach to the use of regulators' and operators' resources for the management of worker protection and NORM residues in line with the International Basic Safety Standards (IAEA Safety Standards Series No. GSR Part 3). Several Member States have already established regulatory requirements, and many are in the process of establishing such requirements for the safe management of NORM.

33. Member States requests are increasing for Agency support for regulatory flexibility in exemption of a practice or source as well as in clearance of material from authorised practices and there is a need for revised guidance. The application of a graded approach has been challenging especially in dealing with those cases related to existing exposure situations such as international trade of commodities, criteria for exemption of surface contaminated non-food commodities and conditional clearance of materials.

34. Member States with little experience in regulating the management of residues containing NORM from industries such as oil and gas and rare earth processing have expressed a need for Agency support in establishing regulatory and safety infrastructure.

35. High participation in Agency webinars and feedback from Member States both indicate a growing awareness among Member States of the effects of exposure to radon in homes and workplaces, as well as radiation doses from the consumption of food and drinking water in non-emergency situations. Non-medical human imaging is also a topic of increasing interest that raises new challenges, including ethical considerations, for regulatory bodies.

36. New and advanced cancer control applications, including radiotherapy technology and procedures, are increasingly used for treatment of cancer in countries and regions that have previously had only limited access to such applications. Improved access to and increasing use of diagnostic imaging procedures utilizing ionizing radiation are creating a need for greater awareness of the importance of justification of medical exposure, optimization of radiation protection, and safety of associated exposures to protect patients from risks related to ionizing radiation.



## Radiation Protection of Patients, Workers and the Public

### There is a ...

- Greater awareness of the importance of justification of medical exposure, optimization of radiation protection, and safety of associated exposures to protect patients from risks related to ionizing radiation;
- Growing awareness among Member States of the effects of exposure to radon in homes and workplaces.

### Need for ...

- Agency support to Member States with little experience in regulating the management of residues containing NORM in establishing regulatory and safety infrastructure;
- Revised guidance regarding the application of regulatory flexibility in exemption and clearance.

### Related Activities

**37. 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 energy production, research, and medical and industrial uses of radionuclides. The Agency is planning to undertake the following activities:**

- Provide assistance to the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic on a methodology for deriving environmental assessment criteria for radioactive substances in the marine environment for the OSPAR maritime area and adapt it for the Baltic Marine Environment Protection Commission;
- Continue providing guidance and support to Member States in radiation protection of patients, workers and the public through capacity building activities and the development of computer-based guidance and webinars. This will be a priority for the Agency;
- Continue to support Member States in the field of occupational radiation protection with specific focus on innovative new tools and techniques (e.g. artificial intelligence and virtual reality) for utilization in workplaces for the radiation protection of workers and work planning.
- Based on the experience gained with the Information System on Uranium Mining Exposures, extend the Information System on Occupational Exposure in Medicine, Industry and Research; and
- Hold a Technical Meeting of the Regulatory Forum for Safety of Uranium Production and Naturally Occurring Radioactive Materials.

## B.2. Control of Radiation Sources

### Trends

38. The increased use of sealed radioactive sources in medicine, industry, agriculture and research has resulted in a growing need to have appropriate arrangements for the control of sources and the safe and secure management of disused sealed radioactive sources, including the building of national disposal facilities.

39. Member States 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.

40. In 2020, no additional Member States made a political commitment to implementing the Code of Conduct on the Safety and Security of Radioactive Sources and the total number remains at 140. Since

the issuance of the *Nuclear Safety Review 2020*, three 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, bringing the total number that have done so to 123. No additional Member States nominated points of contact for facilitating the import and export of radioactive sources, for which the total number of Member States remains at 145, and 6 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 39 (see Figure 2).

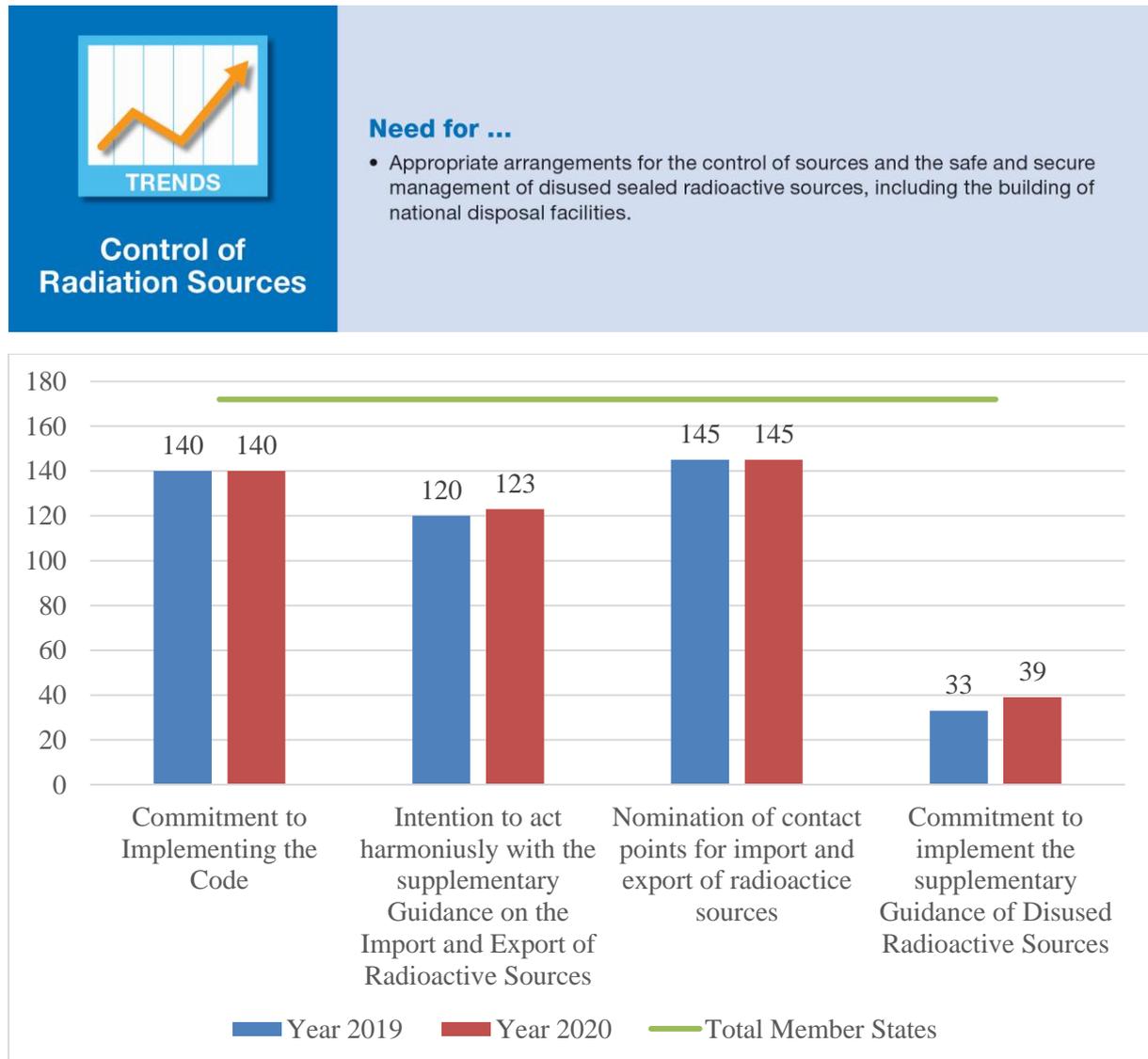


Fig. 2. Member State support for the *Code of Conduct on the Safety and Security of Radioactive Sources* and its supplementary Guidance documents.

### Related Activities

**41. 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 activities:**

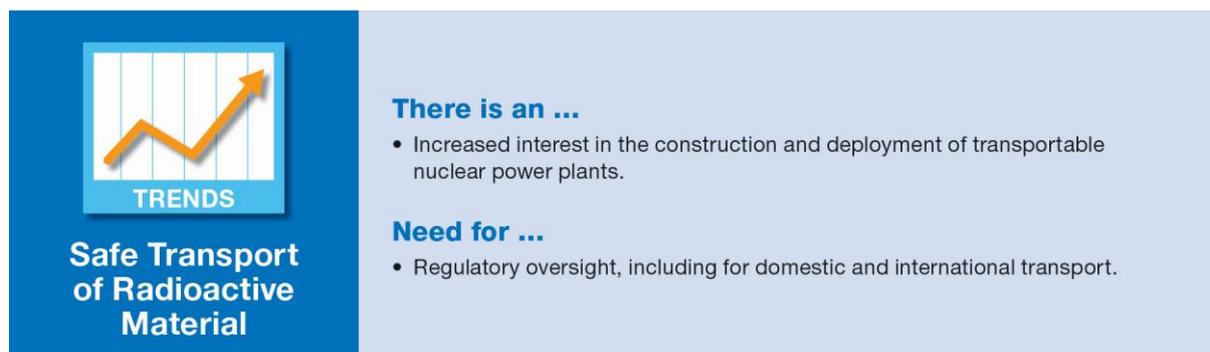
- Hold the rescheduled Open-ended Meeting of Legal and Technical Experts on the Implementation of the Guidance on the Management of Disused of Radioactive Sources in June 2021, and hold a virtual regional meeting on implementation of the Guidance;
- Finalize the aiding document on Financial Provisions to Ensure Safe Management and Secure Protection of Radioactive Sources once they Become Disused;
- Continue to organize workshops for the establishment of national registers of sources and search for orphan sources; and
- Continue supporting the exchange of information on the control of radioactive material inadvertently incorporated into scrap metal amongst Member States.

### B.3. Safe Transport of Radioactive Material

#### Trends

42. The increased use of radioactive material in Member States is creating a growing need for regulatory oversight, including for domestic and international transport.

43. Some Member States are increasingly interested in the construction and deployment of transportable nuclear power plants (TNPPs).



The infographic is divided into two main sections. On the left, a blue box contains a line graph with an upward-trending arrow and the word 'TRENDS' below it. Below the graph, the text 'Safe Transport of Radioactive Material' is written in white. On the right, a light blue box contains two sections: 'There is an ...' and 'Need for ...', each followed by a bullet point.

**TRENDS**

**Safe Transport of Radioactive Material**

**There is an ...**

- Increased interest in the construction and deployment of transportable nuclear power plants.

**Need for ...**

- Regulatory oversight, including for domestic and international transport.

#### Related Activities

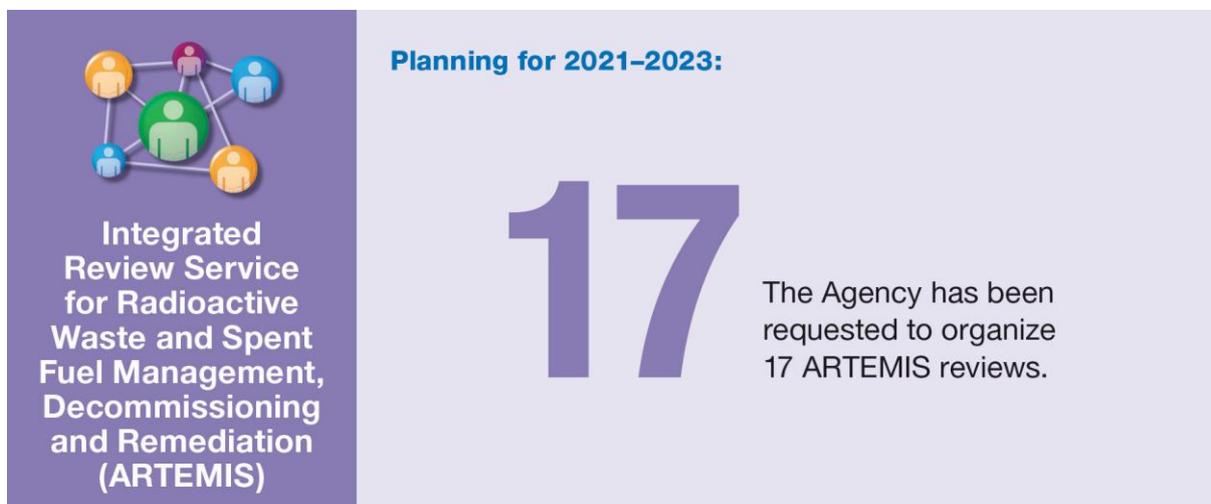
**44. The Agency will assist Member States in building capacity for the safe transport of radioactive material. The Agency is planning to undertake the following activities:**

- Complete and launch the Spanish Version 2 of Modules 0–4 of the Transport Safety e-Learning platform;
- Complete and launch Version 2 of Modules 5–9 of the Transport Safety e-Learning platform in English and Spanish;
- Further develop virtual training events to increase the level of engagement in Member States in relation to the development of transport safety oversight within a Member State and at the regional level;
- Initiate a study to establish options for bringing transportable reactors into the scope of a revised transport safety regulatory infrastructure; and
- Convene the rescheduled International Conference on the Safe and Secure Transport of Nuclear and Radioactive Materials.

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

### Trends

45. Demand for the ARTEMIS services continues to increase and the Agency has been requested to organize 17 ARTEMIS reviews between 2021 and 2023.



46. Significant global growth in the number of nuclear decommissioning projects has increased the need for more flexible provisions in Member States for release of material and waste from regulatory control. Member States are looking for new guidance on establishing clearance levels and granting unconditional, conditional, and case-by-case clearance.

47. Member States continue to seek the Agency's assistance in developing and implementing safe interim long term management solutions for radioactive waste, including on the siting of radioactive waste management facilities. Disposal is the safe long term management solution for waste. This will be a priority for the Agency.

48. Member States are increasingly requesting Agency support to develop and implement plans for near surface disposal of very low and low level radioactive waste.

49. Several Member States are increasingly interested in geological disposal of high level radioactive waste and spent fuel when considered as waste. Licensing activities for geological disposal facilities are progressing in some Member States.

50. Member States continue to request assistance in the safe long term management of disused sealed radioactive sources, including in the development, where appropriate, of safe borehole disposal facilities.



## Decommissioning, Spent Fuel Management and Waste Management

### There is an ...

- Increased interest in Agency support to develop and implement plans for near surface disposal of very low and low level radioactive waste;
- Increased interest in geological disposal of high level radioactive waste and spent fuel when considered as waste.

### Need for ...

- More flexible provisions in Member States for release of material and waste from regulatory control.

### Related Activities

**51. 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, 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 activities:**

- Continue the administration of the International Projects on Demonstrating the Safety of Geological Disposal and the Forum on the Safety of Near Surface Disposal;
- Continue activities related to the application of safety standards on the predisposal management and the disposal of radioactive waste, including the development of a dedicated Safety Guide on national policies and strategies for the safety of radioactive waste and spent fuel management, decommissioning and remediation; and
- Continue to promote the exchange of experience on the implementation of decommissioning strategies and plans and complete the development of specialized training on safety of decommissioning.

## B.5. Radiation Protection of the Environment and Remediation

### Trends

52. As observed during Agency missions, and as in previous years, the use of a wide range of nuclear techniques and applications worldwide has resulted in a growing need to analyse and evaluate the radiological implications of radionuclides being released to the environment. This includes 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 from past and potential future practices.

53. There is also growing interest in the assessment of past unregulated activities and events, and the control of their impact. Member States continue to request Agency assistance in remediation activities, particularly the remediation of legacy sites from past uranium production and other nuclear-related activities.



## Radiation Protection of the Environment and Remediation

### There is a ...

- Growing interest in the assessment of past unregulated activities and events, and the control of their impact.

### Need for ...

- Analysis and evaluation of the radiological implications of radionuclides being released to the environment.

### Related Activities

**54. 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 is planning to undertake the following activities:**

- Continue supporting forums focused on remediation including the Coordination Group for Uranium Legacy Sites and the International Working Forum on Regulatory Supervision of Legacy Sites);
- Continue the development of a new programme (following on from Modelling and Data for Radiological Impact Assessments (MODARIA II)) to address key overarching topics on the assessment of radiation doses to the public and the environment from radionuclide releases to support Member States, including training and mentoring elements and a series of symposia to engage and support junior scientists; and
- Publish guidance on remediation strategies for contaminated areas post nuclear accidents and commence the development of supporting technical guidance on monitoring for the protection of the public and the environment.

## C. Strengthening Safety in Nuclear Installations

### C.1. Nuclear Power Plant Safety

#### C.1.1. Operational Safety

##### Trends

55. 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.



**Operational Safety Review Team (OSART) mission reports**

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.

56. Analysis of data from 85 reports in the International Reporting System for Operating Experience (IRS) indicated a continuing need to learn from events related to human performance; improve operation and maintenance fundamentals; and improve leadership, management and oversight of processes and practices.



**International Reporting System for Operating Experience (IRS)**

**85**

Based on analysis of data from 85 reports, need to:

- learn from events related to human performance;
- improve operation and maintenance fundamentals; and
- improve leadership, management and oversight of processes and practices.

57. Nuclear power reactors around the world have programmes to address LTO and ageing management. In 2020, 67% of the 443 operating NPPs had been in operation for 30 years or more and 20% had been in operation for more than 40 years (see Figure 3).

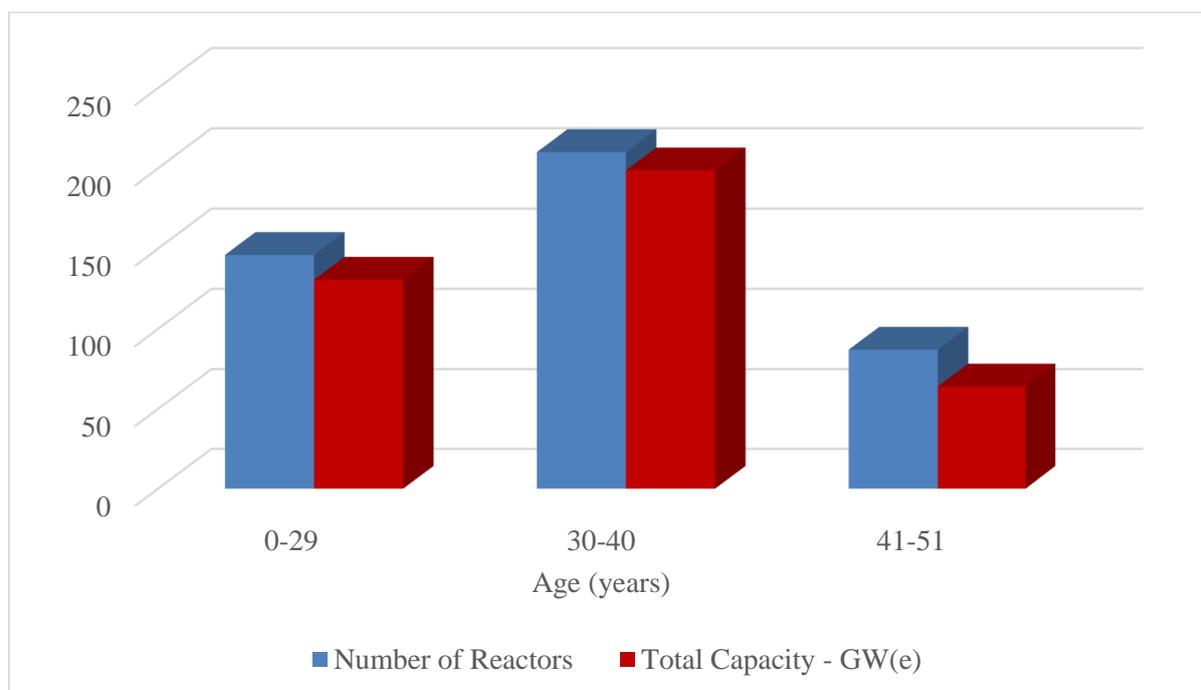


Fig. 3. Age distribution of all 443 operating nuclear power reactors in 2020 based on information from the Power Reactor Information System on 15 December 2020.

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

#### **Related Activities**

***59. 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 implementation of safety upgrades in existing NPPs. The Agency is planning to undertake the following activities:***

- Publish a TECDOC on ageing management of NPPs during delayed construction periods, extended shutdown and permanent shutdown prior to decommissioning; and
- Publish revisions of the *SALTO Peer Review Guidelines* (IAEA Services Series No. 26) and the *PROSPER Guidelines* (IAEA Services Series No. 10).

#### **C.1.2. Site and Design Safety**

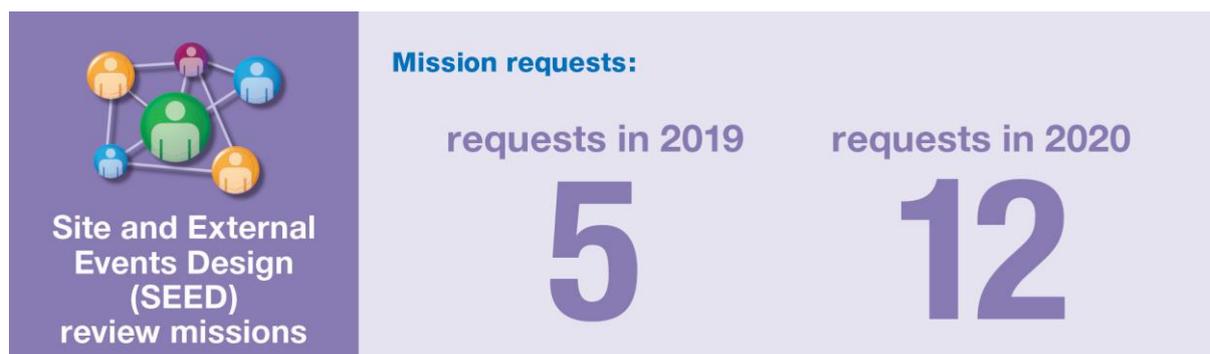
##### **Trends**

60. Member States continue to show interest in the harmonization of approaches for sharing knowledge with respect to the design and safety evaluation of new NPPs, including innovative designs. The application of Agency safety standards to innovative designs of NPPs, including SMRs, is a matter of great interest for Member States. This will be a priority for the Agency at the same time as supporting the safety of operating reactors.

61. 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.

62. Member States continue to express an interest in the lessons arising from the Fukushima Daiichi accident with regard to site and design safety. They are also interested in sharing experiences of the safety reassessment of existing NPPs, performing reasonably practicable safety improvements for preventing accidents as needed, and, should an accident occur, mitigating its consequences and avoiding significant radioactive releases.

63. The Agency continues to receive a high number of requests from Member States for Site and External Events Design (SEED) review missions (five requests in 2019, and twelve requests in 2020, for missions in the subsequent two years), expert missions, and capacity building and training workshops. There is also an increased interest in the assessment of combinations of hazards as well as hazards at multi-unit sites.



64. Member States continue to request assistance in the review of safety assessments of new reactor designs against Agency safety standards as well as TSR peer reviews in other technical subject areas, and express interest in advanced safety assessment techniques in areas such as reliability of digital instrumentation and passive systems, human reliability assessment, and risk analysis in a multi-unit and multi-source context or multi-module interactions.



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

#### Related Activities

**66. The Agency will assist Member States in the application of Agency safety standards relating to the evaluation of safety of nuclear installations, such as siting, design, commissioning and operating requirements, including long term operation. The Agency is planning to undertake the following activities:**

- Continue to organize meetings and TSR peer review services, and develop technical documentation to assist Member States in the application of the Agency's safety assessment and design safety standards, in support of safety improvements for existing NPPs and to address emerging topics in the design safety of new NPPs;
- Initiate the development of a new publication that aims at describing current challenges, synergies, good practices, and examples of corrective actions and safety improvements related to the application of PSRs for justifying LTO for NPPs;
- Assist Member States with operating nuclear installations in implementation of the recommendations of SEED reviews, application of Agency safety standards, and use of the latest knowledge and techniques in site assessments, design and safety assessment with respect to external hazards;

- Initiate new projects on the seismic qualification of equipment and components based on earthquake experience and test data, and develop an External Events Notification System for external event alerts and assessment of lessons learned; and
- Organize Technical Meetings to share experience on site evaluation and design to protect nuclear installations against external hazards, on evaluation of seismic safety for existing nuclear installations and innovative reactors, such as SMRs, and on probabilistic fault displacement hazard analysis techniques.

### **C.1.3. Severe Accident Prevention and Mitigation**

#### **Trends**

67. 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.

68. Member States continue to express an interest in the lessons arising from the Fukushima Daiichi accident and request Agency support in developing clear, comprehensive, well-designed accident management provisions capable of helping to address the difficulties that operators and decision-makers may face when dealing with a severe accident.

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

#### **Related Activities**

**70. *The Agency will provide forums for Member States to share knowledge and experience in their efforts to strengthen severe accident management guidelines. The Agency will further develop technical documentation in this area. The Agency is planning to undertake the following activities:***

- Continue to facilitate the exchange of experiences in the area of severe accident management and develop supporting technical documentation; and
- Promote and support through the Agency's Technical Cooperation programme capacity building and national human resource development in the area of severe accident management, including for newcomers.

### **C.2. Safety of Small and Medium Sized or Modular Reactors**

#### **Trends**

71. The Scientific Forum during the 64th regular session of the General Conference considered the deployment of SMRs to be one of the viable options to mitigate climate change. More than 70 SMR designs are in various stages of development and some concepts are close to deployment. The world's first floating nuclear power plant, "Akademik Lomonosov", was commissioned in the Russian Federation in May 2020.

72. Member State interest in SMRs has been reflected in the growing participation of Member States in Agency activities related to SMRs, particularly in the review of applicability of Agency safety standards to SMR designs and a corresponding increase in requests for workshops and expert missions on licensing and safety matters from countries embarking on SMR technology. This will be a priority for the Agency at the same time as supporting the safety of operating reactors.

73. The regulatory bodies in the Small Modular Reactors Regulators' Forum acknowledge the need to enhance their international cooperation on SMR regulation, with Agency safety standards and technical documentation being important for enhancing international collaboration on the regulatory assessment of SMR designs.

#### **Related Activities**

***74. The Agency will assist Member State activities related to small and medium sized or modular reactors, particularly their efforts to develop safety requirements, build capacity for design safety and safety assessment, and share good practices. The Agency is planning to undertake the following activities:***

- Systematically review the applicability of Agency safety standards in support of the licensing and deployment of emerging SMR technologies and develop a roadmap in close cooperation with interested Member States for the application of Agency safety standards as part of a technology neutral safety and regulatory framework for SMRs;
- Continue developing publications related to safety assessment and design safety of SMRs in the context of Agency safety standards and continue supporting Member States in strengthening their capabilities on safety assessment of SMRs;
- Hold a series of regional workshops for embarking countries on the main outputs of the technical work by the Small Modular Reactors Regulators' Forum in regulating SMRs; and
- Continue the development of a TECDOC on past experience in regulating SMRs by Member States, including challenges and proposed solutions to overcome those challenges.

### **C.3. Research Reactor Safety**

#### **Trends**

75. 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.

76. At least 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**

***77. 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 activities:***

- 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
- Conduct an International Meeting on the Code of Conduct on the Safety of Research Reactors in July 2021.

## **C.4. Fuel Cycle Facility Safety**

### **Trends**

78. In 2020, 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, increased by three to 294. The main lessons learned were on the importance of establishing effective ageing management programmes, continuing training of personnel, and to effectively use operating procedures. More than 80% of the world's nuclear fuel facilities are currently part of the system.

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

### **Related Activities**

*80. The Agency will provide assistance to Member States to support their preparation for implementation of safety upgrades identified by safety reassessments of nuclear fuel cycle facilities. The Agency will continue to support Member States to enhance regulatory supervision. The Agency is planning to undertake the following activities:*

- Assist Member States in the application of a graded approach to nuclear fuel cycle facilities in line with Agency safety standards;
- Assist Member States' regulatory bodies in developing the programmes and competences necessary to ensure effective regulatory control of nuclear fuel cycle facilities; and
- Revise and update the Safety Evaluation of Fuel Cycle Facilities During Operation (SEDO) mission guidelines to reflect the current needs of Member States and to implement recently published Agency safety standards.

## **C.5. Safety Infrastructure for Embarking Countries**

### **C.5.1. Nuclear Power Programmes**

#### **Trends**

81. Twenty-nine Member States are considering or planning a new nuclear power programme. Four of these Member States have commenced the construction of their first NPP, and two of these expect operation of their first unit to begin in 2020.

82. The IRRS, Integrated Nuclear Infrastructure Review (INIR) and other peer review and advisory services continue to identify the need to strengthen regulatory body independence, to build regulatory capacity and competence, and to establish safety regulations and licensing processes as part of effective legislative and regulatory oversight programmes (see Figure 4).

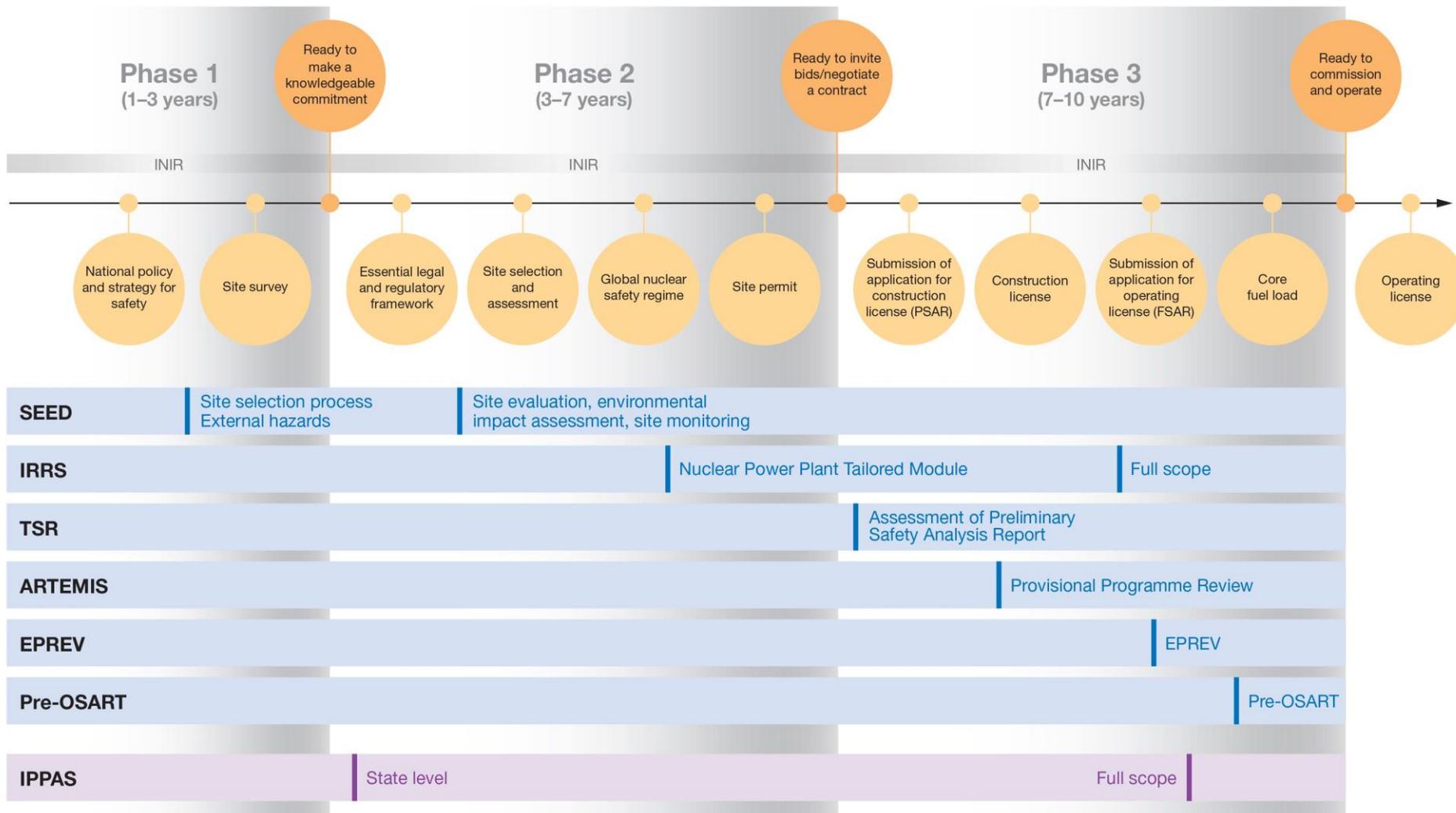


Fig. 4. Timeline for Peer Review and Advisory Services for Embarking Countries

### **Related Activities**

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

- Continue to encourage Member States to host relevant nuclear safety review missions during the early stages of development of a nuclear power programme to support the evaluation of safety infrastructure aspects; and
- Continue to assist newcomer Member States 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. This will be a priority for the Agency.

### **C.5.2. Research Reactors Programme**

#### **Trends**

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

#### **Related Activities**

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

- Continue to provide its support to Member States on the development of safety infrastructure for new research reactor programmes upon request and support capacity building through peer review missions, Technical Meetings and training activities.

## **D. Strengthening Emergency Preparedness and Response**

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

#### **Trends**

86. Effective information exchange and emergency communication remain a priority for Member States. In 2020, the Agency was informed by competent authorities, or became aware through earthquake alerts or media reports, of 177 events involving or suspected to involve nuclear or radiological facilities or activities. This number of events with IEC and Member State interaction remains significant in line with the trend of recent years (see Figure 5). The sustained effort by the Secretariat and Member States with regard to workshops and training on arrangements for notification, reporting and assistance contributed to the increase in the number of recorded events over the past years. In 2020, the Agency received four requests for information about the events from official contact points.

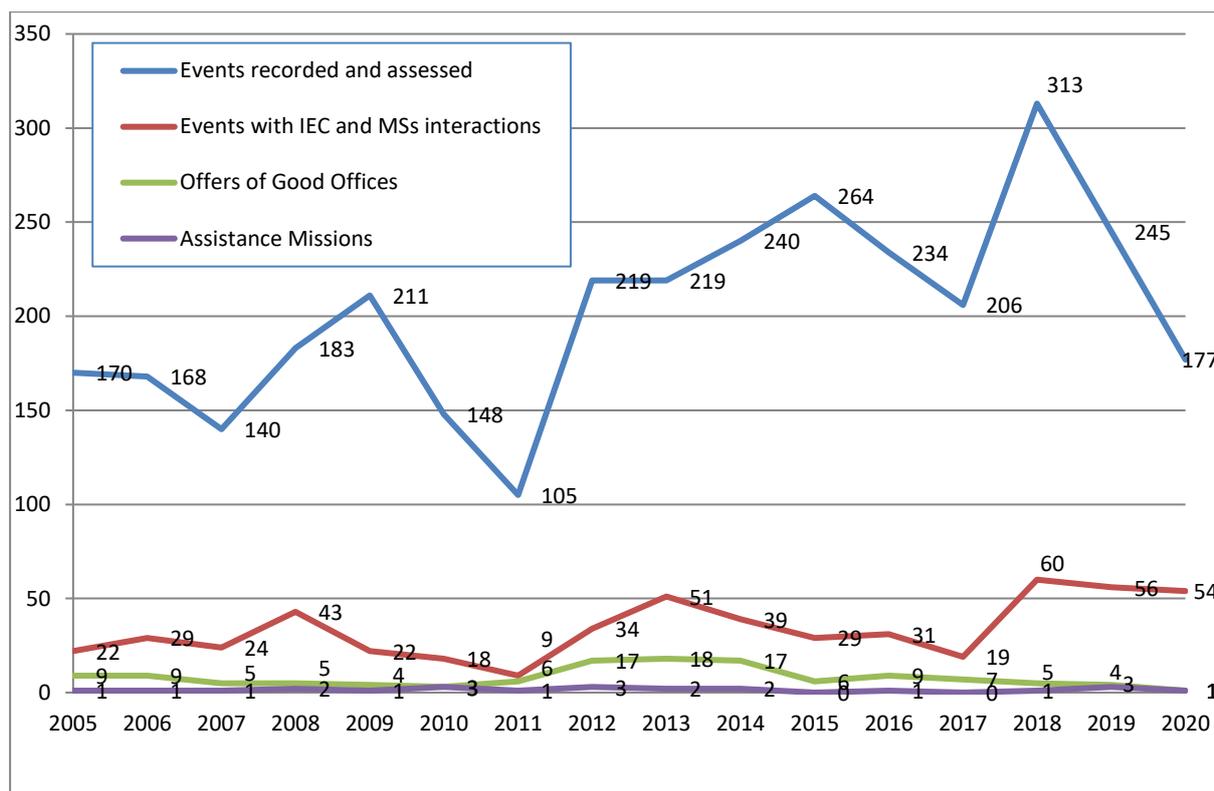


Fig. 5. Number of events involving or suspected to involve nuclear or radiological facilities or activities, about which the Agency was informed by competent authorities, or became aware through earthquake alerts or media reports.

87. Member State support is increasing for the continuous review and update of the arrangements for notification, reporting and assistance through the provision of feedback on the reviewed content of the operational manuals and the latest developments of the Agency web systems and tools used in the implementation of the arrangements. This will be a priority for the Agency.

88. The percentage of new Unified System for Information Exchange in Incidents and Emergencies (USIE) users that requested two-factor authentication increased in 2020. Approximately 16% of all newly registered users of the USIE website in 2020 have registered for two-factor authentication.

89. The Agency continued to encourage Member States to ratify the Convention on Early Notification of a Nuclear Accident (Early Notification Convention)<sup>3</sup> and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Assistance Convention)<sup>4</sup>. In 2020, two further Member States became Parties to the Assistance Convention. To date, 35 of the 122 States Parties to the Assistance Convention have registered National Assistance Capabilities<sup>5</sup> in the Agency's Response and Assistance Network (RANET). New or updated registrations were received from Belarus, Belgium, Canada, Egypt, Finland, Hungary, India, Israel, Japan, Slovenia, Turkey, the United Kingdom and the United States of America.

<sup>3</sup> The text of the Early Notification Convention is available in document INFCIRC/335:  
<https://www.iaea.org/sites/default/files/infirc335.pdf>

<sup>4</sup> The text of the Assistance Convention is available in document INFCIRC/336:  
<https://www.iaea.org/sites/default/files/infirc336.pdf>

<sup>5</sup> 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 2020:**

- Two further Member States became Parties to the Assistance Convention.
- To date, 35 of the 122 States Parties to the Assistance Convention have registered National Assistance Capabilities in RANET.
- Updated registrations were received from **Belarus, Belgium, Canada, Egypt, Finland, Hungary, India, Israel, Japan, Slovenia, Turkey, the United Kingdom, and the United States of America.**

90. Upon a request for assistance from Lebanon, thirteen Member States registered in the IAEA's Response and Assistance Network (RANET) responded through USIE. The IAEA arranged an assistance mission, comprised of four experts from Denmark and France as well as four IAEA staff members, to measure radiation levels at several locations and assess the impact of the explosion on the safety and security of radioactive material and sources in hospitals, scrapyards and the Beirut port. In addition, environmental samples collected by Lebanese authorities were analysed in laboratories in France and Switzerland as part of the IAEA assistance. These laboratories confirmed that there were no elevated radiation levels detected in the samples.

91. During 2020, four additional Member States declared electronic mail as their preferred emergency communication channel bringing the total number of Member States that have declared electronic mail to be their preferred emergency communication channel to 114.

92. The number of nominated contact points for the coordination of activities related to the International Radiation Monitoring Information System (IRMIS) continues to grow. In 2020, eighteen Member States nominated or updated their contact point, bringing the total to 60. The number of Member States using IRMIS for the regular sharing of simulated emergency radiation monitoring data has remained steady in 2020 (nine Member States).

93. In 2020, the number of Member States using the International Nuclear and Radiological Event Scale to communicate the safety significance of nuclear or radiological events increased to 78.

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

#### **Related Activities**

**95. 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 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; and
- Continue to assist Member States in building or strengthening their capabilities for public communication in a nuclear or radiological emergency by conducting training courses and exercises, using the social media simulator when appropriate.

## D.2. Harmonization of Arrangements for Preparedness and Response

### Trends

96. Member States are increasingly requesting technical assistance and advice in strengthening national and regional EPR arrangements through Technical Cooperation projects. Many requests relate to the need for assistance and advice in implementing the requirements established in IAEA Safety Standards Series No. GSR Part 7, including requests for the development of new Safety Guides, for the revision of existing Safety Guides, and for training and exercises. This will be a priority for the Agency.

97. The number of Member States using GSR Part 7 and the recently published Safety Guides *Arrangements for the Termination of a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSG-11) and *Arrangements for Public Communication in Preparedness and Response for a Nuclear or Radiological Emergency* (GSG-14) in developing their national emergency response arrangements is increasing. In addition, interest in the harmonization of EPR arrangements is growing, as evidenced by the audience reached by webinars organized on GSR Part 7 topics and the fact that GSR Part 7 continuously appears in the top ten most accessed publications on the Agency's website.

98. Member States continue to increase their use of EPRIMS (see Figure 6). As of 2020, 123 Member States have appointed national EPRIMS coordinators, with a total of 484 users. The number of published modules also increased to 1289 in 2020 from 1205 in 2019. The regular analysis of the new information uploaded to EPRIMS allowed the Agency to assess progress made in Technical Cooperation Projects and to identify global trends in national EPR arrangements based on Agency safety standards.

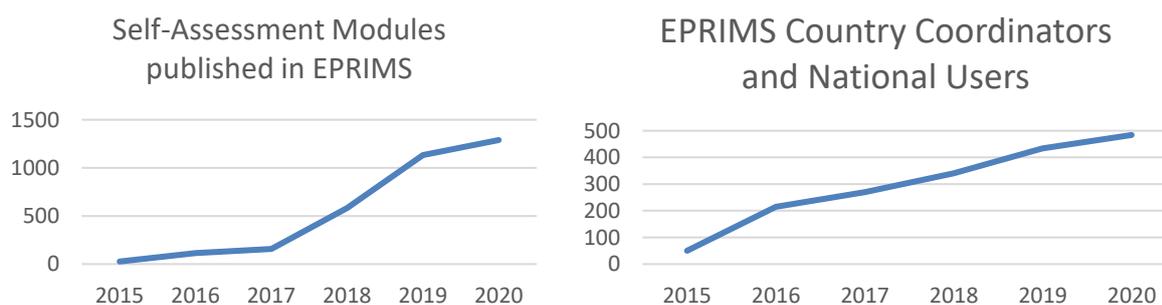


Fig. 6. The use of EPRIMS continued to increase in 2020.

99. An analysis of Member State EPRIMS self-assessments shows trends that are similar to previous years: the lowest level of implementation is shown for Requirements 5 (protection strategy) and 18 (terminating a nuclear or radiological emergency), which were new in GSR Part 7. The Agency therefore developed new guidance to further support Member States' implementation of these requirements. Training events based on this new guidance is being delivered to Member States at an increasing rate (with the constraints set by the COVID-19 pandemic require this training to be in a virtual format) as a priority in an effort to support the harmonization of national EPR arrangements. The requirements with the highest level of implementation are those related to EPR infrastructure (see Figure 7).

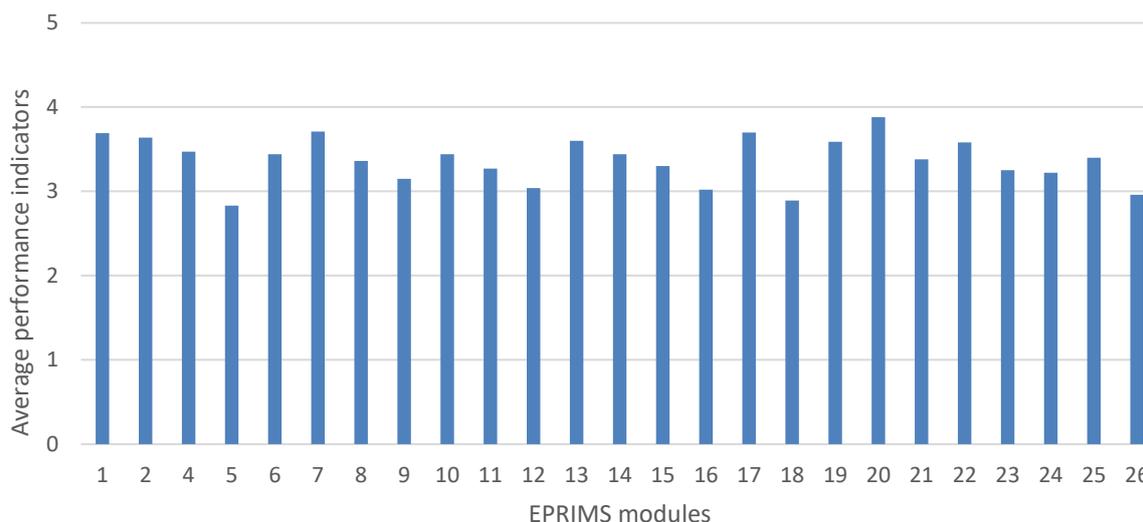


Fig. 7. GSR Part 7 requirements and their ratings according to self-assessment of countries.

100. Interest from Member States was identified to further improve EPRIMS and to include information in the platform from EPREV missions.

101. Interest from Member States in addressing EPR arrangements for new and emerging reactors types, mainly SMRs and TNPPs, continues to grow.

#### 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 activities:**

- Organize a Technical Meeting on Next Generation Reactors and EPR based on the developments from the CRP Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment; and
- Launch a new release of EPRIMS with improvements in self-assessments and interactions with EPREV, and allowing for increased availability of EPREV reports as allowed.

### D.3. Testing Readiness for Response

#### Trends

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

104. The Agency followed up on USIE administrators who did not complete the requested annual tasks and, as a result, more than 20 USIE administrator accounts were removed, and 45 new accounts were created for administrators in different Member States.

105. The participation of Member States in ConvEx-2 exercises continues to be high (see Figure 8).

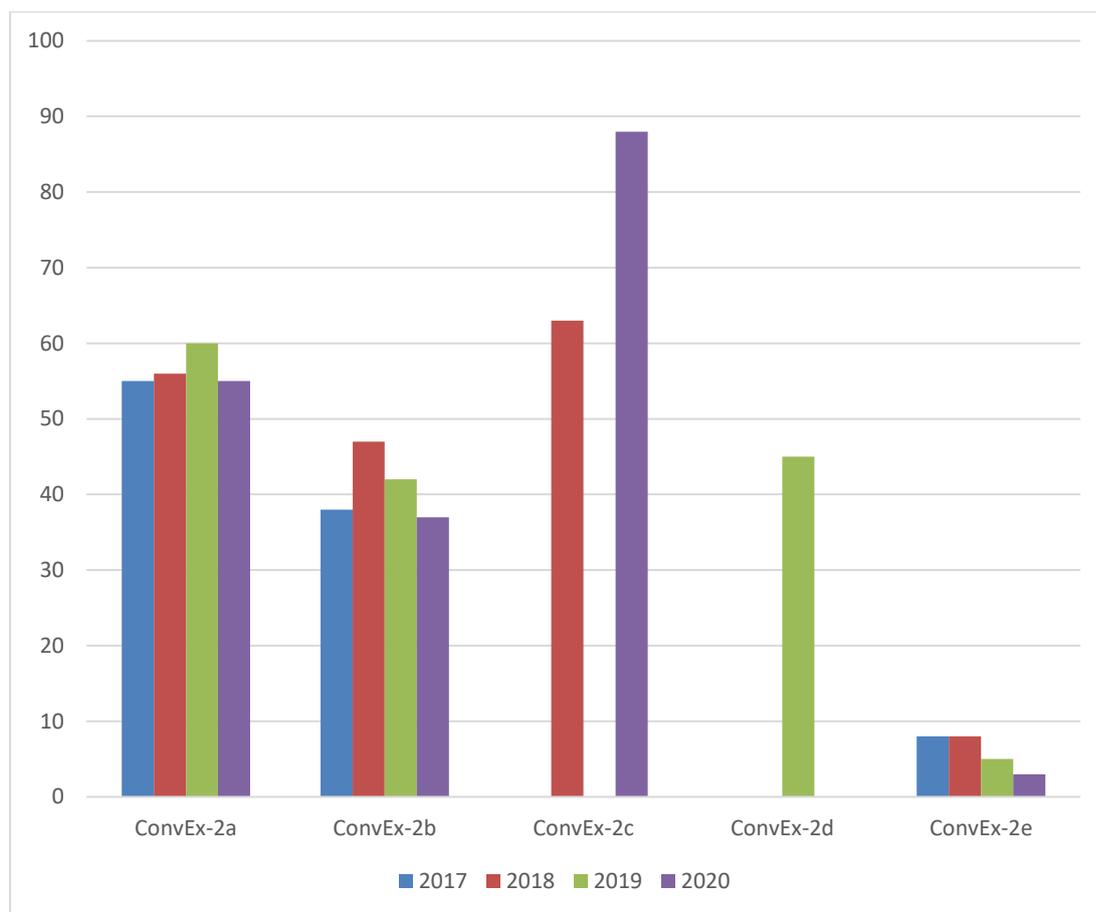


Fig. 8. Participation of Member States and international organizations in ConvEx-2.

106. The percentage of emergency contact points that confirmed a test message via the USIE website during simple communication tests increased from 36% in 2018 to 41% in 2019 and 42% in 2020.

#### Related Activities

**107. 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 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 will continue to conduct regular internal exercises to test operational arrangements;
- Support Member State requests for Agency participation in national and/or specific exercises organized by Member States; and
- Conduct a full-scale ConvEx-3 exercise with an exercise scenario hosted by the United Arab Emirates.

## **E. Improving Management of the Safety and Security Interface**

### **Trends**

108. 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 security are different.

109. 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.

110. INSAG and the Advisory Group on Nuclear Security also highlighted the importance of the safety and security interface. Currently they are working on a joint publication on this topic.

### **Related Activities**

***111. 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 security are different. The Agency is planning to undertake the following activities:***

- Continue to support Member States in managing the interface between nuclear safety and security for nuclear installations by developing new guidance, revising relevant safety standards and holding training activities;
- Continue the development of TECDOCs on interfaces, including one on the interface between transport safety and transport security. This will be a priority for the Agency. A module on this subject will also be developed and uploaded to the e-learning transport safety platform; and
- Provide training on the implementation of the new Technical Report Series publication on notification, authorization, inspection and regulatory enforcement for the safety and security of radioactive sources.

## **F. Strengthening Civil Liability for Nuclear Damage**

### **Trends**

112. 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.<sup>6</sup>

113. 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

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<sup>6</sup> See preambular paragraph (qq) of resolution GC(64)/RES/9 adopted by the General Conference in September 2020.

the achievement of a global nuclear liability regime that were adopted by the Agency's International Expert Group on Nuclear Liability (INLEX) in response to the IAEA Action Plan on Nuclear Safety<sup>7</sup>.

#### **Related Activities**

***114. 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 all international nuclear liability instruments, taking into account the recommendations adopted by INLEX in 2012. The Agency is planning to undertake the following activities:***

- Organize the next meeting of INLEX in 2021, which will be preceded by a workshop for diplomats on nuclear liability;
- With the support of INLEX, organize a sub-regional workshop on civil liability for nuclear damage for Member States in Asia and undertake such other outreach activities that may be requested by individual Member States;
- Following a request from the Contracting Parties to the Convention on Supplementary Compensation for Nuclear Damage (CSC), act as the Secretariat of the CSC by hosting future meetings of the CSC Contracting Parties and Signatories; and
- Continue to support Member States, upon request, in adopting or revising national legislation on civil liability for nuclear damage, in the context of its legislative assistance programme.

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<sup>7</sup> See operative paragraph 32 of part 2 of resolution GC(64)/RES/9. The text of the INLEX recommendations is available at: <https://www.iaea.org/sites/default/files/17/11/actionplan-nuclear-liability.pdf>. The IAEA Action Plan on Nuclear Safety is contained in document GOV/2011/59-GC(55)/14.



# Appendix A

## Agency Activities in 2020

### A. General Safety Areas

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

1. The Agency issued one General Safety Guide and nine Specific Safety Guides. Further details can be found in Appendix B.
2. The Agency included all new safety standards and nuclear security guidance publications in the Nuclear Safety and Security Online User Interface (NSS-OUI) platform. This platform was also used to develop a strategic plan for the revision of Safety Guides on the safety of nuclear fuel cycle facilities.
3. Although the Agency's peer review and advisory services continued to be provided upon request, many were postponed due to COVID-19 measures. The Agency conducted 15 peer review and advisory services across all safety areas (Figure A). Forty-five peer review and advisory services have been postponed due to the COVID-19 pandemic travel restrictions.

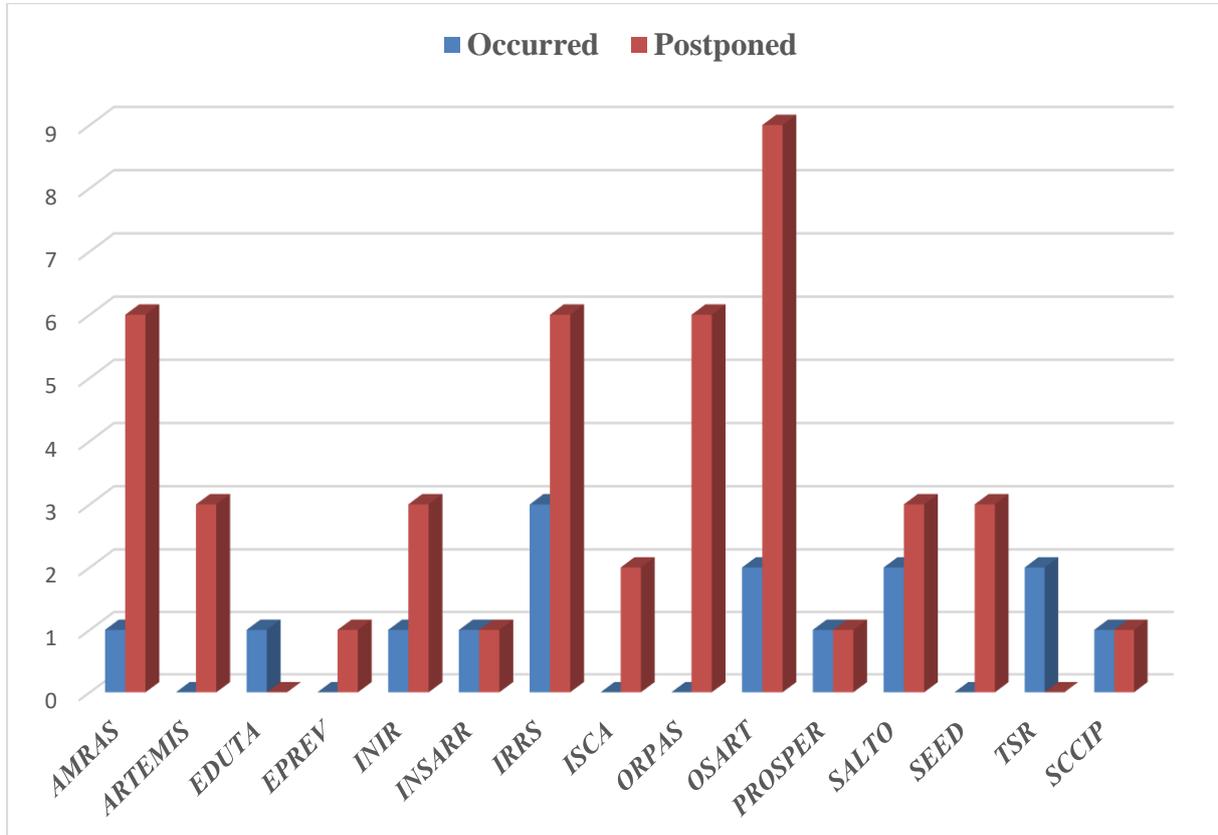


Fig. A. Number of peer review and advisory services conducted in 2020 and postponed from 2020.

4. The Agency has continued to strengthen its peer review and advisory services and self-assessment tools by incorporating lessons learned from their implementation and to share, as appropriate, the relevant information with Member States. In particular, based on the lessons from the first Integrated Regulatory Review Service–Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (IRRS–ARTEMIS) combined mission, guidance has been finalized to support efficient implementation of future IRRS–ARTEMIS combined missions. The Agency also held a virtual Technical Meeting in November 2020 to assess the Self-Assessment of Regulatory Infrastructure for Safety (SARIS) online system.

5. A working group was established in 2020 to take forward the lessons learned from previous IRRS missions, which comprised in their scope the Tailored Module for Embarking Countries on Nuclear Power Programmes, performed in line with IAEA Specific Safety Guide No. SSG-16 (Rev. 1) *Establishing the Safety Infrastructure for a Nuclear Power Programme*. From the analysis of experiences gained from missions, guidance for the IRRS Tailored Module was developed to improve the effectiveness of its implementation. This guidance will be considered when revising *Integrated Regulatory Review Service Guidelines* (IAEA Services Series No. 37). In parallel, the group revised the question sets of the Integrated Review of Infrastructure for Safety (IRIS) tool based on SSG-16 (Rev. 1).

6. Actions to further increase the effectiveness of the Emergency Preparedness Review (EPREV) were developed based on the conclusions of the Technical Meeting on “20 Years of EPREV: Building on Two Decades of Experience” held in 2019. Several actions have already been implemented in the Emergency Preparedness and Response Information Management System (EPRIMS) 3.0 release, which included improved features for self-assessment and the possibility for incorporation of EPREV mission reports. Other actions included development of a database to collect EPREV findings and development of e-learning for training of experts participating in EPREV missions.

7. The Agency drafted guidelines to perform the new Advisory Missions on Regulatory Infrastructure for Radiation Safety and Security of Radioactive Material (RISS). These include a pre-mission questionnaire for counterparts as well as a template for the mission report.

8. The Agency has enhanced the Global Safety Assessment Network to provide Member States with detailed information on safety assessment and design safety programmatic activities, such as peer reviews, workshops, Technical Meetings, and training.

## **A.2. International Safety Conventions**

9. The Agency facilitated a meeting for the Officers of the Eighth Review Meeting of the Convention on Nuclear Safety (CNS) in February 2020 to consider the overall approach and final preparations for the 8th Review Meeting, initially scheduled for March – April 2020. However, due to the COVID-19 pandemic travel restrictions and after intense consultations the Review Meeting was postponed.

10. The Agency held one workshop on the promotion of the CNS for the regulatory body of Uzbekistan in January 2020 in Tashkent. Furthermore, the Agency held a workshop for Permanent Mission Representatives on the CNS in November 2020 in Vienna. The Agency also held a virtual educational workshop on the CNS for countries without nuclear power reactors in December 2020.

11. In 2020, the preparation for the 7th 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 was impacted by the COVID-19 pandemic. The Organizational Meeting for the Seventh Review Meeting of the Contracting Parties to the Joint Convention was postponed and successfully organized, as a virtual meeting in September–October 2020. In addition, the Seventh Review Meeting of the Joint Convention was also postponed.

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

12. The Agency conducted two virtual interregional workshops aimed at training Radiation Safety Information Management System (RASIMS) national coordinators on the use of the new RASIMS 2 in 2020. As of the end of 2020, 87% of nationally appointed RASIMS coordinators had been trained to use the new platform.

13. The Agency created a dedicated area on the Cyber Learning Platform for Network Education and Training (CLP4NET) e-learning platform to host materials from the virtual School for Drafting Regulations, including training materials and technical documentation. However, the School for drafting regulations related to nuclear safety was postponed due to the COVID-19 pandemic travel restrictions.

14. The Agency held a virtual Technical Meeting on Next Generation Reactors and Emergency Preparedness and Response (EPR) in September–October 2020. The meeting discussed different elements relevant to the definition of EPR arrangements for small and medium sized or modular reactors (SMRs).

15. The Agency performed a survey in April 2020 with regulatory bodies in Member States to capture an overview of the impact of the COVID-19 pandemic on regulatory activities for the safety of radiation sources; to better understand Member State challenges and needs; to get feedback on any impact on the Agency safety standards; and to collect notable practices and lessons learned, where applicable. The survey was well received by Member States, with more than 120 regulatory bodies responding. The report was made public on the Agency website and has also been discussed during regional webinars with more than 300 representatives of the responding regulatory bodies.

16. The Regulatory Cooperation Forum (RCF) launched the 2020–2024 RCF Strategic Plan to address common challenges in developing a regulatory framework for countries introducing or expanding their nuclear power programmes. The Strategic Plan was promoted during the virtual RCF annual plenary meeting in September 2020.

17. The Agency is finalizing a Technical Document (TECDOC) to provide guidance on the application of a graded approach in the regulation of nuclear installations. The publication includes guidance on proposed methodologies that promote a systematic and consistent application of a graded approach by regulators as well as numerous case studies of how Member States apply a graded approach in the regulation of nuclear installations.

18. The Agency drafted a TECDOC to provide guidance on the application of a graded approach in the regulation for the safety of radiation sources. The publication includes guidance on proposed methodologies that promote a systematic and consistent approach to regulation in accordance with the Agency safety standards as well as case studies of how Member States apply a graded approach in their regulatory control for radiation safety.

19. The Agency published *Effective Management of Regulatory Experience for Safety* (IAEA TECDOC-1899) and organized a virtual Technical Meeting on the subject in October 2020.

20. The Agency organized a CANDU Senior Regulators' Meeting in November 2020 to share operating and regulatory experience of CANDU type reactors.

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

21. The Agency held a virtual national workshop on communication and consultation with interested parties in July to assist Member States in developing their communication strategies.

22. The Agency published *Safety Culture Practices for the Regulatory Body* (IAEA TECDOC No. 1895) in January 2020.
23. The Agency held the International School of Nuclear and Radiological Leadership for Safety in Tokyo in February 2020 and also conducted two virtual training activities to assist Member States in strengthening leadership, safety management and safety culture for nuclear facilities and regulatory bodies in September and December 2020.
24. The Agency conducted two virtual expert missions on reviewing the regulatory body's Integrated Management System in Egypt in June 2020 and South Africa in October 2020.
25. The Agency conducted one Safety Culture Continuous Improvement Process follow-up mission to six Russian NPPs in August 2020.
26. The Agency held three virtual consultancy meetings for the development of a Safety Guide on leadership and management for safety in June, October, and December 2020. The expected publication date of the Safety Guide is 2022.
27. The Agency continued its support to professional networks and communities of practice through the Global Nuclear Safety and Security Network (GNSSN) and IAEA CONNECT platforms, facilitating information exchange among Member States while providing access to the topical repositories of various materials and publications.

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

28. The Agency held two instances of the Postgraduate Educational Course (PGEC) in Radiation Protection and the Safety of Radiation Sources in November at the Agency-affiliated regional training centres in Africa. The course in Ghana was held in English and the one in Morocco in French. The Agency also held a workshop to train PGEC lecturers on the use of e-learning tools for the Regional Training Centre of Argentina in March 2020. In addition, the Agency held two online workshops to strengthen pedagogical and e-learning skills of PGEC lecturers of the Regional Training Centre of Malaysia.
29. The Agency conducted an Education and Training Appraisal (EduTA) mission to assess national education and training provisions in radiation protection and safety in Jordan in October 2020. This was the first EduTA mission organized with the extensive use of online tools.
30. The Agency continued implementing the Strategic Approach to Education and Training in Nuclear Safety 2013–2020 and developed and finalized progress indicators and a methodology for monitoring and assessing the status of its implementation. The progress indicators are now accessible online for convenience of evaluation. The Agency also developed the Strategic Approach to Building and Sustaining Capacity in Nuclear Safety for the period 2021–2030.
31. The Agency conducted a virtual consultancy meeting in June 2020 with external experts from the French Institute for Radiological Protection and Nuclear Safety (IRSN) and the German Installation and Reactor Safety Company (GRS) to analyse feedback received on the technical support organization (TSO) self-assessment methodology from a national TSO workshop held in 2019.
32. The Agency organized three regional activities for the Asian Nuclear Safety Network (ANSN) membership and held two consultancy meetings to evaluate ANSN activities implemented in 2018–2020 and develop the ANSN activity plan for the next three years. Based on the evaluation results and the proposals for new activities, the Agency developed the ANSN Activity Plan for 2021–2023.

33. The Agency organized two Steering Committee meetings of the European and Central Asian Safety Network (EuCAS) as virtual events in August and November 2020. The terms of reference for EuCAS working groups are under development as determined by the Steering Committee meetings.

34. The Agency conducted a virtual workshop on regulatory review, assessment, and inspection of research reactors in October 2020 for the exchange of information between Arab Network of Nuclear Regulators members and African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology members.

35. The Agency extended the Practical Arrangements between the IAEA and the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO) on Cooperation in the Areas of Nuclear and Radiation Safety, Emergency Preparedness and Response and Nuclear Security in July 2020. The Agency also participated in the FORO's Executive Technical Committee meetings held virtually in July and November, and in the FORO side event "Enhancing nuclear safety and security through regional and international cooperation: Outcomes and news from the Ibero-American Forum of Radiological and Nuclear Regulatory Agencies – FORO" organized during the General Conference.

36. A new term of the GNSSN Steering Committee was established, consisting of 29 members representing 23 countries and 3 international organizations and industry groups. The Agency held two virtual GNSSN Steering Committee meetings to review the terms of reference and strategic plan as well as a virtual meeting with regional and thematic network leadership to solicit input on future priorities.

37. The Agency held a National Workshop on Safety Principles and Safety Requirements Applicable in the Design of NPPs in Jakarta in February 2020 where participants discussed the latest Agency safety principles and safety requirements and their applicability in the design of new NPPs.

38. The annual meeting of the International Network for Education and Training for Emergency Preparedness and Response (iNET-EPR) was postponed to 2021, due to the COVID-19 pandemic travel restrictions. However, the Agency conducted several activities virtually allowing for significant progress in the development of initiatives by iNET-EPR working groups. To date, 180 entities from 69 Member States have registered as points of contact in the iNET-EPR network.

## **A.6. Research and Development for Safety**

39. The Agency held the first preparatory meeting virtually in November for the CRP on Developing a Phenomena Identification and Ranking Table (PIRT) and a Validation Matrix, and Performing a Benchmark for In-Vessel Melt Retention.

40. The Agency issued *Passive Shutdown Systems for Fast Neutron Reactors* (IAEA Nuclear Energy Series No. NR-T-1.16) in May 2020, in which past experience and state-of-the-art technologies related to passive shutdown systems for liquid metal and gas cooled fast reactors are presented.

41. The Agency launched a new CRP on Testing and Simulation for Advanced Technology and Accident Tolerant Fuels (ATF-TS) in April 2020 to support interested Member States in their efforts to design and develop ATF-TS for light water reactors to enhance the safety and sustainability of nuclear power. The Agency also initiated activities on the development of detailed technical documentation on the applicability of Agency safety standards to accident tolerant fuels.

42. The Agency made significant progress in the development of a new Safety Guide on assessment of the application of general requirements for design of NPPs in support of the practical implementation of the Agency's updated safety standards. The Agency also continued the development of detailed technical documentation with respect to advanced NPP designs addressing, inter alia, design extension conditions' analysis, application of general requirements for design of NPPs, and equipment qualification for severe accident conditions.

43. The Agency initiated a high-level mapping of the applicability of Agency safety standards to SMRs and identification of gaps for future developments towards the technology neutral nuclear safety, legislative and regulatory framework.

44. The Agency published *Fuel Modelling in Accident Conditions (FUMAC)* (IAEA TECDOC No. 1889) in December 2019, summarizing the research undertaken during the CRP on fuel behaviour in accident conditions, with a focus on loss of coolant accidents. The Agency also published *Analysis of Options and Experimental Examination of Fuels for Water Cooled Reactors with Increased Accident Tolerance (ACTOF)* (IAEA TECDOC No. 1921) in July 2020, compiling experimental data on new fuel types and cladding materials, and assessing modelling code capacity to predict the behaviour of the components and the integral performance of accident tolerant fuel designs under normal and transient conditions.

45. The Agency held a virtual Research Coordination Meeting for the CRP on the Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment in August 2020. Due to COVID-19 pandemic related constraints, the CRP was extended such that the final products of the research conducted will be shared in 2021.

46. The first Research Coordination Meeting of the CRP on the Effective Use of Dose Projection Tools in the Preparedness and Response to Nuclear and Radiological Emergencies was held in January 2020 in Vienna. Participating institutes presented their programme of work and an action plan with common activities to be conducted was adopted. The first Research Coordination Meeting of the CRP on Effective Public Emergency Communication in a Misinformation Environment will be scheduled for 2021.

## **B. Strengthening Radiation, Transport and Waste Safety**

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

47. The Agency contributed to the information overview prepared by the Inter-Agency Committee on Radiation Safety on managing exposure due to radon at home and at work in July 2020.

48. The Agency continued to develop the Radiation Safety Compass Digital Platform. The Digital Platform covers a diverse range of radiation safety topics from radiation basics to radiation protection of the public and the environment. Regulatory bodies and other interested stakeholders, such as licensees, operators, and the radiation protection community in general are able to use the Digital Platform to train staff.

49. The Agency held 18 webinars on radiation safety addressing patient protection, occupational radiation protection, radon, non-medical human imaging, food and drinking water, and consumer products in collaboration with professional societies and international organizations. In reaction to specific work conditions and limited possibilities to organize a number of face-to-face events, the Agency organized a series of webinars bringing together leading experts to share knowledge and expertise, strengthening radiation protection efforts, and ensuring continuity of all services important for radiation protection. Of almost 4000 registered participants in 2020, more than 2600 from 111 Member States attended the live sessions and the rest were able to watch the recorded webinars.

50. The Agency organized the virtual International Conference on Radiation Safety: Improving Radiation Protection in Practice in November 2020 in cooperation with the European Commission, the

Food and Agriculture Organization of the United Nations, the International Labour Organization, the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), the Pan American Health Organization, the United Nations Environment Programme and the World Health Organization. This conference took stock of the worldwide radiation safety situation, in particular, the lessons learned from applying GSR Part 3 and improvements to be considered to further facilitate its application.

51. The Agency launched a module on safety in radionuclide therapy procedures in the integrated voluntary reporting and learning system Safety in Radiation Oncology (SAFRON) in January 2020. The Agency also initiated the development of a new training package on safety culture in medicine in February 2020 and developed six e-learning courses on radiation protection in medical uses.

52. The Agency held a virtual Technical Meeting on the Justification and Optimization of Protection of Patients Requiring Multiple Imaging Procedures in October 2020 to review the latest data on patient exposure from recurrent radiological imaging and agree on a joint position statement and a call for action.

53. The Agency contributed to the preparation of a position statement of the Inter-Agency Committee on Radiation Safety (IACRS) on managing exposure due to radon at home and at work. This document summarized the IACRS's understanding of strategies for the use of a new dose conversion factor for occupational exposure to radon as recommended by the International Commission on Radiological Protection (ICRP). A report by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) on lung cancer from exposure to radon confirms that the previous assessment of lung cancer risk due to radon is still compatible with the evidence reviewed by its experts and does not require any change in the established dose conversion factor.

54. The Agency continued work to produce a TECDOC on exposure due to radionuclides in food other than during a nuclear or radiological emergency. The Agency also developed a discussion document on radioactivity in feed, food and drinking-water in non-emergency situations at the request of the Codex Committee on Contaminants in Food.

55. The Agency published *Occupational Radiation Protection Appraisal Service (ORPAS) Guidelines* (IAEA Services Series No. 43) based on the experiences and lessons learned from past missions in September 2020. The Agency also continued the development of a global survey of the Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR): Industrial Radiography and published, for the first time, its annual report.

56. The Agency developed a new dose management system for the use of individual monitoring services in Member States and released it in July 2020 through the Occupational Radiation Protection Networks (ORPNET) web-platform. The Agency also completed the development of a TECDOC on assessment of prospective cancer risks due to occupational exposure to ionizing radiation that presents a methodological framework for the assessment of prospective risks of cancer incidence potentially incurred by workers from occupational exposure to radiation, provides assistance in managerial decisions on constraining or controlling exposure, and facilitates the implementation of occupational radiation protection programmes.

57. The Agency extended the coverage of industry specific safety reports addressing industrial processes involving naturally occurring radioactive material for the realistic assessment of radiological impact and published *Occupational Radiation Protection in the Uranium Mining and Processing Industry* (Safety Report Series No. 100) in April 2020. A training package based on the Safety Report was made available in English and Russian on the ORPNET web-platform.

58. The Agency is consolidating the output from the Modelling and Data for Radiological Impact Assessments (MODARIA II) programme and is publishing the content in an external journal to obtain a wider audience in Member States.

## **B.2. Control of Radiation Sources**

59. The Agency is developing an aiding document on financial provisions to ensure safe management and secure protection of radioactive sources once they become disused to address Member State requests for more detailed guidance on the application of the financial guarantee provision of the Code of Conduct on the Safety and Security of Radioactive Sources.

60. The Agency held a meeting with the developer of RAIS+ to discuss progress achieved and a way forward to improve the system development process. Four Member States received RAIS 3.4 web servers. RAIS training, which included assistance via videoconferencing platforms to Member States in the Caribbean region, continued in 2020.

61. The Agency developed and launched the Scrap Metal Tool Kit, a collaboration platform for information exchange relating to the control of radioactive material inadvertently incorporated into scrap metal and semi-finished products of the metal recycling industries. The Agency simultaneously launched a supporting e-learning course on the control of radioactive material inadvertently incorporated into scrap metal.

## **B.3. Safe Transport of Radioactive Material**

62. The Agency launched version 2 of Modules 0–4 of the Transport Safety e-Learning platform, to reflect *Regulations for the Safe Transport of Radioactive Material* (IAEA Safety Standards Series No. SSR-6 (Rev.1)) in October 2020.

63. The Agency continued its preparations to convene the rescheduled International Conference on the Safe and Secure Transport of Nuclear and Radioactive Materials in 2021.

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

64. The Agency began the process to produce two new Safety Guides on national policies and strategies for the safety of radioactive waste and spent fuel management, decommissioning and remediation, and on the application of the concept of clearance.

65. The Agency held the Second Technical Meeting of the International Project on Decommissioning of Small Facilities in Vienna in February 2020 and the Third Technical Meeting of the International Project on Completion of Decommissioning virtually in October 2020.

## **B.5. Radiation Protection of the Environment and Remediation**

66. The Agency started work on drafting a report to provide support to regulators in the assessment and approval of remediation strategies for uranium legacy sites. In addition, the Agency continued to develop a Safety Report on a methodology for the assessment of the impact of radioactive discharges to the environment, which now includes a methodology for assessing radiological impacts to animals and plants. The Agency is also developing a Safety Report on living and working in contaminated areas.

67. The Agency continued to support the activities of the Coordination Group for Uranium Legacy Sites (CGULS) whose annual meeting was held virtually in November 2020. The meeting focused on information exchange and remediation project updates. Activities of the International Working Forum on Regulatory Supervision of Legacy Sites were postponed due to the COVID-19 pandemic travel restrictions.

68. The Agency is currently updating the Strategic Master Plan for Environmental Remediation of Uranium Legacy Sites in Central Asia, which is just one of the international instruments of assistance in this area. Central Asia Member States and international organizations participating in CGULS are being consulted and have provided up to date information on the commencement of remediation of the uranium legacy sites in Kyrgyzstan and on progress towards establishing the necessary mechanisms to remediate the legacy sites in Tajikistan and Uzbekistan.

69. The Agency is developing a new programme to replace MODARIA, which addresses key overarching topics on the assessment of radiation doses to the public and the environment from radionuclide releases.

## **C. Strengthening Safety in Nuclear Installations**

### **C.1. Nuclear Power Plant Safety**

#### **C.1.1. Operational Safety**

70. The Agency held a Technical Meeting on the Use of PSR in Support of long term operation (LTO) in Vienna in February 2020. In addition, the Agency held a virtual Technical Meeting of the International Generic Ageing Lessons Learned (IGALL) Steering Committee in December 2020. The Agency also held nine workshops and eight IGALL meetings to support operators, regulators, and other organizations in ageing management and LTO.

71. The Agency published on *Ageing Management for Nuclear Power Plants: International Generic Ageing Lessons Learned (IGALL)* (Safety Report Series No.82 (Rev. 1)) in September 2020.

72. The Agency held a virtual Technical Meeting of the International Reporting System for Operating Experience National Coordinators (co-organized with the OECD/ NEA) to share operating experience from significant events through the International Reporting System for Operating Experience.

73. The seventh edition of the joint IAEA/NEA publication *Nuclear Power Plant Operation Experience* was published in April 2020, providing an overview of lessons learned by operators during the 2015–2017 period.

#### **C.1.2. Site and Design Safety**

74. The Agency held a Technical Meeting on Safety Aspects of Using Smart Digital Devices in Nuclear Systems in Vienna in February 2020, which addressed specific safety aspects and design criteria considered for application of smart devices in nuclear systems and provided valuable comments for a draft Agency publication.

75. The Agency held a virtual Technical Meeting on the Application of the New IAEA Principles for Design Safety of New Nuclear Power Plants in September 2020 to provide a platform to Member States to share their national practices in the implementation of IAEA Safety Standards Series No. SSR-2/1 (Rev. 1) and supporting Safety Guides in the design and licensing of new nuclear power plants. The Agency also held a virtual Technical Meeting on the Enhancement of Methods, Approaches and Tools for Development and Application of Probabilistic Safety Assessments in September–October 2020.

76. The Agency published *Experiences in Implementing Safety Improvements at Existing Nuclear Power Plants* (IAEA TECDOC No. 1894) in January 2020 and *Seismic Isolation Systems for Nuclear Installations* (IAEA TECDOC No. 1905), *In-vessel Melt Retention and Ex-vessel Corium Colling*

(IAEA TECDOC No. 1906) and *Considerations on Performing Integrated Risk Informed Decision Making* (IAEA TECDOC No. 1909) in May 2020.

77. The Agency assisted Member States embarking on nuclear power programmes in developing a regulatory framework for siting and site evaluation through the Integrated Work Plan (IWP) process. The Agency also held virtual advisory services in the area of site safety for Egypt, Jordan, Poland, and Uzbekistan.

78. The Agency assisted Romania during a Site and External Events Design (SEED) related expert mission on design and qualification to external hazards of an on-site emergency control centre at the Cernavodă NPP, Romania. The Agency also held a SEED national workshop for Israel.

79. The Agency completed a Technical Safety Review (TSR) National Safety Requirements peer review service on draft Nigerian regulations on design and construction, commissioning, safety of operation, and decommissioning of nuclear power plants.

80. The Agency published *Methodologies for Seismic Safety Evaluation of Existing Nuclear Installations* (Safety Report Series No. 103) in August 2020 and is developing a Safety Report on multi-unit probabilistic safety assessment, consideration of external hazards in probabilistic safety assessment for single unit and multi-unit nuclear power plants.

81. The Agency held a virtual Technical Meeting on Protection of Nuclear Installations Against External Hazards in November 2020.

82. The following Safety Guides were submitted for publication: *Design of Nuclear Installations Against External Events Excluding Earthquakes*; *Seismic Design of Nuclear Installations*; and *Seismic Hazards in Site Evaluation for Nuclear Installations*.

83. The Agency initiated the development of a TECDOC on the safety assessment of nuclear installations against combination of external hazards.

### **C.1.3. Severe Accident Prevention and Mitigation**

84. The Agency held a virtual Technical Meeting on Accident Management for Advanced Reactors in September 2020 where participants discussed the applicability of *Accident Management Programmes for Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-54) to advanced reactor designs, either water or non-water cooled.

85. The Agency updated the Severe Accident Management Guideline Development (SAMG-D) Toolkit to incorporate updated Agency safety standards and the latest developments in severe accident management. The Agency also held a virtual Training Workshop on the Development of Severe Accident Management Guidelines Using the IAEA's Severe Accident Management Guideline Development Toolkit in October 2020.

86. The Agency conducted a virtual consultancy meeting in May 2020 to develop prognosis components of the Reactor Assessment Tool (RAT) for specific types of nuclear power reactors. The Agency also conducted a virtual consultancy meeting in April 2020 to draft specifications for the development of an Agency database of source terms.

87. The Agency used technical cooperation implementation mechanisms to promote and support capacity building and national human resource development in the area of simulation and modelling of severe accidents in water cooled reactors through the SAMG-D Toolkit and dedicated workshops.

## **C.2. Safety of Small and Medium Sized or Modular Reactors**

88. The Agency developed a draft publication related to the applicability of design safety requirements to SMR technologies intended for near-term deployment and continued developing publications related to safety assessment and analysis of SMRs and the approach and methodology for the development of regulatory safety requirements for the design of SMRs.

89. The Agency initiated the development of a Safety Report to provide a roadmap for the application of Agency safety standards as part of a technology neutral safety and regulatory framework to SMRs. The Agency also held a Technical Meeting on the Application of the Milestones Approach and Evaluation of the Status of National Nuclear Infrastructure in the case of SMR deployment.

90. The Agency continued developing publications collecting experiences from Member States in the safety assessment and design of SMRs in support of the strengthening of international capability on SMR safety assessment.

91. The Small Modular Reactor Regulators Forum completed its second technical report on SMRs, covering the areas of licensing, design and safety assessment, and maintenance/commissioning and operations. The Forum also started work on its third phase with a focus on regulatory cooperation on SMRs.

## **C.3. Research Reactor Safety**

92. The Agency drafted two Safety Guides (*Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report* (IAEA Safety Standard Series No. SSG-20 (Rev. 1)) and *Safety in the Utilization and Modification of Research Reactors* (IAEA Safety Standard Series No. SSG-24 (Rev. 1))) to reflect feedback from Member States and the revision of the Safety Requirements.

93. The Agency provided further guidance on the implementation of the Code of Conduct on the Safety of Research Reactors. The Agency issued *Reliability Data for Research Reactor Probabilistic Safety Assessment* (IAEA TECDOC No. 1922). In addition, the Agency published *Periodic Safety Review for Research Reactors* (Safety Report Series No. 99) to provide guidance and examples on this process.

94. The Agency held a virtual workshop on periodic safety review (PSRs) in November 2020. The Agency also held a virtual workshop on the regulatory review and assessment and inspection of research reactors in Rabat October 2020.

95. The Agency held the 8th Annual Meeting of the Regional Advisory Safety Committee for Research Reactors in Asia and the Pacific virtually in November–December 2020.

## **C.4. Fuel Cycle Facility Safety**

96. The Agency held a virtual Technical Meeting on Regulatory Supervision of Nuclear Fuel Cycle Facilities in November 2020.

97. The Agency held a virtual Technical Meeting for National Coordinators of the Fuel Incident Notification and Analysis System (FINAS) in October 2020 where participants discussed important lessons learned from events reported to FINAS and shared their views on further enhancement of operating experience effectiveness through FINAS. The Agency also finalized a new publication covering the feedback from operating experience of nuclear fuel cycle facilities since the establishment of FINAS.

98. The Agency is in the process of revising three Safety Guides (*Safety of Conversion Facilities and Uranium Enrichment Facilities* (IAEA Safety Standards Series No. SSG-5), *Safety of Uranium Fuel*

*Fabrication Facilities* (IAEA Safety Standards Series No. SSG-6), and *Safety of Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities* (IAEA Safety Standards Series No. SSG-7)) to reflect challenges faced by Member States and reflect the requirements of *Safety of Nuclear Fuel Cycle Facilities* (IAEA Safety Standards No. SSR-4). The Agency also published a Safety Report in April 2020 providing information on methods and practices for performing safety analysis and preparing licensing documentation for nuclear fuel cycle facilities.

## **C.5. Safety Infrastructure for Embarking Countries**

### **C.5.1. Nuclear Power Programmes**

99. The Agency continued to apply the IWP process to 17 Member States in different phases of their nuclear power programmes.

100. The Agency held a virtual Technical Meeting on the Implementation of the IAEA's Self-Assessment Methodology and Tools in November 2020 to exchange views on the latest developments of the SARIS-IRIS online self-assessment tool.

101. The Agency held a Technical Meeting on Current Practices in Performing Comprehensive Evaluations of Safety and Periodic Safety Reviews of Nuclear Power Plants in Vienna in February 2020 where participants were encouraged to request the TSR-PSR peer review service through detailed presentation of the process and discussions of benefits with meeting participants.

102. The Agency participated in an independent review of the management system of EUAS International ICC, Turkey, in October 2020. The main outputs were an evaluation of the company management system including conformance with Agency safety standards and advice on leadership and management for safety improvements.

103. The Agency conducted an Integrated Nuclear Infrastructure Review (INIR) phase 3 mission to Belarus in March 2020. This was followed by two consultancy meetings to incorporate the lessons learned from the two pilot missions resulting in the revision of *Evaluation of the Status of National Nuclear Infrastructure Development* (IAEA Nuclear Energy Series No. NG-T-3.2 (Rev.1), 2016).

104. The Agency continued its review of *Considerations in Emergency Preparedness and Response for a State Embarking on a Nuclear Power Programme* (EPR Embarking 2012) taking into account feedback from Member States.

### **C.5.2. Research Reactors Programme**

105. The Agency implemented a virtual expert mission to the Saudi Arabia low power research reactor in November–December 2020. In addition, virtual meetings were held with: Thailand in September 2020 on safety requirements and licensing of a new 45 kW research reactor; Algeria in July–August 2020 on preparation for the safety review of modifications of the NUR research reactor; and the Democratic Republic of the Congo in October 2020 on safety aspects of operation of a TRICO Mark II research reactor after a long period of shutdown.

106. Although the Agency had organized three missions in support of the establishment of national safety infrastructure for licensing and construction of a new research reactor, and the commissioning of a new research reactors, these were postponed due to the COVID-19 pandemic travel restrictions.

## **D. Strengthening Emergency Preparedness and Response**

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

107. The Agency held the Tenth Meeting of the Representatives of Competent Authorities identified under the Early Notification Convention and the Assistance Convention virtually in June 2020. The meeting adopted nine conclusions with 22 associated actions for the Secretariat and Member States.

108. Following an explosion in the Beirut port, the IAEA responded to the Lebanese Republic's request for assistance through its Response and Assistance Network (RANET). The IAEA deployed an Assistance Mission in September 2020 conducted under pandemic conditions by IAEA, Danish and French experts, who confirmed the radiation safety and security of radioactive sources in hospitals in Beirut and checked that no hazard was presented by materials containing naturally occurring radionuclides that are stored at the Beirut port. The mission experts strictly followed the IAEA's and the Lebanese authorities' health and safety regulations to prevent the spread of COVID. In addition, environmental samples collected by the Lebanese Republic and analysed at laboratories in France (IRSN) and Switzerland (Spiez Laboratory) confirmed that they did not contain elevated radiation levels. Information has been provided to the Agency's Board of Governors within document GOV/INF/2020/14.

109. The Agency held a virtual national workshop on EPR in Ukraine in April 2020 to enhance knowledge on how to prepare and conduct EPR activities. In addition, the Agency conducted 49 webinars on specific details of the international arrangements to implement the Early Notification and Assistance Conventions.

110. The Agency conducted one ConvEx-2e exercise during which an initial statement and a detailed public statement were published, based on information provided by the Accident State, the Agency's Status Summary report, and the output of the Agency's assessment and prognosis process. The Agency also conducted a ConvEx-2c exercise in December 2020 based on a national exercise hosted by Finland and a ConvEx-2f exercise in December 2020 with the involvement of the public information officers of Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE) participating organizations.

111. The Agency updated the USIE website in accordance with the *Operations Manual for Incident and Emergency Communication* (EPR-IEComm 2019) and compiled a list of features to be made more user-friendly for using USIE on mobile devices. The Agency also developed and implemented prognosis workflows in all the NPP modules of the RAT on the Agency's assessment and prognosis tools website and added new functionalities, such as the management of air concentration data and a larger choice of radionuclides on the Agency's International Radiation Monitoring Information System (IRMIS) website.

### **D.2. Harmonization of Arrangements for Preparedness and Response**

112. The Agency, in the framework of the Emergency Preparedness Response Standards Committee identified priorities to develop additional guidance to support Member States in further aligning their national EPR arrangements with GSR Part 7.

113. *Arrangements for Public Communication in Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSG-14), which was jointly co-sponsored by six international intergovernmental organizations and is the first Agency safety standard to address communication with the public during a nuclear or radiological emergency, was published. A virtual

Technical Meeting was also held to discuss draft revisions to *Arrangements for Preparedness for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GS-G-2.1) with Member States.

114. The Agency, responding to the growing interest in EPR guidance for new reactors, organized a virtual Technical Meeting on Next Generation Reactors and EPR in September–October 2020.

115. The Agency held a total of 10 training events at the regional and interregional levels and 11 events at the national level relating to EPR.

116. The Agency held a virtual regional meeting that endorsed the Guidelines for Cooperation in Preparedness and Response to Nuclear or Radiological Emergencies in Coastal Ports and at Sea in the Mediterranean Region in October 2020.

117. The RANET Joint Assistance Team exercise that was planned to be conducted in the Fukushima Prefecture in Japan was conducted as a virtual five-day tabletop exercise that included assessment and prognosis, the use of IRMIS, and aspects related to international assistance through the RANET mechanism.

### **D.3. Testing Readiness for Response**

118. The Agency conducted a ConvEx-2a exercise involving 55 Member States in May 2020. The Agency conducted a ConvEx-2b exercise involving 35 Member States and two Regional Specialized Meteorological Centres of the World Meteorological Organization in March 2020. The Agency also conducted a ConvEx-2c exercise in December 2020, ConvEx-2e exercises in August, November, and December 2020, a ConvEx-2f exercise in December 2020, and a ConvEx-2g exercise in October 2020.

119. The Agency performed quarterly emergency communication tests with the IAEA LEU Bank in Kazakhstan. The Agency also released a new USIE feature which allows USIE administrators to confirm or modify their data and settings directly in the website interface.

120. Five ConvEx-2e exercises were cancelled by Member States that initially requested the conduct of such exercises due to the COVID-19 pandemic.

121. The Agency participated in four virtual task group meetings under the IACRNE Working Group on Coordinated International Exercises for the preparation of the ConvEx-3 exercise to be hosted by the United Arab Emirates in 2021.

## **E. Improving Management of the Safety and Security Interface**

122. The Interface Group, composed of the Chairs of all safety standard and nuclear security guidance Review Committees, reviewed seven document preparation profiles in 2020 to confirm those proposed as interface publications. Four proposals were confirmed as being interface publications.

123. The meetings of the International Nuclear Safety Group (INSAG) and the meetings of the Advisory Group on Nuclear Security (AdSec) in 2020 included discussions on a joint publication regarding the safety and security interface. A draft publication has been developed jointly by INSAG and AdSec.

## **F. Strengthening Civil Liability for Nuclear Damage**

124. The 20th regular meeting of the International Expert Group on Nuclear Liability (INLEX) took place as a virtual meeting in June 2020 to hear about new developments and activities in the field of civil liability for nuclear damage and to discuss future outreach activities.

125. The Government of the United Arab Emirates hosted a Workshop on Civil Liability for Nuclear Damage for Newcomer Countries, in Abu Dhabi in March 2020. In October 2020, a virtual national seminar on civil liability for nuclear damage was held for officials of the Government of Pakistan. Both activities were conducted with the assistance of experts from INLEX.

126. In the context of the Agency's legislative assistance programme, assistance was provided to 11 Member States in the development of national legislation which also includes civil liability for nuclear damage.



## Appendix B

### *The Agency's Safety Standards Activities in 2020*

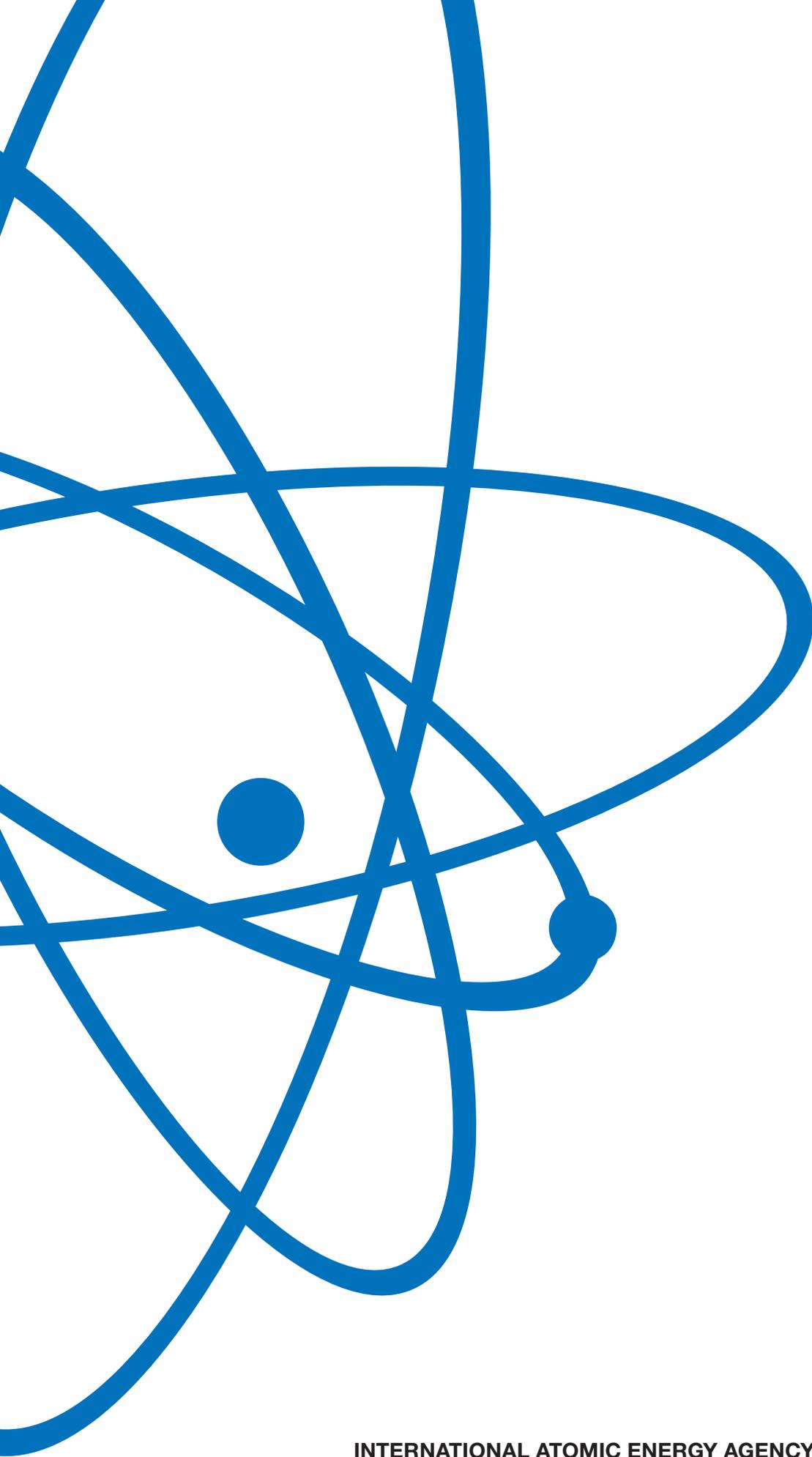
1. The Agency issued one General Safety Guide and nine Specific Safety Guides after endorsement by the Commission on Safety Standards (CSS):

- *Arrangements for Public Communication in Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSG-14);
- *Storage of Spent Nuclear Fuel* (IAEA Safety Standards Series No. SSG-15 (Rev. 1));
- *Establishing the Safety Infrastructure for a Nuclear Power Programme* (IAEA Safety Standards Series No. SSG-16 (Rev. 1));
- *Radiation Safety of X Ray Generators and Other Radiation Sources Used for Inspection Purposes and for Non-medical Human Imaging* (IAEA Safety Standards Series No. SSG-55);
- *Design of the Reactor Coolant System and Associated Systems for Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-56);
- *Radiation Safety in Well Logging* (IAEA Safety Standards Series No. SSG-57);
- *Radiation Safety in the Use of Nuclear Gauges* (IAEA Safety Standards Series No. SSG-58);
- *Radiation Safety of Accelerator Based Radioisotope Production Facilities* (IAEA Safety Standards Series No. SSG-59);
- *Design of Auxiliary Systems and Supporting Systems for Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-62); and
- *Design of Fuel Handling and Storage Systems for Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-63).

2. The CSS met twice in 2020. It endorsed for submission for publication the following draft Safety Guides:

- Remediation Strategy and Process for Areas Affected by Past Activities or Events (DS468);
- Leadership, Management and Culture for Safety in Radioactive Waste Management (DS477);
- Seismic Design of Nuclear Installations (DS490);
- Format and Content of the Package Design Safety Report for the Transport of Radioactive Material (DS493);
- Design of Nuclear Installations Against External Events Excluding Earthquakes (DS498);
- Seismic Hazards in Site Evaluation for Nuclear Installations (DS 507);

- Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report (DS510A);
  - Safety in the Utilization and Modification of Research Reactors (DS510B); and
  - Equipment Qualification for Nuclear Installations (DS514).
3. In 2020, the CSS also approved the following document preparation profiles for Safety Guides:
- Radiation Protection Programmes for the Transport of Radioactive Material, revision of TS-G-1.3. (DS521);
  - Chemistry Programme for Water Cooled Nuclear Power Plants, revision of SSG-13 (DS525);
  - National Policies and Strategies for the Safety of Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (DS526);
  - Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, revision of GSG-2 (DS527); and
  - Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants, revision of SSG-4 (DS528).
4. The CSS meetings in 2020, held virtually in June and November, were the first of its seventh term and the CSS discussed its recommendations for this new term.
5. The CSS considered experience from Member States in addressing challenges due to the COVID-19 pandemic and initiated a discussion on possible implications on the Agency's safety standards. A gap analysis exercise is underway to determine any necessary strengthening of safety standards in the light of the pandemic.
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 relationship search functionality of the platform was further enhanced in 2020. The platform contains information on the relationship between the publications and helps users to navigate from one publication to other relevant guidance and recommendations from other publications.
7. The IAEA Safety Glossary is available in a dedicated knowledge organization server and was used to tag the defined terms in the IAEA Safety Requirements with embedded links to the relevant glossary definitions. This web-based version of the IAEA Safety 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 series. The functionality ensures that any revision of Agency safety standards or part of the safety standards is justified by the above-mentioned feedback, therefore also ensuring stability of the parts of the standards that remain valid. The NSS-OUI platform will be further used for the systematic revision of Agency safety standards.



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