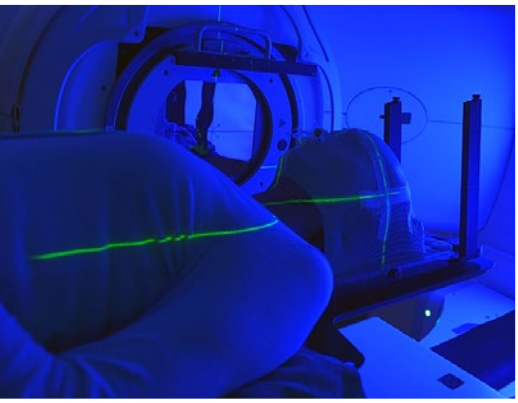
NUCLEAR SAFETY REVIEW 2017



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Nuclear Safety Review 2017

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Foreword

The *Nuclear Safety Review 2017* includes the global trends and the Agency's activities in 2016. It also presents priorities and related activities for 2017 and beyond, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety. The Appendix provides details on the activities of the Commission on Safety Standards and on other activities relevant to the Agency's safety standards.

A draft version of the *Nuclear Safety Review 2017* was submitted to the March 2017 session of the Board of Governors in document GOV/2017/3. The final version of the *Nuclear Safety Review 2017* was prepared in light of the discussions held during the Board of Governors and also of the comments received from the Member States.

Executive Overview

1. The *Nuclear Safety Review 2017* includes the global trends and the Agency's activities in 2016. It also presents priorities and related activities for 2017 and beyond, as identified by the Agency, for strengthening nuclear, radiation, transport and waste safety. The Executive Overview provides a summary of the trends, activities and priorities covered in this report. They include those related to general safety areas; radiation, transport and waste safety; safety in nuclear installations; emergency preparedness and response (EPR); management of the safety and security interface; and strengthening civil liability for nuclear damage. The Appendix provides details on the activities of the Commission on Safety Standards (CSS) and activities relevant to the Agency's safety standards.

2. Since the adoption of the IAEA Action Plan on Nuclear Safety (Action Plan) in 2011, many activities have been undertaken by the Secretariat, Member States and other relevant organizations to strengthen nuclear safety worldwide. The Director General's final report on the Action Plan, submitted to the Board of Governors in September 2015, showed that progress continued to be made in improving global nuclear safety.

3. During the period of implementation of the Action Plan there was a focus on the safety of nuclear power plants (NPPs), particularly in relation to extreme natural hazards, and on related radioactive waste management and radiation safety matters. Going forward, strengthening nuclear, radiation, transport and waste safety will be considered in a more comprehensive manner. In this regard, the priorities have been identified through application of the methodology described in the Report by the Director General on Measures to Strengthen International Cooperation in Nuclear, Radiation, Transport and Waste Safety: Building on the Action Plan on Nuclear Safety (document GC(60)/INF/11).

General Safety Areas

Trends

4. The main focus in the production of the Agency's safety standards is the revision of existing standards rather than the establishment of new ones.

5. Member State requests for the Agency's peer review and advisory services continued to increase.

6. An increasing number of Member States are requesting assistance in developing their programmes for leadership and management for safety and continuous improvement, including safety culture assessment.

7. There is an increasing demand from Member States for Agency support in capacity building, including education and training.

Activities

8. In 2016, the work on establishing a comprehensive set of Safety Requirements was almost completed; more efforts were devoted to the revision of Safety Guides.

9. Seven Safety Requirements publications were issued: *Governmental, Legal and Regulatory Framework for Safety* (IAEA Safety Standards Series No. GSR Part 1 (Rev. 1))[1], *Site Evaluation for Nuclear Installations* (IAEA Safety Standards Series No. NS-R-3 (Rev. 1))[2], *Safety of Nuclear Power Plants: Design* (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1))[3], *Safety of Nuclear Power Plants: Commissioning and Operation* (IAEA Safety Standards Series No. SSR-2/2 (Rev. 1))[4], *Safety Assessment for Facilities and Activities* (IAEA Safety Standards Series No. GSR Part 4 (Rev. 1))[5]; *Leadership and Management for Safety* (IAEA Safety Standards Series No. GSR Part 2)[6] and *Safety of Research Reactors* (IAEA Safety Standards Series No. SSR-3)[7]. These Safety Standards include revised requirements that take into account lessons arising from the Fukushima Daiichi accident.

10. The Safety Guides are being revised across topical areas, taking into account feedback on their application. Examples of these topical areas are severe accident management, radioactive waste disposal and occupational radiation protection. The revision by topical areas was introduced to ensure the consistency across the IAEA Safety Standards Series.

11. A large number of missions were conducted across all safety areas. The Agency established an internal Peer Review and Advisory Services Committee to assess the overall structure of all review services offered by the Department of Nuclear Safety and Security and to identify appropriate methods for monitoring and improving the effectiveness and efficiency of the services.

12. Several preparatory meetings were held in support of the Seventh Review Meeting of Contracting Parties to the Convention on Nuclear Safety (CNS), to be held in Vienna, Austria in March-April 2017, including training meetings for new Review Meeting officers. The Agency undertook activities to further encourage adherence to the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (the Joint Convention), to encourage active participation in the peer review process, and to increase the effectiveness of the review process for Contracting Parties without a nuclear power programme.

13. The International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally was organized by the Agency in Vienna, Austria, in April 2016. The Conference encouraged: Member States that are not Contracting Parties to join the international legal instruments for safety; those that have joined but not yet ratified them to do so; and those that are Contracting Parties to fully comply with their obligations.

14. The International Conference on Human and Organizational Aspects of Assuring Nuclear Safety — Exploring 30 Years of Safety Culture was held in Vienna, Austria, in February 2016. The

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[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), IAEA, Vienna (2016).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Site Evaluation for Nuclear Installations, IAEA Safety Standards Series No. NS-R-3 (Rev. 1), IAEA, Vienna (2016).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Design, IAEA Safety Standards Series No. SSR-2/1 (Rev. 1), IAEA, Vienna (2016).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Commissioning and Operation, IAEA Safety Standards Series No. SSR-2/2 (Rev. 1), IAEA, Vienna (2016).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities (IAEA Safety Standards Series No. GSR Part 4 (Rev. 1), IAEA, Vienna (2016).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, IAEA Safety Standards Series No. GSR Part 2, IAEA, Vienna (2016).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Research Reactors, IAEA Safety Standards Series No. SSR-3, IAEA, Vienna (2016).

participants discussed, inter alia, the need to expand the Agency's work on safety culture to address all nuclear and radiological applications.

15. The Agency issued two publications relating to safety culture assessment: *Performing Safety Culture Self-Assessments* (Safety Reports Series No. 83)[8], and *OSART Independent Safety Culture Assessment (ISCA) Guidelines* (IAEA Services Series No. 32)[9].

16. The Agency organized 35 training events related to the safety of nuclear installations, in particular operational safety, design safety, protection against external events, design extension conditions, severe accident management, long term operation and safety culture. In addition, ten interregional capacity building activities on nuclear infrastructure were organized for 35 Member States embarking on new nuclear power programmes or expanding existing programmes. The Agency also organized 38 regional and national training events and workshops in EPR and 35 training events in the areas of radiation, transport and waste safety.

Priorities for strengthening general safety areas

17. The Agency will:

- Strengthen the Agency's safety standards using lessons arising from the Fukushima Daiichi accident and other relevant sources, and taking into account the principles of the Vienna Declaration on Nuclear Safety[10];
- Strengthen the Agency's peer review and advisory services;
- Assist Member States in the application of the Agency's safety standards through, inter alia, the peer review and advisory services;
- Strengthen the Agency's activities to promote universal adherence to the international safety conventions;
- Assist Member States in strengthening regulatory effectiveness;
- Assist Member States in strengthening leadership and management for the safety of nuclear facilities and activities, and in fostering a strong safety culture;
- Assist Member States in strengthening their processes for communicating radiation risks to the public in planned and existing exposure situations and during an emergency;
- Assist Member States in capacity building programmes, including education and training in nuclear, radiation, waste and transport safety as well as EPR; and
- Support research and development for safety and facilitate the exchange of results.

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[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Performing Safety Culture Self-assessments, IAEA Safety Reports Series No. 83, IAEA, Vienna (2016).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, OSART Independent Safety Culture Assessment (ISCA) Guidelines, IAEA Services Series No. 32, IAEA, Vienna (2016).

[10] The document is available at: https://www.iaea.org/sites/default/files/infcirc872.pdf.

Improving Radiation, Transport and Waste Safety

Trends

18. The wider use of the application of radiation and radioactive substances in medicine results in additional medical exposure to radiation and is creating further demands for Agency guidance and assistance.

19. The increased use of sealed radioactive sources worldwide in medicine, industry, agriculture and research, has resulted in further demands for appropriate arrangements for the management of sources that are no longer in use.

20. The increased use of radioactive material in Member States is creating additional demands for regulatory oversight, including for transport within and across national borders.

21. Member States continue to seek the Agency's assistance with developing their long-term management solutions for radioactive waste and the safe implementation of such solutions.

22. Experience from completed and ongoing decommissioning projects indicates that the costs of decommissioning can be underestimated, leading to challenges in completing decommissioning projects.

23. There has been growing recognition of the need to remediate uranium legacy sites. This need has also been recognized through international assistance programmes for the remediation of former uranium production sites in Central Asia.

Activities

24. In 2016, the Agency organized Technical Meetings on Justification of Medical Exposure in Diagnostic Imaging, and on Patient Dose Monitoring and the Use of Diagnostic Reference Levels for the Optimization of Protection in Medical Imaging, to discuss and exchange experiences related to safety implications of these applications.

25. The Agency initiated regional and international projects on the cradle to grave control of sealed radioactive sources, focusing on the management of sources at the end of their life. The Agency is also assisting Member States that are actively pursuing borehole disposal as an option for disused sealed radioactive sources.

26. The Agency continued to support capacity building activities for the regulatory oversight of transport of radioactive material in over 80 Member States in Africa, Asia and the Pacific, and the Mediterranean region.

27. The Agency organized the International Conference on the Safety of Radioactive Waste Management, in Vienna, Austria, in November 2016. The conference facilitated information exchange on the management of all types of radioactive waste, as well as on current and future challenges. The conference participants highlighted the need for continued assistance to Member States in building and strengthening the capacities of both regulators and operators.

28. The Agency organized the International Conference on Advancing the Global Implementation of Decommissioning and Environmental Remediation Programmes, in Madrid, Spain, in May 2016. The conference provided an opportunity for sharing and reviewing challenges, achievements and lessons related to decommissioning and environmental remediation programmes. In particular, the conference participants discussed the importance of addressing legacies from past activities, identified current priority needs and provided recommendations on the strategies and approaches for safety.

29. The Agency's Coordination Group for Uranium Legacy Sites (CGULS) continues to play a pivotal role in coordinating the many different organizations working towards the goal of sustainable remediation of uranium legacy sites in Central Asia. Many Member States are participating in the Agency's International Working Forum on Regulatory Supervision of Legacy Sites (RSLS), reflecting the need for enhanced coordination and knowledge transfer concerning the remediation of these sites.

Priorities for improving radiation, transport and waste safety

30. The Agency will assist Member States in:

- The effective implementation of the radiation protection principles of justification and optimization based on *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards* (IAEA Safety Standards Series No. GSR Part 3)[11], with particular emphasis on medical exposures;
- The management of radioactive sources from cradle to grave and the effective application of the Code of Conduct on the Safety and Security of Radioactive Sources;
- Building capacity for the safe transport of radioactive material;
- The safe management of radioactive waste, including geological disposal of high level waste, and the development of decommissioning strategies and plans; and
- The remediation of contaminated areas, including from post-accident situations and from uranium legacy sites.

Strengthening Safety in Nuclear Installations

Trends

31. The need for effective and proactive leadership and management is a recurring lesson of the most recent Operational Safety Review (OSART) missions. These missions also highlighted the need to reinforce consideration of the interactions between technical, human and organizational factors; to improve the use of operational experience; to manage the challenges associated with an ageing workforce; and to further strengthen accident management and on-site EPR.

32. An increasing number of nuclear power reactor operators are implementing long term operation (LTO) and ageing management programmes and the Agency has received an increase in Member State requests for the Safety Aspects of Long Term Operation (SALTO) peer review service.

33. Experts attending Agency Technical Meetings on external hazards continued to express an interest in addressing lessons arising from the Fukushima Daiichi accident related to: the uncertainties associated with the evaluation of extreme external hazards; the need to use historical and prehistoric data in the evaluation of external hazards; consideration of combinations of external hazards; consideration of the impact of external hazards on multi-unit sites; and the use of probabilistic approaches in the analysis of external events.

34. Several Member States are showing an interest in small and medium sized or modular reactors (SMRs). The development of SMRs involves the use of passive safety features, and an increased use of factory construction and inspection techniques.

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[11] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014).

35. Many Member States are planning or implementing modifications and refurbishment projects to address the ageing of structures, systems and components of research reactors.

36. Integrated Regulatory Review Service (IRRS) missions and Integrated Nuclear Infrastructure Review (INIR) missions have identified that for several Member States there remains a need to establish an adequate and effective regulatory framework.

Activities

37. In 2016, the Agency conducted three OSART missions and five follow-up OSART missions. The Agency also published *OSART Guidelines: 2015 Edition* (IAEA Services Series No. 12 (Rev. 1))[12]. The revision takes into account lessons arising from the Fukushima Daiichi accident and experience gained from the application of the Agency's safety standards.

38. The Agency has initiated the third phase of the International Generic Ageing Lessons Learned (IGALL) programme, which provides a technical basis and practical guidance on managing ageing of structures, systems and components of NPPs.

39. The Agency conducted seven SALTO and follow-up SALTO missions and organized a Technical Meeting on lessons learned from SALTO peer reviews, in Vienna, Austria in June 2016.

40. The Agency continued to update safety standards and issue detailed Technical Documents and Safety Reports supporting the protection of nuclear installations against external hazards.

41. Currently, there are about 50 SMR designs under development. The Agency has initiated a study on the application of design-related safety requirements to SMR designs intended for the near term deployment, which includes a review of current practices in Member States with regard to the application of the Agency's safety standards to SMR technologies.

42. In 2016, the Agency conducted three Integrated Safety Assessment of Research Reactors (INSARR) missions and one follow-up INSARR mission. The Agency also conducted advisory missions to three Member States to assist research reactor operating organizations in implementing safety enhancements based on the recommendations of previous INSARR missions.

43. The Agency conducted several expert missions, workshops and training courses that provided guidance and information on all elements of establishing an effective nuclear safety infrastructure. The Agency continued to assist these Member States in establishing and strengthening their national nuclear safety infrastructures through peer reviews, such as the IRRS, and advisory services.

Priorities for strengthening safety in nuclear installations

44. The Agency will assist Member States in:

- Implementing and improving programmes for ageing management and the safe LTO of nuclear installations;
- Facilitating the exchange of operating experience at NPPs;
- The application of Agency safety standards relating to the evaluation of external events;
- The application of Agency safety standards for safety assessment and design of nuclear installations;

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[12] INTERNATIONAL ATOMIC ENERGY AGENCY, OSART Guidelines, 2015 Edition, IAEA Services Series No. 12 (Rev. 1), IAEA, Vienna (2016).

- Strengthening severe accident management guidelines;
- Developing safety requirements for SMR design and safety assessment;
- Performing safety assessments of research reactors, managing ageing of research facilities, enhancing regulatory supervision and strengthening the application of the Code of Conduct on the Safety of Research Reactors;
- Performing safety assessments and implementing safety upgrades to nuclear fuel cycle facilities; and
- Developing safety infrastructure for new nuclear power and research reactor programmes.

Strengthening Emergency Preparedness and Response

Trends

45. There is an ongoing demand from Member States for technical assistance and advice in strengthening national and regional EPR arrangements. Many requests received from Member States are related to a need for assistance and advice in the implementation of the requirements established in *Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSR Part 7)[13].

46. The widespread use of social media reinforces the need for a timely public communication response in an emergency. The International Conference on Global Emergency Preparedness and Response, which took place in Vienna, Austria in October 2015, highlighted the need to prepare appropriate background information in advance[14] and to provide regular training on public communication.

47. Member States continue to show strong interest in seeking the Agency's support for improving their emergency exercises.

Activities

48. The Agency organized a total of 38 training events and workshops focusing on assistance with the implementation of the requirements established in IAEA Safety Standards Series No. GSR Part 7. The Agency also conducted two Schools of Radiation Emergency Management to address the need for comprehensive training on all relevant EPR topics.

49. The Eighth Meeting of the Representatives of Competent Authorities Identified under the Early Notification Convention and the Assistance Convention took place in Vienna, Austria, in June 2016. This meeting discussed a range of topics including information exchange, international assistance, communication with the public, and training and exercises. The Agency organized a Technical Meeting to Review the IAEA's Assessment and Prognosis Procedures for Nuclear and Radiological Emergencies in Vienna, Austria, in November–December 2016, which also covered the associated communication processes.

50. The Agency assisted Member States in the organization, conduct and evaluation of ten national emergency exercises.

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[13] INTERNATIONAL ATOMIC ENERGY AGENCY, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

[14] INTERNATIONAL ATOMIC ENERGY AGENCY, Report on the International Conference on Global Emergency Preparedness and Response, IAEA, Vienna (2015).

Priorities for strengthening emergency preparedness and response

51. The Agency will:

- Develop operational arrangements for notification, reporting and requesting assistance in a nuclear or radiological incident or emergency;
- Assist Member States in the implementation of the IAEA Safety Standards Series No. GSR Part 7 and develop associated Safety Guides; and
- Implement an active exercise programme to test EPR at the international level and support national EPR exercise programmes.

Improving Management of the Safety and Security Interface

Trends

52. The International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally underlined the importance of managing the interface between safety and security in a number of areas, in particular, in the establishment of strong nuclear safety and security cultures, the design of nuclear installations, and the management of disused sealed radioactive sources.

Activities

53. In 2016, the Agency developed draft Guidance on the Management of Disused Radioactive Sources. This guidance is based on the Agency's safety standards and nuclear security guidance, and addresses safety and security in an integrated manner similar to that of the Code of Conduct on the Safety and Security of Radioactive Sources..

Priorities for improving management of the safety and security interface

54. The Agency will ensure that safety standards and nuclear security guidance take into account the implications for both safety and security whenever appropriate, recognising that the activities that address nuclear safety and security are different.

Strengthening Civil Liability for Nuclear Damage

Trends

55. 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 due to a nuclear incident, as well as to establishing a global nuclear liability regime.

Activities

56. The 16th regular meeting of the Agency's International Expert Group on Nuclear Liability (INLEX) took place in Vienna, Austria, in May 2016 and was preceded by the Fifth Workshop on Civil Liability for Nuclear Damage, also held in May 2016. A joint Agency–INLEX mission to raise awareness of the international legal instruments relevant for achieving a global nuclear liability regime was conducted in China in March 2016. In addition, the revision of the Explanatory Texts for the 1997 Vienna Convention on Civil Liability for Nuclear Damage and the Convention on Supplementary Compensation for Nuclear Damage was finalized in 2016.

Priorities for strengthening civil liability for nuclear damage

57. The Agency will continue to facilitate the establishment of a global nuclear liability regime and assist Member States, upon request, in their efforts to adhere to and implement the international nuclear liability instruments, taking into account the recommendations adopted by INLEX in 2012.

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Analytical Overview

A. General Safety Areas

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

Trends

1. The main focus in the production of the Agency's safety standards is the revision of existing standards rather than the establishment of new standards. In 2016, the work on establishing a comprehensive set of Safety Requirements was almost completed and more efforts were devoted to the revision of Safety Guides. The Safety Guides are being revised across topical areas, taking into account feedback on their application. Examples of these topical areas are severe accident management, radioactive waste disposal and occupational radiation protection. The revision by topical areas was introduced to ensure consistency across the safety standards series.

2. Member State requests for the Agency's peer review and advisory services continued to increase and a large number of missions were conducted across all safety areas. The Agency received the following requests for peer review missions to be conducted over the next two years: 25 requests for Integrated Regulatory Review Service (IRRS) missions; 13 requests for Operational Safety Review (OSART) missions; 5 requests for Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) missions; and 15 requests for the Safety Aspects of Long Term Operation (SALTO) missions.

3. Member States' interest in hosting Emergency Preparedness Review (EPREV) missions continues to be high, especially among those with established nuclear power programmes and those embarking on nuclear power programmes. The Agency has received two requests for EPREV missions to be conducted in 2017 and has received 12 requests from Member States for Site and External Events Design (SEED) review missions. The Agency has observed a continuously high level of requests for design safety, generic reactor safety and probabilistic safety assessment (PSA)-related reviews.

Activities

4. In 2016, seven Safety Requirements publications were issued that take into account lessons arising from the Fukushima Daiichi accident:

- *Governmental, Legal and Regulatory Framework for Safety* (IAEA Safety Standards Series No. GSR Part 1 (Rev. 1));
- *Site Evaluation for Nuclear Installations* (IAEA Safety Standards Series No. NS-R-3 (Rev. 1));
- *Safety of Nuclear Power Plants: Design* (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1));
- *Safety of Nuclear Power Plants: Commissioning and Operation* (IAEA Safety Standards Series No. SSR-2/2 (Rev. 1));
- *Safety Assessment for Facilities and Activities* (IAEA Safety Standards Series No. GSR Part 4 (Rev. 1));
- *Leadership and Management for Safety* (IAEA Safety Standards Series No. GSR Part 2); and

- *Safety of Research Reactors* (IAEA Safety Standards Series No. SSR-3).

5. A revision of the Safety Requirements publication applicable to nuclear fuel cycle facilities is being conducted, and this will also take into account lessons arising from the Fukushima Daiichi accident.

6. The review and revision of two other Safety Requirements publications are currently under way. The Safety Requirements publication applicable to site evaluation for nuclear installations is being revised and will take into account Member States' experiences with issues arising from recent developments in site evaluation of existing and new nuclear installations. The Safety Requirements publication on the safe transport of radioactive material was reviewed in accordance with the review cycle of the United Nations Committee of Experts on the Transport of Dangerous Goods, and is now being revised to take into account agreed changes, including changes relating to the transport of large objects and the transport of radioactive material after storage.

7. A number of Safety Guides are currently being reviewed and revised using lessons arising from the Fukushima Daiichi accident and other relevant lessons from the Agency's activities in nuclear, radiation, transport and waste safety, and taking into account the principles of the Vienna Declaration on Nuclear Safety. The preparation of several new Safety Guides is ongoing, including *Arrangements for the Termination of a Nuclear or Radiological Emergency* (DS474), *Arrangements for Public Communications in Preparedness and Response for a Nuclear or Radiological Emergency* (DS475), and *Preparedness and Response for an Emergency during the Transport of Nuclear Material or Radioactive Material* (DS469).

8. The Nuclear Safety and Security Online User Interface (NSS-OUI) platform[15] became operational in 2016. This platform offers users of the safety standards and the nuclear security guidance an enhanced way of accessing and browsing the content of both series using advanced multi-criteria search capabilities. It also includes a centralized mechanism to collect and retrieve feedback on the safety standards and the nuclear security guidance that will serve as a solid foundation for future reviews and revisions. Several projects have been initiated that aim to use the NSS-OUI to support the revision of the safety standards across topical areas.

9. The Commission on Safety Standards (CSS), at its 40th meeting held in November 2016 in Vienna, Austria, agreed to establish a working group to consider the implications for the Agency's safety standards of the 2012 United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) report on *Attributing Health Effects to Ionizing Radiation Exposure and Inferring Risks*[16]. The CSS agreed that representatives from the Secretariats of the International Commission on Radiological Protection (ICRP) and UNSCEAR would also be invited to participate in the working group.

10. In 2016, seven IRRS missions took place, out of which two were missions to Member States with operating nuclear power plants (NPPs), two were to Member States with NPPs under decommissioning, and three were to Member States without NPPs. Three follow-up IRRS missions were conducted in Member States with operating NPPs. Two EPREV missions were conducted in 2016. Performance indicators to assess the efficiency of EPREV missions have been developed and piloted. The Agency conducted three OSART missions and five follow-up OSART missions. The new OSART guidelines were used and emphasis was placed on the conduct of operations, leadership and

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[15] See: https://nucleus-apps.iaea.org/nss-oui/.
[16] UNITED NATIONS, Sources and Effects of Ionizing Radiation (2012 Report to the General Assembly), United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), UN, New York (2015) Annex A: Attributing Health Effects to Ionizing Radiation Exposure and Inferring Risks.

management for safety, severe accident management, emergency preparedness and response (EPR), and safety culture. The Agency conducted four SALTO missions and three follow-up SALTO missions. The Agency conducted three preparatory SEED missions, five SEED missions, three Integrated Safety Assessment of Research Reactors (INSARR) missions and one INSARR follow-up mission. The Agency also completed three Technical Safety Reviews, two on generic reactor design safety documentation and one on PSA.

11. In 2016, the Agency conducted advisory missions on strengthening national regulatory infrastructures for radiation safety in nine Member States. The newly developed web-based Radiation Safety Advisory Mission Tool[17] was used to prepare and implement these missions.

12. The Agency has established an internal Peer Review and Advisory Services Committee to assess the overall structure of all review services offered by the Department of Nuclear Safety and Security and to identify appropriate methods of monitoring and improving the effectiveness and efficiency of the services.

13. The Agency has also revised the question sets for the Self-Assessment of Regulatory Infrastructure for Safety (SARIS)[18] methodology and tools, and conducted a training course for radiation safety reviewers taking part in IRRS missions.

14. The results of the analysis of IRRS missions to Member States with operating NPPs in 2006–2015 have been incorporated into two draft Safety Guides that support IAEA Safety Standards Series No. GSR Part 1 (Rev. 1): *Organization, Management and Staffing of a Regulatory Body for Safety* (DS472) and *Functions and Processes of the Regulatory Body for Safety* (DS473).

Priorities and Related Activities

15. ***The Agency will strengthen its safety standards using lessons arising from the Fukushima Daiichi accident and other relevant sources, and taking into account the principles of the Vienna Declaration on Nuclear Safety. The Agency will assist the application of its safety standards by, inter alia, strengthening its peer review and advisory services. The Agency will undertake the following activities in relation to these priorities:***

- The Agency will complete the revision of the Safety Requirements publications on nuclear fuel cycle facilities. The Agency will also continue to focus efforts on the review and revision of a set of Safety Guides to take account of lessons arising from the Fukushima Daiichi accident, other relevant sources of existing relevant or new information;

- The Agency will develop the necessary guidance on application of the requirements established in *Preparedness and Response for a Nuclear or Radiological Emergency* (IAEA Safety Standards Series No. GSR Part 7);

- The NSS-OUI platform will be further strengthened and used to gather feedback from Member States on the current set of safety standards to ensure that there is a solid foundation for identifying future priorities in the revision of existing standards;

- The Agency will assess the overall structure, effectiveness and efficiency of the peer review and advisory services;

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[17] See the following dedicated web page on Radiation Safety Advisory Mission Tool: https://rasamt.iaea.org/.

[18] See the following dedicated web page on SARIS: https://www-ns.iaea.org/tech-areas/regulatory-infrastructure/sat-tool.asp.

- The Agency will continue strengthening its peer review and advisory services and self-assessment tools by incorporating lessons learned from their implementation and share, as appropriate, the relevant information with Member States. The Agency will organize a Technical Meeting to support the revision of the IRRS guidelines and will publish the ARTEMIS self-assessment and review guidelines;

- The Agency will continue providing training for IRRS reviewers in the areas of nuclear and radiation safety and will publish analyses of the results of IRRS missions conducted from 2006 to 2015 in Member States with operating NPPs. These analyses will also provide feedback for the review and revision of the relevant safety standards; and

- The Agency will develop two IAEA Technical Documents for regulatory bodies to support the enhancement of their regulatory frameworks. One will deal with conducting regulatory inspections and the other with the processes and methods for sharing regulatory experience.

A.2. International Safety Conventions

Trends

16. The Convention on Nuclear Safety[19] (CNS) was adopted on 17 June 1994 and entered into force on 24 October 1996. As of December 2016, there were 78 Contracting Parties to the CNS[20].

17. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention)[21] was adopted on 5 September 1997 and entered into force on 18 June 2001. As of December 2016, there were 73 Contracting Parties to the Joint Convention[22].

Activities

18. Several preparatory meetings were held in 2016 in support of the upcoming Seventh Review Meeting of Contracting Parties to the CNS to take place in March-April 2017, including training meetings for new Review Meeting officers, an Officers' Turnover meeting and two meetings of the Officers' Preparatory Working Group.

19. The Agency hosted a topical meeting of the Contracting Parties to the Joint Convention, on the Challenges and Responsibilities of Multinational Radioactive Waste Disposal Facilities, in Vienna, Austria in September 2016. The meeting was attended by 75 delegates, representing 29 Contracting Parties and 1 international organization who discussed safety challenges and responsibility issues related to the disposal of spent fuel or radioactive waste in a country other than the one where they were generated. A Meeting to Discuss Feedback from Contracting Parties to Improve the Review Process for the Joint Convention was held in October 2016 and its outcome will be discussed at the Third Extraordinary Meeting of the Contracting Parties to the Joint Convention to take place in May 2017.

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[19] The text of the CNS is available in the document INFCIRC/449: https://www.iaea.org/sites/default/files/infcirc449.pdf.

[20] Two Member States (Niger and Myanmar) deposited their instruments of accession to the CNS in December 2016 and will become Contracting Parties thereof in March 2017, leading thus to an increase in the number of Contracting Parties from 78 to 80.

[21] The text of the Joint Convention is available in the document INFCIRC/546: https://www.iaea.org/sites/default/files/infcirc546.pdf.

[22] One Member State (Niger) deposited its instrument of accession to the Joint Convention in December 2016 and will become a Contracting Party thereof in March 2017, leading thus to a further increase in the number of Contracting Parties from 73 to 74.

20. The Agency undertook activities to further encourage adherence to the Joint Convention, encourage active participation in the peer review process, and increase the effectiveness of the review process for Contracting Parties without a nuclear power programme.

Priorities and Related Activities

21. ***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 will undertake the following activities in relation to this priority:***

- The Agency will provide support for the Seventh Review Meeting of the Contracting Parties to the CNS, which will be held in March–April 2017;

- The Agency will provide support for the Third Extraordinary Meeting of the Contracting Parties to the Joint Convention which will be held in May 2017, as well as for the Organizational Meeting for the Sixth Review Meeting of the Contracting Parties to the Joint Convention to be held in the same month;

- The Agency will continue to organize workshops, including at the regional level as well as bilateral outreach activities with the Member States to raise awareness and promote adherence to the Joint Convention and develop similar activities to promote the CNS; and

- The Agency will promote adherence to the CNS and Joint Convention, with particular attention to be given to Member States embarking on nuclear power programmes and to States with radioactive waste not originating from the nuclear fuel cycle, such as radioactive sources.

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

Trends

22. Some Member States benefiting from technical assistance from the Agency have made good progress in strengthening their regulatory effectiveness in radiation, transport and waste safety but information from the Agency's Radiation Safety Information Management System (RASIMS)[23] indicates that almost 80% of those Member States still need additional support to develop a national regulatory infrastructure consistent with the Agency's safety standards (see Figure 1). Factors which affect such development include changes in national programme priorities and insufficient human and financial resources for the regulatory body.

[23] The Agency's Radiation Safety Information Management System (http://rasims.iaea.org/).

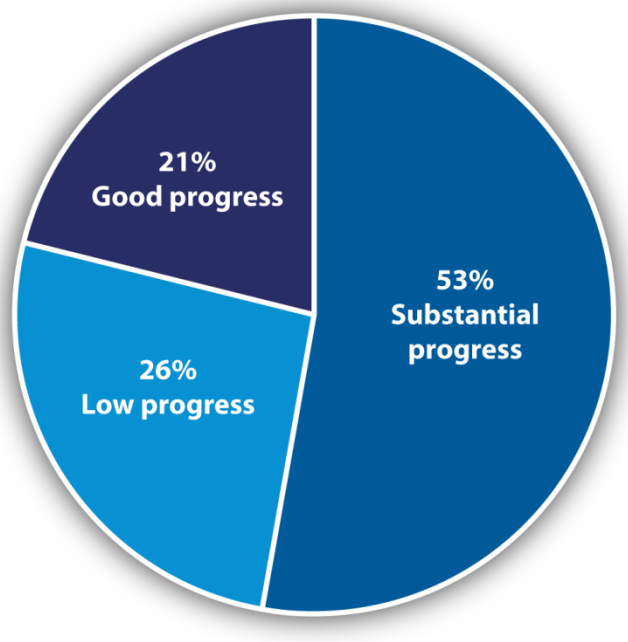

FIG. 1. Status of progress made in establishing a national radiation safety regulatory infrastructure in Member States receiving Agency assistance (data from October 2016).

23. The Agency analyses of the IRRS follow-up missions indicated that Member States with operating NPPs showed a high level of implementation of the recommendations and suggestions from the initial missions (73% of recommendations and 83% of suggestions).

24. Recent Agency peer review missions show that regulatory bodies are making efforts to apply an all hazards approach in developing their EPR arrangements. Nevertheless, additional efforts are needed to fully align the national arrangements with the provisions of the Agency's safety standards in the field of EPR.

25. There is a continuing need for improvement in the effectiveness of regulatory oversight of research reactors and fuel cycle facilities, particularly with respect to establishing regulatory inspection programmes and verifying how relevant lessons arising from the Fukushima Daiichi accident are being implemented.

Activities

26. The Agency organized the International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally, in Vienna, Austria, in April 2016. The conference, which was the fourth on this topic, was attended by participants from 62 Member States and 8 international organizations. Participants at the conference noted the importance of increasing Member State participation in the various international nuclear instruments. The participants also highlighted issues for consideration by governments, including ensuring the independence of the regulatory body from agencies which promote the nuclear and radiological sectors and providing the regulatory body with adequate authority, resources and staff.

27. In 2016, seven IRRS missions took place. Two missions were conducted to Member States with operating NPPs — Japan and South Africa and two missions to Member States with NPPs under decommissioning — Italy and Lithuania. Three missions were conducted to Member States without operating NPPs — Belarus, Estonia, and Kenya. Three follow-up IRRS missions were conducted in Member States with operating NPPs — Bulgaria, China and Sweden. The EPR module of the IRRS

missions, which was revised in line with IAEA Safety Standards Series No. GSR Part 7 has been applied to the missions undertaken in 2016.

28. The Agency also conducted two regional workshops in Asia and the Pacific and in Africa on regulatory inspection programmes for research reactors.

29. Two Schools for Drafting Regulations on Radiation Safety were organized by the Agency in Europe and in Africa. The Control of Sources Network platform was used for the preparation and implementation of these activities.[24] In addition, a similar training event on drafting nuclear safety regulations for NPPs in the areas of safety assessment and design was held in Vienna, Austria. The Agency organized workshops for RASIMS coordinators in Member States in the Europe region and the Latin America and the Caribbean region.

30. The Agency completed the implementation of the Regulatory Infrastructure Development Project, which was designed to strengthen national regulatory infrastructure for the safe use of radiation sources in Member States in North Africa and the Middle East.

31. The Agency continued to address radiation safety infrastructure in Member States that have a particular interest in establishing or enhancing their radiotherapy programmes through imPACT Review[25] missions, of which five were conducted in 2016.

Priorities and Related Activities

32. ***The Agency will assist Member States in strengthening their regulatory effectiveness by identifying lessons from international conferences, peer reviews, advisory missions, appraisal services, knowledge networks and relevant meetings and workshops. The Agency will undertake the following activities in relation to this priority:***

- The Agency will assist Member States' efforts to achieve effective regulatory independence and to enhance regulatory frameworks and technical competencies by continuing to offer education and training in this area. The Agency will share information, analyses, results and lessons learned from review services through the International Regulatory Network (RegNet). The Agency will continue operating RASIMS as a tool for assisting Member States that receive technical support from the Agency with the evaluation of their progress in applying the Agency's radiation safety standards, especially in the regulatory area;

- The Agency will assist Member States in enhancing their regulatory effectiveness, taking into account the conclusions of the 2016 International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally;

- The Agency will continue to assist Member States in further strengthening their national regulatory infrastructures for nuclear and radiation safety through the provision of peer reviews and advisory services. In particular, the Agency will assist Member States, upon request, in developing national requirements for the safety of research reactors and for fuel cycle facilities; and

- In the area of regulatory aspects of EPR, the Agency will foster the harmonized implementation by Member States of the requirements established in IAEA Safety Standards Series No. GSR Part 7, particularly for Member States embarking on a nuclear power programme.

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[24] The Control of Sources Network home page can be found at: https://gnssn.iaea.org/CSN/default.aspx.

[25] The imPACT Review missions, where imPACT stands for 'integrated missions of PACT', are conducted through the Agency's Programme of Action for Cancer Therapy (PACT).

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

Trends

33. Experience gained from Agency peer review missions indicates that a considerable number of Member States need to address issues in the area of leadership and management for safety, including fostering a strong safety culture.

34. An increasing number of Member States are requesting assistance in developing their programmes for safety-related leadership and continuous improvement, including safety culture assessments.

35. Assessments and conclusions from international conferences and review missions have identified the need for individuals and organizations to continuously challenge or re-examine the prevailing assumptions about nuclear and radiological safety and consider the safety implications of their decisions and actions.

36. Member States and international organizations recognize the need to improve communication on nuclear and radiation safety issues by use of clearer language and enhanced communication strategies — in particular, to ensure that communication with the public, media and other interested parties is conducted in a timely and understandable manner.

Activities

37. The Agency organized the International Conference on Human and Organizational Aspects of Assuring Nuclear Safety — Exploring 30 Years of Safety Culture in Vienna, Austria, in February 2016, attended by 350 participants from 56 Member States and 7 international organisations. The conference participants, inter alia, highlighted the benefits of a systemic approach to safety to deal effectively with organizational complexities, and the need to expand the Agency's work on safety culture to address all nuclear and radiological applications.

38. The Agency is currently revising the Safety Guides supporting the Safety Requirements publication on IAEA Safety Standards Series No. GSR Part 2. Training material based on this publication was finalized and used in a workshop conducted for Member States in Africa and for those Member States that are party to the ARASIA Agreement[26]. The Agency arranged its fourth annual Workshop on Leadership and Culture for Safety for Senior Managers and launched a new series of workshops for middle managers on the systemic approach to safety.

39. The Agency continues to work towards the international harmonization of approaches to assist Member States with the application of IAEA Safety Standards Series No. GSR Part 2 and the use of safety culture assessment methods. In 2016, the Agency issued two publications relating to safety culture assessment: *Performing Safety Culture Self-assessments* (Safety Reports Series No. 83)[27] and *OSART Independent Safety Culture Assessment (ISCA) Guidelines* (IAEA Services Series No. 32)[28]. The Agency initiated the development of training material on regulatory body safety culture in

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[26] The Co-operative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA).

[27] INTERNATIONAL ATOMIC ENERGY AGENCY, Performing Safety Culture Self-assessments, IAEA Safety Reports Series No. 83, IAEA, Vienna (2016).

[28] INTERNATIONAL ATOMIC ENERGY AGENCY, OSART Independent Safety Culture Assessment (ISCA) Guidelines, IAEA Services Series No. 32, IAEA, Vienna (2016).

radiation safety. Two new modules on the assessment of leadership and management for safety and of technical, human and organizational interfaces were incorporated into the Agency's OSART service.

40. The Global Nuclear Safety and Security Communication Network (GNSSCOM) was established under the Global Nuclear Safety and Security Network (GNSSN)[29]. This new network will facilitate sharing international practices to strengthen Member States' communication strategies.

41. The Agency conducted several advisory missions to Member States in Central Asia and Japan in 2016 to assist them in enhancing their communication strategies for public and other stakeholder engagement regarding technical risk assessments, radiation monitoring results, key post-accident recovery and remediation initiatives.

Priorities and Related Activities

42. ***The Agency will assist Member States in strengthening leadership and management activities 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 will undertake the following activities in relation to these priorities:***

- The Agency will assist Member States in the area of leadership and management for safety. This will include assessing leadership and management processes and performance during OSART missions, assisting staff at nuclear facilities in the self-assessment of their safety culture and encouraging continuous improvement, and preparing senior and middle managers for their roles as leaders of safety culture within their organizations;

- The Agency will develop and pilot an International School for Nuclear and Radiological Leadership for Safety. This new School will be aimed at junior and mid-career professionals and future leaders in the nuclear safety field, and it will be supported by web links and resources for networking and exchange of experience amongst the participants. The overarching objective of the School is to assist Member States in their application of the requirements established in IAEA Safety Standards Series No. GSR Part 2;

- The Agency will promote safety culture and security culture, taking into account their various interfaces;

- The Agency will assist Member States in assessing and improving safety culture at all levels, including within nuclear regulatory bodies and within nuclear operator organizations;

- The Agency will complete the development and revision of training material and technical reports in support of regulatory body safety culture in the areas of nuclear and radiation safety and will conduct the associated training courses for Member States upon request; and

- The Agency will support the GNSSCOM in the development of a nuclear safety-related communication toolbox and strategy for all Member States.

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[29] See the GNSSN home page: https://gnssn.iaea.org/main/Pages/default.aspx

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

Trends

43. There is an increased use of, and need for, medical, industrial and agricultural applications of radioactive sources. Ensuring the safe manufacture, use, transport, storage and disposal of radiation sources is highly dependent on Member States having skilled users, a competent regulatory body, and radiation protection professionals who have the appropriate level of education and training to handle these sources.

44. There is an increasing demand for Agency support for education and training activities related to the operational safety of nuclear installations, design safety, protection against external events, design extension conditions, severe accident management, long term operation and safety culture. This demand comes from Member States with existing nuclear installations as well as from those considering embarking on nuclear programmes. Member States embarking on a new nuclear power programme have requested greater support for practical hands-on training with, for example, safety assessment computer software.

45. A number of Member States receiving Agency support, have made progress in developing the key elements of a national strategy for education and training[30] in line with the Agency's Strategic Approach to Education and Training in Radiation, Transport and Waste Safety 2011–2020[31] (see Figure 2).

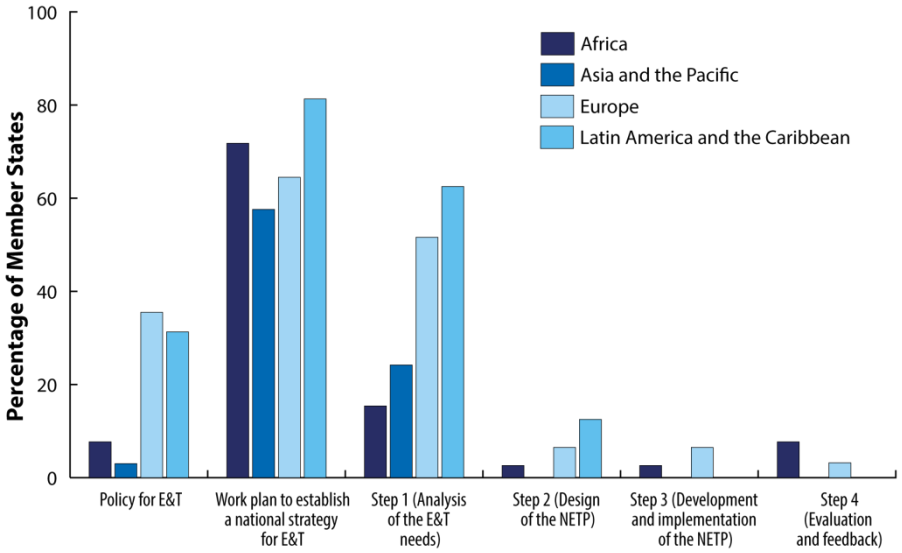

FIG. 2. Percentage of Member States receiving Agency support in each region which have completed an Agency-guided exercise on the steps involved in establishing a national strategy for education and training (E&T) in radiation, transport and waste safety as part of a national education and training programme (NETP).

46. Many Member States considering embarking on a nuclear power programme or on a first research reactor project are facing challenges in allocating resources for regulatory capacity building.

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[30] INTERNATIONAL ATOMIC ENERGY AGENCY, Building Competence in Radiation Protection and the Safe Use of Radiation Sources, IAEA Safety Standards Series No. RS-G-1.4, IAEA, Vienna (2001).

[31] INTERNATIONAL ATOMIC ENERGY AGENCY, Strategic Approach to Education and Training in Radiation, Transport and Waste Safety 2011–2020, Note by the Secretariat 2010/Note 44, IAEA, Vienna (2010).

In many of these Member States, the programme or project schedules allow limited time for the regulatory body to establish its resources and competency in order to perform its regulatory functions effectively.

47. Some Member States also encounter difficulties in recruiting competent staff, which can be traced to the absence of appropriate national infrastructure and/or coordination of national resources in education and training. There is a need for these Member States to continue their efforts to enhance the structure of their capacity building plans and to make effective use of all Agency programmes and mechanisms when submitting requests for assistance.

48. Member States have shown a greater interest in, and made increased use of, the GNSSN and its associated networks[32]. In 2016, 19 Member States developed and updated their national nuclear safety knowledge platforms under the GNSSN.

49. Member States use of, and demand for, EPR capacity building centres for regional training is increasing.

Activities

50. In 2016, 35 training events were carried out in the areas of radiation, transport and waste safety, and 38 regional and national workshops and training courses in EPR were organized. The Agency organized 35 training activities on safety assessment and design safety for staff from NPP operating organizations, regulatory bodies and technical and scientific support organizations. Ten interregional capacity building activities on nuclear safety infrastructure were conducted for 35 Member States embarking on a new nuclear power programme or expanding existing programmes. Two Technical Meetings and three training workshops were held on the topic of NPP operating experience. The Agency also organized 14 training activities and workshops on safety areas of common concern for research reactors and fuel cycle facilities, including safety assessment, management systems, ageing management and the use of a graded approach.

51. Within the framework of the Regulatory Cooperation Forum (RCF), a workshop on regulatory control and two Hands-on Regulatory Inspector Training Workshops were conducted at the Zwentendorf NPP in Austria that was constructed but not commissioned.

52. The five-month Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources was hosted by Agency-affiliated regional training centres in Africa, Asia, Europe and Latin America and the Caribbean. The Basic Professional Training Course on Nuclear Safety (BPTC) was conducted in Africa, Asia and Latin America and the Caribbean.

53. Three Education and Training Appraisal (EduTA) missions were conducted to Member States, Cuba, Georgia and Peru, and a preparatory EduTA mission was hosted by the United Arab Emirates. A regional workshop on the use of the Systematic Assessment of Regulatory Competence Needs (SARCoN) methodology was organized for Member States in the European region.

54. A Technical Meeting of the Steering Committee on Regulatory Capacity Building and Knowledge Management was held in Vienna, Austria, in December 2016, attended by participants

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[32] The GNSSN includes global networks such as, inter alia, the International Regulatory Network (RegNet), the Technical and Scientific Support Organization Forum (TSOF) and the Global Safety Assessment Network (GSAN); regional networks such as the Asian Nuclear Safety Network (ANSN), the Arab Network of Nuclear Regulators (ANNuR) and the Forum of Nuclear Regulatory Bodies in Africa (FNRBA); and thematic networks such as the Regulatory Cooperation Forum (RCF), the CANDU Senior Regulators Group (CSRG), the Forum of the State Nuclear Safety Authorities of the Countries Operating WWER Type Reactors (WWER Regulators' Forum), the Small Modular Reactor Regulators' Forum (SMR Regulators' Forum) and the Control of Sources Network (CSN).

from 26 Member States. The meeting focused on knowledge management and on the implementation of the Strategic Approach to Education and Training in Nuclear Safety 2013–2020.

55. A Technical Meeting of the Steering Committee on Education and Training in Radiation, Transport and Waste Safety was held in Vienna, Austria, in November 2016, attended by participants from 16 Member States and 2 international organizations. The Steering Committee provided to advise on the implementation of the IAEA Strategic Approach to Education and Training in Radiation, Transport and Waste Safety 2011–2020.

56. Regional cooperation to support capacity building and knowledge sharing is increasing. The Ibero-American Forum of Radiological and Nuclear Regulatory Agencies (FORO) developed common safety competency frameworks, identified regional training resources and increased the number of technical publications that it issues jointly with the Agency. During 2016, the Asian Nuclear Safety Network (ANSN)[33], the Arab Network of Nuclear Regulators (ANNuR)[34], and the Forum of Nuclear Regulatory Bodies in Africa (FNRBA)[35] organized more than 40 capacity building activities intended to support regulatory bodies. The European and Central Asian Safety Network (EuCAS) was established in 2016 and its membership now comprises 22 member organizations from 20 Member States.

Priorities and Related Activities

57. ***The Agency will assist Member State, upon request, in their capacity building programmes, including education and training in nuclear, radiation, transport and waste safety as well as EPR, and will also assist Member States in developing their expertise in the relevant technical areas. The Agency will undertake the following activities in relation to this priority:***

- The Agency will publish a Safety Report aimed at assisting Member States in the establishment of a national policy and strategy for education and training in radiation, transport and waste safety;

- The Agency will finalize the development of an IAEA Technical Document on knowledge management for regulatory bodies which draws on experience gained with the use of the SARCoN methodology;

- The Agency will organize further Regulatory Control Courses, BPTC and Hands-on Regulatory Inspectors Training Workshops, as well as SARCoN, EduTA and Education and Training Review Service (ETReS) missions. The Agency will continue to offer the Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources. The Agency will continue to organize specialized training events[36] and to offer e-learning activities such as those on the Radiation Protection of Patients (RPOP) website[37];

- The Agency will strengthen its activities to support practical learning, experimental training and assessment of training effectiveness. The Agency will facilitate the acquisition of computer codes for safety assessment, in particular for embarking countries. The current computer-based reactor simulator

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[33] The ANSN home page can be found at: https://ansn.iaea.org/default.aspx.

[34] The ANNuR home page can be found at: https://gnssn.iaea.org/main/ANNuR/Pages/default.aspx.

[35] The FNRBA home page can be found at: https://gnssn.iaea.org/main/FNRBA/Pages/default.aspx.

[36] See the nuclear safety and security training events calendar at: https://www-ns.iaea.org/training/calendar.asp.

[37] See the training section of the RPOP website: https://rpop.iaea.org/RPOP/RPoP/Content/AdditionalResources/Training/index.htm.

library will be expanded to include advanced nuclear reactor designs such as integral pressurized water reactors, sodium cooled fast reactors and high temperature gas cooled reactors;

- The Agency will enhance the Safety Assessment Education and Training Programme, which supports the updated Safety Requirements publication *Safety of Nuclear Power Plants: Design* (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1));

- The Agency will develop and assess a toolkit for 'smart decision-making' to assist Member States' interest in reactor technologies that are suited to their specific objectives and their needs for capacity building;

- The Agency will deliver training for practical implementation on topics related to the interactions between technical, human and organizational factors;

- Capacity building efforts in EPR will be increased through the activities undertaken at the capacity building centres; and

- The Agency will develop partnerships and strengthen its coordination and cooperation with existing partners within the GNSSN, as well as with other associations such as the FORO and the Western European Nuclear Regulators Association (WENRA). Monitoring progress and evaluating the performance of networks with regard to capacity building and strengthening radiation and nuclear safety infrastructure will be a key objective for the GNSSN. Deploying e-learning courses and further developing the national nuclear safety knowledge platforms will be the main priority for the GNSSN website.

A.6. Research and Development for Safety

Trends

58. Research and development (R&D) continues to be is essential for providing a sound technical bases for safety related decision-making. Much of the recent work undertaken in Member States has been dedicated to gaining an increased understanding of severe accident phenomena and novel design features to provide a demonstration of the safety of nuclear installations.

59. Member States are interested in obtaining a better understanding of how nuclear fuel behaves under accident conditions, and in developing and predicting the performance of advanced fuel types with increased tolerance to accident conditions.

60. Research and development and innovation activities on reactors are being carried out at the national and international levels. These activities relate to water cooled reactors, small and medium sized or modular reactors, fast reactors, high temperature reactors and molten salt reactors.

61. While knowledge of the health impact of low doses of radiation on humans, including non-cancer effects, continues to increase as the results of further research are reported, many fundamental questions remain. Extensive national and international research programmes to answer these questions are currently being conducted.

62. Member States are increasingly looking to R&D to support, in a sustainable and practical manner, their activities in the safety of waste management, decommissioning, and the assessment and management of environmental releases.

Activities

63. The Agency organized a Technical Meeting on Phenomenology and Technologies Relevant to In-Vessel Melt Retention and Ex-Vessel Corium Cooling in Shanghai, China, in October 2016, and contributed to the International Workshop on In-Vessel Corium Retention Strategy: Status of Knowledge and Perspectives held in Aix-en-Provence, France, in June 2016.

64. The Agency supported coordinated research projects (CRPs) on the establishment of a database of materials used in research reactors to enable continued safe operation, as well as a CRP on benchmarking against experimental data of computational methods and tools used for research reactor safety analysis.

65. An IAEA Technical Document entitled *Design Safety Considerations for Water Cooled Small Modular Reactors Incorporating Lessons Learned from the Fukushima Daiichi Accident* (TECDOC-1785)[38] was published in March 2016.

66. In 2016, work continued under the CRPs entitled 'Analysis of Options and Experimental Examination of Fuels for Water Cooled Reactors with Increased Accident Tolerance' (ACTOF) and 'Fuel Modelling in Accident Conditions' (FUMAC), which were launched, respectively, in 2015 and 2013. The ACTOF project seeks to explore the potential to design and use advanced fuels that are intended to be more tolerant of severe accident conditions. The purpose of the FUMAC project is to share experimental data and best practices in the application of fuel modelling computer codes in order to achieve a better understanding of the behaviour of water-cooled power reactor fuel in accident conditions. In addition, a CRP on the design and performance assessment of non-electric engineered safety features in advanced small and medium sized or modular reactors was launched in 2016 and will conclude in 2019.

67. A CRP on the subject of spent fuel performance assessment and research (SPAR-IV) was initiated in 2016. The objective of this CRP is to develop a technical knowledge base on the long term behaviour of power reactor spent fuel and storage system materials, including their implications for safety, through the evaluation of operating experience and research undertaken by participating Member States.

68. Another CRP, on the management of severely damaged spent fuel and corium, was initiated to establish the options for the long term management of severely damaged spent fuel (up to 100 years). The CRP results will provide the basis for characterizing, modelling and establishing the behaviour of conditioned packages, as well as for developing tools and techniques for the retrieval of severely damaged spent fuel, its stabilization for interim storage, and its further processing and disposal.

69. As part of the Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR), the Agency has developed and begun to promote two new web-based tools dealing with, respectively, industrial radiography (ISEMIR-IR) and interventional cardiology (ISEMIR-IC). The ISEMIR-IR tool is meant to be used by non-destructive testing companies carrying out industrial radiography to help them improve the implementation of occupational radiation protection, while ISEMIR-IC is a tool for radiation protection optimization in interventional cardiology facilities.

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[38] INTERNATIONAL ATOMIC ENERGY AGENCY, Design Safety Considerations for Water Cooled Small Modular Reactors Incorporating Lessons Learned from the Fukushima Daiichi Accident, IAEA-TECDOC-1785, IAEA, Vienna (2016).

Priorities and Related Activities

70. ***The Agency will assist the Member States 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 will undertake the following activities in relation to this priority:***

- Safety focused R&D will continue to be facilitated via collaborative projects with a priority on activities to support regulatory decision-making for applications related to novel NPP design features;

- The Agency will continue to organize meetings and activities to encourage R&D relating to the practical implementation of the Agency's updated safety standards, such as IAEA Safety Standards Series No. SSR-2/1 (Rev. 1), for novel NPP designs;

- The Agency will organize and conduct Technical Meetings on instrumentation for the management of severe accidents in heavy water reactors (2018–2019); spent fuel accidents and simulation codes (2018–2019); robust measures for reactor core cooling (2019); development and assessment of water cooled reactor technologies to cope with severe accidents (2018–2019); and hydrogen management in severe accidents (2018–2019);

- The Agency has planned a new CRP for 2018–2019 on performance analysis of severe accidents using multi-physics/multi-scale modelling tools. In preparation for this CRP, a Technical Meeting is planned for 2017 on the status and evaluation of severe accident simulation computer codes for water cooled reactors;

- The Agency has planned a new CRP on PSA for multi-unit, multi-reactor sites to be carried out in the period 2017–2020; and

- The Agency will prepare an IAEA Technical Document on severe accident mitigation through improvements to filtered vent systems and containment cooling strategies for water cooled reactors.

B. Improving Radiation, Transport and Waste Safety

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

Trends

71. The wider use of the application of radiation and radioactive substances in medicine results in additional medical exposure to radiation and is creating further demands for Agency guidance and assistance. Further effort is needed globally to ensure that individual medical exposures are justified and that radiation protection of patients in diagnostic imaging is optimised.

72. Complex radiotherapeutic technologies and procedures are increasingly being introduced into regions where they have not been previously used, resulting in the need to establish adequate safety measures. While there is broad agreement among experts that radiotherapy is an effective form of treatment, it is also recognized that safety measures need to be further enhanced.

73. Statistics from the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) have shown a continuous increase in the number of workers occupationally exposed to

radiation in industry, medicine and research.[39] This increase is creating a greater demand in Member States for education and training on radiation protection to assess, manage and control occupational exposure to radiation.

74. Exposure due to radon in homes remains the largest contributor to the radiation dose of many individuals.

75. There are several international standards[40] relating to radionuclides in food and drinking water that are used in emergency exposure situations and in existing exposure situations. The referenced figures of activity concentrations contained in these standards continue to differ because of the different scope of their application. There continues to be a need for a harmonized approach to control radionuclides in food and drinking water.

Activities

76. The Agency organized a Technical Meeting on Justification of Medical Exposure in Diagnostic Imaging in March 2016 which was attended by 56 participants from 28 Member States and five international organizations. The participants discussed the challenges associated with radiological imaging and identified opportunities for strengthening the justification of its use. A Technical Meeting on Patient Dose Monitoring and the Use of Diagnostic Reference Levels for the Optimization of Protection in Medical Imaging was organized in June 2016 and attended by more than 60 participants from 35 Member States 8 international organizations and professional bodies. The participants focused on identifying strengths and weaknesses in the use of diagnostic reference levels (DRLs) for optimization of patient safety and improving medical practice.

77. The Agency held a Training Course on Radiation Safety in Brachytherapy in November 2016 and introduced e-learning courses on safety and quality in radiotherapy and on radiation dose management in computed tomography. Seven internet based seminars on radiation protection in medicine were organized and involving over 1350 participants from 90 Member States.[41]

78. The Ibero-American Conference on Radiation Protection in Medicine, held in Madrid, Spain, in October 2016, reviewed advances in the implementation of the actions proposed in the Bonn Call for Action[42]. The conference provided an opportunity to exchange information and experience gained in recent years in relation to radiation protection in medicine, and to establish and strengthen ties between Ibero-American countries for cooperation in this field.

79. The Agency assisted Member States in evaluating the need for a national action plan to control exposure due to radon. In cooperation with the World Health Organization (WHO) and the National Nuclear Regulator of South Africa, the Agency organized a Workshop on the Control of Public Exposure in Compliance with the International Basic Safety Standards, held in Cape Town, South Africa, in May 2016.

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[39] UNITED NATIONS, Sources and Effects of Ionizing Radiation (2008 Report to the General Assembly), UNSCEAR, UN, New York (2008) Annex B: Sources and Effects of Ionizing Radiation.

[40] The term ‘standards’ is used in a general sense when referring to the various publications of the Food and Agriculture Organization of the United Nations, the Agency and the World Health Organization dealing with radionuclides in food and drinking water.

[41] See the training section of the RPOP website: https://rpop.iaea.org/RPOP/RPoP/Content/AdditionalResources/Training/index.htm.

[42] Bonn Call-for-Action. Joint Position Statement by the IAEA and WHO, Bonn (2012). Available online at: http://www.who.int/ionizing_radiation/medical_exposure/Bonn_call_action.pdf.

80. The Agency organized a regional training course on occupational radiation protection programmes and safety culture in collaboration with the Regional European and Central Asian ALARA ('as low as reasonably achievable') Network.

Priorities and Related Activities

81. ***The Agency will assist Member States in the application of the Agency's safety standards in radiation protection, in particular, the IAEA Safety Standards Series No. GSR Part 3 regarding the effective implementation of the principles of justification and optimization. The Agency will assist Member States in their efforts to justify the medical exposure of patients through the use of clinical guidelines and to optimize the radiation protection of patients and health workers from the use of radiation in medicine. The Agency will undertake the following activities in relation to these priorities:***

- The Agency will assist Member States to optimize the protection of patients and health workers against ionizing radiation from medical uses. The Agency will prepare IAEA Safety Standards to support justification and optimization, develop training material for health professionals, and provide information to create awareness among patients, the public and medical staff on the benefits and risks of using radiation in medicine;

- The Agency will further develop and promote the Safety in Radiation Oncology (SAFRON) and Safety in Radiological Procedures (SAFRAD) voluntary reporting and learning systems, and encourage radiological facilities in Member States to submit data to these systems to improve patient safety by sharing safety related events and safety analysis worldwide;

- The Occupational Radiation Protection Networks (ORPNET) and the Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR) will be further enhanced;

- The Agency will encourage Member States embarking on a nuclear power programme to participate in the Information System on Occupational Exposure (ISOE)[43] in order to facilitate the transfer of experience related to optimizing protection against occupational exposure to radiation;

- The Agency will prepare a Safety Guide on the radiation exposure of workers in the uranium mining and extraction industries, which will also cover the application of a graded approach to the radiation safety of workers in naturally occurring radioactive material industries;

- The Agency will initiate joint activities, including workshops, with the Food and Agriculture Organization of the United Nations and the WHO to better harmonize the existing international standards relating to radioactive material in food and drinking water in existing exposure situations; and

- The Agency will continue its work with the WHO to raise awareness of public exposure due to radon in homes and to assist Member States that need to do so to establish and implement national action plans to reduce such exposures.

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[43] The IAEA and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA) jointly operate the ISOE.

B.2. Control of Radiation Sources

Trends

82. The increased use of sealed radioactive sources in medicine, industry, agriculture and research, has resulted in further demands for appropriate arrangements for the management of sealed radioactive sources that are no longer in use.[44]

83. Member States continue to be supportive of, the Code of Conduct on the Safety and Security of Radioactive Sources[45]. The number of Member States expressing their support to the Code and its associated Guidance on Import and Export of Radioactive Sources continues to increase. As of December 2016, 133 Member States, including 6 in the reporting period, had made a political commitment to implementing the Code. In addition, 106 Member States, including 8 in the reporting period, notified the Director General of their intention to act in a harmonized manner with the Code's supplementary Guidance on the Import and Export of Radioactive Sources[46]. A total of 139 Member States, including 7 in the reporting period, nominated points of contact for facilitating the export and import of radioactive sources.

Activities

84. The Agency organized a third Open-ended Meeting of Legal and Technical Experts to Develop Internationally Harmonized Guidance for Implementing the Recommendations of the Code of Conduct on the Safety and Security of Radioactive Sources in Relation to the Management of Disused Radioactive Sources, in Vienna, Austria, in June–July 2016. The meeting was attended by 108 participants from 69 Member States. Revised draft guidance on the management of disused radioactive sources was produced.

85. The fourth Open-ended Meeting of Technical and Legal Experts to Share Information on States' Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and Its Supplementary Guidance on the Import and Export of Radioactive Sources was held in May–June 2016. The meeting was attended by 190 participants from 102 Member States and two non-Member States. Participants shared information on their national implementation of the Code and the Guidance and took note of the development of Guidelines for preparation of national papers for the next such Open-ended Meeting, foreseen for 2019.

86. The Agency initiated regional and international projects on the cradle-to-grave control of radioactive sources, focusing on the management of radioactive sources at the end of their life. These projects supported Member States activities in developing regulatory frameworks and operations for the conditioning of disused sealed radioactive sources.

Priorities and Related Activities

87. ***The Agency will assist Member States in the management of radioactive sources from cradle to grave through guidance documents, peer reviews, advisory services and workshops. The Agency will also promote the effective application of the Code of Conduct on the Safety and Security of***

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[44] Radioactive sources are defined as 'disused' when they are no longer used for the practice for which they were authorized.

[45] INTERNATIONAL ATOMIC ENERGY AGENCY, Code of Conduct on the Safety and Security of Radioactive Sources, IAEA, Vienna (2004). Available at: http://www-pub.iaea.org/MTCD/publications/PDF/code-2004_web.pdf

[46] INTERNATIONAL ATOMIC ENERGY AGENCY, Guidance on the Import and Export of Radioactive Sources, IAEA, Vienna (2012). Available at: http://www-pub.iaea.org/MTCD/publications/PDF/8901_web.pdf

Radioactive Sources and facilitate the sharing of experience. The Agency will undertake the following activities in relation to these priorities:

- The Agency will finalize the draft Guidance on the Management of Disused Radioactive Sources; and

- The Agency will assist Member States in their efforts to build the capacity to implement the provisions of the Code of Conduct on the Safety and Security of Radioactive Sources.

B.3. Safe Transport of Radioactive Material

Trends

88. The increased use of radioactive material in Member States is creating additional demands for regulatory oversight, including for transport within and across national borders. Many Member States do not have the regulatory capacity or framework for oversight of the transport of radioactive material within and across their borders.

89. Interaction with Member States indicated that the complexity of the *Regulations for the Safe Transport of Radioactive Material* (IAEA Safety Standards Series No. SSR-6)[47] may prevent their implementation into the laws and regulations of the developing Member States that have a need for a limited range of transport of radioactive material.

Activities

90. The draft revision of the IAEA Safety Standards Series No. SSR-6 was made available to Member States for consultation. A draft revision of the *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition)* (IAEA Safety Standards Series No. SSG-26)[48] is being prepared.

91. The Agency continued to support capacity building for the regulatory oversight of transport of radioactive material in over 80 Member States Member States in Africa, Asia and the Pacific, and the Mediterranean region.

Priorities and Related Activities

92. ***The Agency will assist Member States in building capacity for the safe transport of radioactive material. The Agency will undertake the following activities in relation to this priority:***

- The Agency will assist Member States in building capacity for the safe transport of radioactive material through workshops, its peer review and advisory services and the development of appropriate e-learning material;

- The Agency will pilot test and launch an e-learning platform for the safe transport of radioactive material;

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[47] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series No. SSR-6, IAEA, Vienna (2012).

[48] INTERNATIONAL ATOMIC ENERGY AGENCY, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition), IAEA Safety Standards Series No. SSG-26, IAEA, Vienna (2014).

- The Agency will continue to foster collaboration among transport regulatory bodies within the regions, as well as with Member States with more established regulatory programmes, to support the development of appropriate regulatory oversight of the transport of radioactive material; and

- The Agency will complete the development of guidance for the application of IAEA Safety Standards Series No. SSR-6 and make it easier to use and facilitate its direct adoption in the transport-related laws and regulations of Member States.

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

Trends

93. Member States continue to seek Agency assistance with developing their long term management solutions for radioactive waste and the safe implementation of such solutions.

94. Experience from completed and ongoing decommissioning projects indicates that the costs of decommissioning can be underestimated, leading to challenges in completing decommissioning projects.

95. The nuclear industry is in general experiencing an ageing workforce and also faces the difficulty of attracting and retaining young professionals, and this is particularly acute for decommissioning activities.

96. Progress is being made in several Member States on the development of geological disposal facilities for high level radioactive waste and spent fuel. A construction licence for a geological disposal facility for spent fuel has been granted in Finland and a licence application for construction of a disposal facility for spent fuel has been submitted in Sweden. In the coming years, it is expected that several other Member States will continue to make progress on the geological disposal of high level waste and spent fuel while others will have to develop comprehensive programmes for the safe management of high level waste and spent fuel, including their disposal.

Activities

97. The Agency organized the International Conference on Advancing the Global Implementation of Decommissioning and Environmental Remediation Programmes in Madrid, Spain, in May 2016. The conference was attended by 540 participants from 54 Member States and 4 international organizations. The participants shared and reviewed challenges, achievements and lessons related to the decommissioning and environmental remediation programmes that have been implemented. In particular, the conference participants discussed the importance of addressing legacies from past nuclear activities, identified current priority needs and provided recommendations on the strategies and approaches for the safe and effective implementation of decommissioning and environmental remediation programmes.

98. The Agency organized an International Conference on the Safety of Radioactive Waste Management, in Vienna, Austria, in November 2016 attended by 276 participants from 63 Member States and 4 international organizations. The conference facilitated information exchange on the management of all types of radioactive waste, as well as on current and future challenges, and highlighted the need for continued assistance to Member States in building and strengthening the capacities of both regulators and operators. This aspect was also highlighted during the International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally, held in April 2016.

99. The Agency has convened the International Project on Demonstration of the Operational and Long-Term Safety of Geological Disposal Facilities for Radioactive Waste (GEOSAF-II) and the International Project on Human Intrusion in the Context of Disposal of Radioactive Waste (HIDRA), on the safety of high level radioactive waste disposal.

100. Implementation of the International Project on Managing the Decommissioning and Remediation of Damaged Nuclear Facilities continued in 2016. The Agency convened meetings of the working groups on regulatory, technical and strategic planning aspects, and is compiling the results of these meetings.

101. The Agency is assisting Member States that are actively pursuing borehole disposal as an option for disused sealed radioactive sources. This assistance includes training on regulations for waste disposal, including borehole disposal, and the consolidation of IAEA Technical Documents supporting the borehole disposal option, including radioactive source conditioning operations.

Priorities and Related Activities

102. ***The Agency will assist Member States in developing and implementing national policies and strategies for the safe management of radioactive waste, including geological disposal of high level waste and the development of decommissioning strategies and plans. The Agency will undertake the following activities in relation to this priority:***

- The Agency will further strengthen the draft guidelines for the ARTEMIS peer review service, as well as enhance the self-assessment module using the experience gained from the organization of the first ARTEMIS reviews to be carried out in 2017 and 2018. The Agency will work with Member States to ensure the availability of sufficient internationally recognized experts to support the ARTEMIS review activities;

- The Agency will organize a Technical Meeting to obtain the views of Member States on issues relating to institutional controls and termination of authorization for the decommissioning of nuclear facilities;

- The Agency will provide assistance to Member States in line with the outcomes of the International Conference on Advancing the Global Implementation of Decommissioning and Environmental Remediation Programmes;

- The Agency will assist Member States with the establishment of national policies for the management of liabilities associated with the decommissioning of disused nuclear facilities and the remediation of contaminated lands, together with relevant strategies for their implementation;

- The Agency will assist Member States in adopting a holistic approach to decommissioning, environmental remediation activities and management of the associated waste in order to avoid imposing an undue burden on future generations;

- The Agency will, upon request, assist Member States in their efforts to evaluate licence applications for the borehole disposal of disused sealed radioactive sources;

- The Agency will, upon request, assist Member States efforts to develop comprehensive policies and strategies for the safe management of high level radioactive waste and spent fuel, including disposal; and

- The Agency will assist Member States in building and strengthening the capacities of both regulatory bodies and operating organizations for the development of safe geological disposal facilities for high level radioactive waste and spent fuel, as well as of disposal options for other radioactive waste classes and disused sealed radioactive sources.

B.5. Radiation Protection of the Environment and Remediation

Trends

103. The increasing use of nuclear techniques and applications worldwide has resulted in an increased demand for analysing and evaluating the radiological implications of radionuclides being released to the environment.

104. There has been growing recognition of the need to remediate uranium legacy sites. This need has also been recognized through international assistance programmes for the remediation of former uranium production sites in Central Asia.

105. The participation of many Member States in the Agency's International Working Forum on Regulatory Supervision of Legacy Sites (RSLS) reflecting the need for enhanced coordination and knowledge transfer concerning the remediation of these sites.

Activities

106. The Agency launched the second phase of the Modelling and Data for Radiological Impact Assessments (MODARIA) programme. The first Technical Meeting for MODARIA II was organized in October–November 2016 and attended by 145 participants from 47 Member States. The programme is intended to build up experience and transfer knowledge in the field of assessing radiation doses arising from radionuclides in the environment.

107. The Agency organized a Technical Meeting on Remediation Techniques and Strategies in Post- Accident Situations, in Vienna, Austria, in June 2016, attended by 55 participants from 35 Member States and 2 international organizations. The meeting participants shared knowledge and experience related to their activities on remediation and recovery of contaminated areas and on the application of the Agency's safety standards. The Agency is analysing experience gained from the Chernobyl and Fukushima Daiichi accidents with the aim of preparing a Safety Report on situation-specific remediation strategies for contaminated urban and rural areas for a wide range of environmental conditions.

108. A series of consultation meetings on post-accident recovery, including environmental remediation, were conducted between the Agency, international experts and the Ministry of the Environment of Japan. Summaries of the meetings containing updated information about Japan's environmental remediation activities were shared with the international community through Agency networks.

109. The Agency's Coordination Group for Uranium Legacy Sites (CGULS) continues to play a pivotal role in coordinating the many different organizations working towards the goal of sustainable remediation of uranium legacy sites in Central Asia.

110. The Agency completed the development of a comprehensive seven-module training course on the safety and regulatory aspects of uranium production. A substantial portion of this training course is directed towards the remediation of legacy uranium production sites.

Priorities and Related Activities

111. ***The Agency will promote and facilitate the sharing of experience gained in dealing with the remediation of contaminated areas, including from post-accident situations and uranium legacy sites. The Agency will undertake the following activities in relation to this priority:***

- The Agency will publish reports on situation-specific remediation strategies for contaminated urban and rural areas for a wide range of environmental conditions and on the remediation and decommissioning of an area or site affected by a nuclear or radiological emergency;

- The Agency will publish two reports aimed at preventing legacy site situations from arising in the future, focusing on the safety aspects of uranium production and the development and management of uranium production by in situ leaching;

- The Agency will disseminate the lessons learned from the remediation and management of uranium legacy sites to all those responsible for operating or developing new uranium production sites;

- The Agency will assist Member States in identifying and evaluating sites that have been contaminated with radionuclides by past practices so that such sites can be brought under appropriate regulatory control; and

- The Agency will assist Member States efforts to be prepared for post-accident remediation activities, including, the establishment of criteria for doses to people and contamination levels in soil, food and drinking water and planning for the implementation of remediation.

C. Strengthening Safety in Nuclear Installations

C.1. Nuclear Power Plant Safety

C.1.1. Operational Safety: Operating Experience and Long Term Operation

Trends

112. The need for effective and proactive leadership and management to promote continuous safety improvements is a recurring lesson of the most recent OSART missions. These missions also highlighted that further efforts are needed to:

— Reinforce consideration of the interactions between technological, human and organizational factors;

— Improve the use of operational experience to prevent the recurrence of safety significant events, identify safety upgrades and complete the programmes of safety improvements;

— Manage the challenges associated with an ageing workforce; and

— Further strengthen accident management and on-site EPR.

113. Analysis of data from the International Reporting System for Operating Experience[49] indicates a number of ongoing challenges. These challenges include addressing the vulnerabilities in the design of NPPs and their operation in relation to protection against external hazards. The data also indicate that contractor surveillance continues to be a challenge and that the number of incidents related to component degradation due to ageing is increasing.

[49] The Joint IAEA–OECD/NEA International Reporting System for Operating Experience is a tool to exchange information on events at NPPs and increase awareness of actual and potential safety problems.

114. Programmes are being implemented for an increasing number of nuclear power reactors around the world for long term operation (LTO) and ageing management. At the end of 2016, 45% of the 450 nuclear power reactors operating in the world had been in operation for between 30 and 40 years, and another 15% for more than 40 years (see Figure 3).

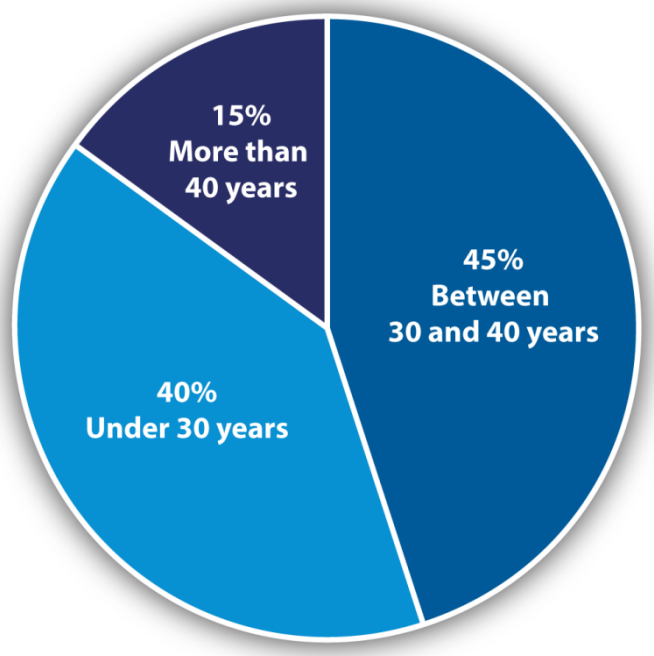

FIG. 3. Age distribution for all nuclear power reactors in 2016 based on information from the IAEA PRIS system.[50]

115. The Agency noted an increase in Member State requests for the Safety Aspects of Long Term Operation (SALTO) peer review service. The number of such missions increased from three to four per year in 2012–2015 to nine in 2016.

Activities

116. The Agency conducted three OSART missions in 2016, in Canada, France and Romania, and five follow-up OSART missions, in France (2), Hungary, the Netherlands and the Russian Federation. The *OSART Guidelines: 2015 Edition* (IAEA Services Series No. 12 (Rev. 1))[51] was published. The new guidelines take into account the lessons arising from the Fukushima Daiichi accident and experience gained from the application of the Agency's safety standards.

117. The Agency conducted four SALTO missions to Argentina, Armenia, Bulgaria and Sweden, and three follow-up SALTO missions to Belgium, the Czech Republic and Sweden. In addition, two expert missions based on the SALTO methodology were carried out in Belgium and Brazil. The large quantity of data collected during these missions was analysed by the Agency and presented at a Technical Meeting on lessons learned from SALTO peer reviews held in Vienna, Austria in June

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[50] The Power Reactor Information System (PRIS), developed and maintained by the IAEA, is a comprehensive database focusing on nuclear power plants worldwide.

[51] INTERNATIONAL ATOMIC ENERGY AGENCY, OSART Guidelines, 2015 Edition, IAEA Services Series No. 12 (Rev. 1), IAEA, Vienna (2016).

2016, attended by more than 40 participants from 23 Member States and 1 international organization. The Agency also prepared a "SALTO mission highlights" report, for use during missions and training activities that summarized the results of 22 SALTO missions and 6 SALTO follow-up missions.

118. The Agency conducted SALTO workshops/seminars, workshops on LTO and ageing management, and support missions in Argentina, Armenia, Brazil, China, the Czech Republic, Finland, France, Mexico, Pakistan, Romania, the Russian Federation, Slovenia, South Africa, Sweden, Ukraine and the United States of America in preparation for SALTO missions. The third phase of the International Generic Ageing Lessons Learned (IGALL) programme was initiated with the participation of 29 Member States that have operating NPPs. The programme provides a technical basis and practical guidance on managing ageing of structures, systems and components of NPPs.

119. In 2016, the Agency signed Practical Arrangements with the CANDU Owners Group to cooperate in the area of safe and reliable operation of CANDU-type pressurized heavy water reactors worldwide. The Agency continued its dialogue with the World Association of Nuclear Operators (WANO) to improve the coordination of activities to ensure effective and efficient peer review of operational safety.

Priorities and Related Activities

120. ***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. The Agency will undertake the following activities in relation to these priorities:***

- The Agency will finalize the development of a revised Safety Guide on ageing management and development of an LTO programme for NPPs;

- The Agency will further improve the coordination of its activities with WANO within their respective mandates, governing regulations, rules, policies and procedures to ensure effective and efficient international peer review of operational safety; and

- The Agency will continue to assist Member States in their efforts to strengthen the effective management of operating experience. This will include the reporting, screening, trending and analysis of events and near misses at their own NPPs and also taking account of such events in NPPs of other Member States.

C.1.2. Site and Design Safety

Trends

121. The International Nuclear Safety Group (INSAG) noted that modern reactor designs are being developed to reduce the risks from internal events to very low levels. The predominant source of risk is likely to arise from external events, which justifies continuing attention in the years ahead.[52]

122. Based on the results of Agency Technical Meetings, there is continuing Member State interest in addressing lessons arising from the Fukushima Daiichi accident related to: the uncertainties associated with the evaluation of extreme external hazards; the need for using historical and prehistoric data in the evaluation of external hazards; consideration of external hazard combinations; consideration of the impact of external hazards on multi-unit sites; and the use of a probabilistic approach to the analysis of external events. The Agency continued to update safety standards and issued detailed Technical

[52] INSAG Annual Letter of Assessment 2015: https://www-ns.iaea.org/committees/files/insag/743/INSAGLetter2015.pdf.

Documents and Safety Reports supporting the protection of nuclear installations against external hazards.

123. During 2016, the Agency received 19 requests from Member States for SEED review missions, capacity building and training workshops. A number of Member States have initiated siting and site evaluation activities before having the necessary regulatory framework in place for these activities. This leads to difficulties during site selection and site evaluation processes and during the review and licensing process.

124. The Vienna Declaration on Nuclear Safety adopted principles to guide the Contracting Parties in the implementation of the CNS objective to prevent accidents with radiological consequences and mitigate such consequences should they occur. The current Agency safety standards also require design features to mitigate the consequences of accidents and also to practically eliminate large or early radioactive releases. For NPPs designed to meet earlier standards, such objectives may be challenging.

125. Innovative reactor designs for future deployment will need to ensure that all reasonable measures are taken to have the highest assurance that accidents with large external consequences will be practically eliminated. The new NPPs currently being licensed already incorporate improvements in their design to prevent severe accidents and mitigate their consequence.

Activities

126. The Agency continued to update safety standards and issued detailed Technical Documents and Safety Reports supporting the enhancement of site safety, including *Site Evaluation for Nuclear Installations (*IAEA Safety Standards Series No. NS-R-3 (Rev. 1)), *Volcanic Hazard Assessments for Nuclear Installations: Methods and Examples in Site Evaluation* (IAEA-TECDOC-1795)[53], *Seismic Hazard Assessment in Site Evaluation for Nuclear Installations: Ground Motion Prediction Equations and Site Response* (IAEA-TECDOC-1796)[54] and *Diffuse Seismicity in Seismic Hazard Assessment for Site Evaluation of Nuclear Installations* (Safety Reports Series No. 89)[55].

127. The Agency conducted three preparatory SEED missions — Belarus, France and the Islamic Republic of Iran, five SEED peer review missions — Japan, Jordan, Pakistan, Poland and Tunisia, and six SEED training workshops. The Agency conducted two expert missions to Egypt: in January to assist the Egyptian Nuclear and Radiological Regulatory Authority (ENRRA) in reviewing regulations on siting; and in May to assist ENRRA in reviewing the population distribution at the El-Dabaa site.

128. The Agency organized a Technical Meeting on Lessons Learned and Safety Improvements Related to External Hazards Based on the IAEA Fukushima Report in November 2016 which was attended by more than 50 participants from 30 Member States. The participants exchanged information and experience related to the safety improvements that have been achieved at operating nuclear installations since the Fukushima Daiichi accident. The participants also shared best practices in the identification of potential safety issues and areas for improvement related to external hazards and how these issues were addressed.

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[53] INTERNATIONAL ATOMIC ENERGY AGENCY, Volcanic Hazard Assessments for Nuclear Installations: Methods and Examples in Site Evaluation, IAEA-TECDOC-1795, IAEA, Vienna (2016).

[54] INTERNATIONAL ATOMIC ENERGY AGENCY, Seismic Hazard Assessment in Site Evaluation for Nuclear Installations: Ground Motion Prediction Equations and Site Response, IAEA-TECDOC-1796, IAEA, Vienna (2016).

[55] INTERNATIONAL ATOMIC ENERGY AGENCY, Diffuse Seismicity in Seismic Hazard Assessment for Site Evaluation of Nuclear Installations, Safety Reports Series No. 89, Vienna (2016).

129. The Agency published a revised Safety Guide entitled *Design of Instrumentation and Control Systems for Nuclear Power Plants* (IAEA Safety Standards Series No. SSG-39)[56]. The Agency also published *Considerations on the Application of the IAEA Safety Requirements for the Design of Nuclear Power Plants* (IAEA-TECDOC-1791)[57] to support the revised safety standards. This publication is intended to facilitate an understanding of selected new topics and terms, such as design extension conditions and practical elimination introduced in IAEA Safety Standards Series No. SSR-2/1 (Rev. 1). IAEA-TECDOC-1791 elaborates on the practical incorporation of design extension conditions into the plant design as part of the defence in depth approach and on the demonstration of practical elimination of large or early releases.

130. The Agency organized two workshops in Asia to support the practical application of the design safety principles established in the revised Agency Safety Requirements.

Priorities and Related Activities

131. ***The Agency will assist Member States in the application of the Agency safety standards relating to the evaluation of external events. The Agency will assist Member States in their application of the Agency safety standards for safety assessment and design of nuclear installations. The Agency will undertake the following activities in relation to these priorities:***

- The Agency will revise and update its safety standards and will develop technical guidance for Member States to address the uncertainties related to the evaluation of external hazards at nuclear installations as well as the impact of external hazards on multi-unit sites;

- The Agency will assist, through its advisory services and training activities, Member States embarking on a nuclear power programme in the development of a regulatory framework and qualified human resources for siting and site evaluation. The Agency will also assist Member States in the implementation of the recommendations of SEED reviews;

- The Agency will continue to progress with the development of nine new and revised Safety Guides on NPP design dealing with the following specific topics: seismic design and qualification; protection against internal hazards; design of the reactor core; design of fuel handling and storage systems; design of the reactor coolant system; design of the reactor containment system; human factors engineering; deterministic safety analysis; and the format and content of the safety analysis report;

- The Agency will organize workshops on the safety demonstration related to new safety features for the prevention and mitigation of severe accidents and the application of new technologies resulting in the practical elimination of early or large radioactive releases; and

- The Agency will convene an International Conference on Topical Issues in Nuclear Installation Safety: Safety Demonstration of Advanced Water Cooled Nuclear Power Plants in June 2017 in Vienna, Austria.

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[56] INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Instrumentation and Control Systems for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-39, IAEA, Vienna (2016).

[57] INTERNATIONAL ATOMIC ENERGY AGENCY, Considerations on the Application of the IAEA Safety Requirements for the Design of Nuclear Power Plants, IAEA-TECDOC-1791, IAEA, Vienna (2016).

C.1.3. Severe Accident Prevention and Mitigation

Trends

132. The lessons arising from the Fukushima Daiichi accident highlighted the need for accident management provisions to be clear, comprehensive, well designed and based on the challenges that operators and decision-makers may face when dealing with a severe accident.

Activities

133. The Agency has continued to strengthen the SAMG-D ('Severe Accident Management Guideline Development') Toolkit. The objective of the Toolkit is provide training to Member States on how to prepare SAMGs and is applicable to both operating organizations and regulatory bodies. The Toolkit is based on the Agency's safety standards and associated Technical Documents.

134. The Agency piloted the revised SAMG-D Toolkit during a two-day workshop in December 2016 to assess its effectiveness and identify areas for further improvement.

135. The Agency organized a Technical Meeting on the Verification and Validation of Severe Accident Management Guidelines in December 2016. This meeting was attended by over 50 participants from 16 Member States and three international organizations. The participants shared best international practices on how to ensure the effectiveness of SAMGs through verification and validation.

Priorities and Related Activities

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

- The Agency will finalize the development of a revised Safety Guide on severe accident management;
- The Agency will prepare a Technical Document to share the available information on severe accident management and guide Member States in their further development of SAMGs; and
- The Agency will organize Technical Meetings and training activities to enhance Member State awareness of the need for clear, comprehensive and well designed SAMGs.

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

Trends

137. Several Member States are showing an interest in small and medium sized or modular reactors (SMRs). The development of SMRs involves the use of passive safety features, and an increased use of factory construction and inspection techniques. Currently, there are about 50 SMR designs under development.

138. Feedback from Agency activities, including international meetings and Technical Safety Review services, has shown an increased interest in the application of the Agency's design-related Safety Requirements to SMR designs.

Activities

139. The Agency facilitated meetings of the SMR Regulators' Forum's Steering Committee and its Working Groups. The three Working Groups developed reports on the size of emergency planning zones, application of defence in depth and application of a graded approach to SMRs.

140. The Agency conducted two workshops on SMR safety and licensing for members of ANNuR and the FNRBA. The workshops provided a forum for sharing information on the status of global SMR designs that are scheduled for near term licensing, a forum to present ongoing regulatory efforts and challenges, and an introduction to the licensing processes.

141. The Agency has initiated a study on the application of the design-related Safety Requirements to SMR designs intended for near term deployment. This study includes a review of current practices in Member States with regard to the application of the Agency's safety standards to SMR technologies, and the development of an IAEA Technical Document on their applicability to SMRs.

Priorities and Related Activities

142. ***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 and safety assessment, and share best practices. The Agency will undertake the following activities in relation to this priority:***

- The Agency will continue providing support to the SMR Regulators' Forum to facilitate discussions on issues of common interest. It will also organize workshops for Member States embarking on a new nuclear programme that includes SMRs, in order to share information and experience of nuclear regulation;
- The Agency will conclude a study on the application of its safety standards to SMR designs; and
- The Agency will organize a Technical Meeting to assist Member States in the application of its Safety Requirements to the design of SMRs.

C.3. Research Reactor Safety

Trends

143. Feedback from Agency activities has shown that an increasing number of Member States are applying the provisions of the Code of Conduct on the Safety of Research Reactors. However, there remains a need for further improvements in capacity building to enhance regulatory effectiveness, the implementation of systematic programmes for ageing management and periodic safety reviews, emergency planning and the development of decommissioning plans.

144. Many Member States are planning or implementing modification and refurbishment projects to address ageing of the structures, systems and components of research reactors. Projects on physical protection systems are also planned or being implemented to strengthen the security measures at many facilities. It is important to ensure adequate coordination when planning and implementing these projects for effective management of the safety–security interface.

Activities

145. The recently published Safety Requirements publication *Safety of Research Reactors* (IAEA Safety Standards Series No. SSR-3) focuses on the design and operation of research reactors, including design extension conditions, management of the interface between safety and security, and

use of computer based systems important to safety. The Agency also published *Management of the Interface between Nuclear Safety and Security for Research Reactors* (IAEA-TECDOC-1801)[58], which provides technical guidelines and practical information for coordinating safety and security at research reactor sites.

146. The Agency conducted three Integrated Safety Assessment of Research Reactors (INSARR) missions in Jordan, the Netherlands and Portugal and a follow-up INSARR mission in Malaysia. These missions reviewed the operational safety of the facilities and provided guidance and recommendations for further safety improvements.

147. The Agency also conducted advisory missions to five Member States to Indonesia, Jamaica, Malaysia, Peru and Poland, to assist research reactor operating organizations in implementing safety enhancements based on the recommendations of previous INSARR missions related to safety management, operational radiation protection, emergency planning and instrumentation upgrades. An expert mission was also conducted to Ghana, which provided recommendations to ensure safety in converting a research reactor to the use low of enriched uranium fuel.

148. The Agency organized a Technical Meeting on the Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors in May 2016 attended by 54 participants from 38 Member States. The participants shared information and exchanging knowledge and experiences in relation to the use of a graded approach in the application of the safety requirements for research reactors.

149. The annual meetings of the Regional Advisory Safety Committees for Research Reactors in Africa, Asia and the Pacific, and Europe were held with the participation of 29 Member States. The meetings discussed research reactor safety issues of common concern and strategies for harmonizing national practices within the regions in line with the Agency's safety standards.

Priorities and Related Activities

150. ***The Agency will assist Member States in performing 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 recently revised Agency Safety Requirements. The Agency will undertake the following activities in relation to these priorities:***

- The Agency will 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 through peer review services, regional meetings and organization of the triennial International Meeting on Application of the Code of Conduct on the Safety of Research Reactors in May 2017;

- The Agency will assist Member States in performing safety assessments for research reactors taking into account lessons arising from the Fukushima Daiichi accident and in implementing the safety upgrades identified through such assessments by organizing Technical Meetings and workshops and conducting safety review and advisory service missions;

- The Agency will assist Member States in addressing ageing management and periodic safety reviews through the development of a Safety Report on periodic safety reviews, by conducting safety review and advisory service missions to examine projects for the refurbishment and upgrade of

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[58] INTERNATIONAL ATOMIC ENERGY AGENCY, Management of the Interface between Nuclear Safety and Security for Research Reactors, IAEA-TECDOC-1801, IAEA, Vienna (2016).

research reactors, and by organizing training activities, workshops and Technical Meetings on these topics; and

- The Agency will assist Member State regulatory bodies in developing the programmes and competences necessary to ensure effective regulatory control of research reactors. The Agency will assist Member States in developing capacity for assessing safety culture in research reactor operating organizations by conducting safety reviews and training activities.

C.4. Fuel Cycle Facility Safety

Trends

151. The Agency's safety standards for fuel cycle facilities have been further developed and cover a wide range of facilities and activities, including criticality safety, conversion and enrichment, fuel fabrication, interim spent fuel storage, reprocessing, waste monitoring, and R&D.

152. There is an increase in the participation of Member States in the Fuel Incident Notification and Analysis System (FINAS), which is a self-reporting and information sharing system on lessons learned from incidents at nuclear fuel cycle facilities.

153. The feedback from FINAS data and from the Agency's activities on the safety of nuclear fuel cycle facilities shows the need to give continued attention to regulatory effectiveness, including the establishment of inspection programmes addressing relevant lessons arising from the Fukushima Daiichi accident. This feedback also highlights the need to develop and maintain adequately qualified human resources to ensure operational safety.

Activities

154. The Agency submitted the Safety Requirements publication on the safety of nuclear fuel cycle facilities for approval by the Safety Standards Committees. The Agency published *Safety Reassessment for Nuclear Fuel Cycle Facilities in Light of the Accident at the Fukushima Daiichi Nuclear Power Plant* (Safety Reports Series No. 90)[59]. The Agency also organized a workshop on the topic of this Safety Report with the participation of 21 Member States.

155. The Agency organized a workshop on safety analysis and safety documents for nuclear fuel cycle facilities, involving participants from 17 Member States. The workshop provided the participants with practical information based on the Agency's safety standards. This included safety analysis methods, criticality safety analysis, consideration of ageing of the structures, systems and components when performing safety analysis, as well as on establishing processes for periodic safety reviews of such facilities.

156. The Agency and the Organisation for Economic Co-operation and Development/Nuclear Energy Agency (OECD/NEA) jointly conducted the biennial Technical Meeting for the National Coordinators of FINAS, in Paris, France in October 2016, with the participation of 19 Member States. The meeting provided a forum for the exchange of operating experience and for discussion of the events reported to FINAS, including their root causes and actions taken to prevent their recurrence.

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[59] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Reassessment for Nuclear Fuel Cycle Facilities in Light of the Accident at the Fukushima Daiichi Nuclear Power Plant, Safety Reports Series No. 90, IAEA, Vienna (2016).

Priorities and Related Activities

157. ***The Agency will assist Member States in performing safety assessments and in implementing safety upgrades to nuclear fuel cycle facilities. The Agency will undertake the following activities in relation to this priority:***

- The Agency will finalize the revision of the Safety Requirements publication on the safety of nuclear fuel cycle facilities and will develop guidance, in the form of a Safety Report, on the use of a graded approach for nuclear fuel cycle facilities. The Agency will also conduct training activities on the application of the Agency's safety standards;

- The Agency will develop a report on safety analysis and safety documents for nuclear fuel cycle facilities to guide Member States in performing safety analysis as well as in preparing, updating and reviewing safety documents for such facilities;

- The Agency will promote the sharing of information on operating experience feedback for nuclear fuel cycle facilities and will continue to operate FINAS, as well as disseminating root causes of reported events and the associated lessons learned; and

- The Agency will conduct, upon request, advisory service missions and training activities to assist Member States in addressing the challenges involved in establishing effective ageing management programmes that address the diversity of nuclear fuel cycle facilities and their particular design features, taking into account the potential nuclear and chemical hazards that are often specific to such facilities.

C.5. Safety Infrastructure for Embarking Countries

C.5.1. Nuclear Power Programmes

Trends

158. Around 30 Member States are at different stages of initiating new nuclear power programmes. The IRRS and Integrated Nuclear Infrastructure Review (INIR) missions have identified that for several Member States there remains a need to establish an adequate and effective regulatory framework, including an independent regulatory body with a sufficient number of qualified and competent staff.

159. As observed during relevant Agency expert missions, the regulatory bodies of some Member States embarking on nuclear power programmes are yet to finalize appropriate human resource development policies, strategies and programmes that take into consideration the exact scope, scale and schedule of their prospective nuclear power programmes.

160. The Agency's INIR missions continue to be in high demand among those Member States initiating new nuclear power programmes.

Activities

161. The Agency continued to assist Member States embarking on new programmes in establishing and strengthening their national nuclear safety infrastructures through peer reviews, such as the IRRS, and advisory services. Several activities in the area of regulatory frameworks and infrastructure were conducted, including expert missions, workshops or training courses that provided guidance and information on all elements of establishing an effective nuclear safety infrastructure. These activities focused on the development of national nuclear safety regulations, the establishment of a management system at the regulatory body, and the preparation of a national plan for human resource development,

particularly a competency and training framework for the regulatory body. Additionally, many of these Member States received assistance from the Agency to enhance their technical capabilities in the areas of regulatory review and assessment, and regulatory inspection.

162. The Agency conducted four national workshops to assist Member States, including on: establishing a communication strategy to build public confidence in the regulatory body; inspection of NPP construction; vendor inspections and construction project management; and drafting safety evaluation reports.

163. The Agency conducted two regional workshops to assist Member States on the topics: review and assessment by the regulatory body; knowledge management at the regulatory body and its technical and scientific support organization; information and communication technology interfaces; drafting of nuclear safety regulations; and communication by the regulatory body.

164. Within the framework of the Regulatory Cooperation Forum (RCF) the four current RCF recipient Member States (Belarus, Jordan, Poland and Viet Nam) identified the necessary RCF support activities including a regulatory control workshop organized by the Agency. More importance has been placed on the enhancement of coordination for support activities, including within networks such as the ANSN, ANNuR and FNRBA.

165. The Agency conducted 25 capacity and competency building activities such as workshops, and training courses based on the Safety Assessment Education and Training (SAET) Programme, for Member States embarking on a new nuclear power programme. These activities were aimed at providing regulatory bodies, future owner/operator organizations and technical and scientific support organizations with essential knowledge related to, and practical training in, safety assessment.

166. In 2016, two INIR Phase 1[60] missions to Kazakhstan and Malaysia and two follow-up missions to Bangladesh and Poland and were conducted. INIR mission recommendations and suggestions are incorporated in the RCF support plan for regulatory infrastructure development.

Priorities and Related Activities

167. ***The Agency will assist member States in the development of safety infrastructures for new nuclear power programmes. The Agency will undertake the following activities in relation to this priority:***

- The Agency will provide assistance to Member States embarking on a nuclear power programme to enhance their technical capabilities in the areas of safety review, assessment and authorization through Agency workshops, expert missions, scientific visits and fellowships;

- The Agency will continue to provide coordination and assistance to regulatory bodies through the RCF, including Technical Meetings and training workshops, in order to assist Member States in building regulatory capacity, in cooperation with other international stakeholders;

- The Agency will assist Member States' efforts to enhance regulatory capacity for performing self-assessment, establishing effective regulatory oversight programmes, and implementing integrated management systems;

- The Agency will revise the Integrated Review of Infrastructure for Safety self-assessment tool (IRIS) and conduct self-assessment seminars at the national and regional levels;

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[60] The main objective of an INIR mission in Phase 1 is to assist the national government in their considerations before a decision is taken to launch a nuclear power programme.

- The Agency will further promote the development of an adequate and effective legal and regulatory framework as well as the establishment of an independent regulatory body with a sufficient number of qualified and competent staff;

- The Agency will continue to assist Member State capacity building programmes through the SAET Programme with the aim of strengthening the capability of organizations to support a strong nuclear safety assessment infrastructure, as well as encouraging a strong national commitment of resources; and

- The Agency will finalize the development of Phase 3 INIR[61] missions taking into account synergy with its other peer review services. The Agency will encourage Member States to host all relevant nuclear safety review missions during the early stages of the development of a nuclear power programme in order to evaluate the safety infrastructure aspects. The results of these missions will be reflected in the INIR Phase 3 missions and will provide for an effective use of Agency review services and avoid duplication for Member States.

C.5.2. Research Reactor Programmes

Trends

168. Many Member States are planning or implementing projects to establish their first or a new research reactor in support of capacity building for embarking on a nuclear power programme and for R&D to support industry and specific national programmes, including those dealing with radioisotope production for the medical sector. The majority of these Member States face difficulties in developing the necessary safety and regulatory infrastructure consistently with the project milestones. These difficulties relate to human resources and national competencies to implement activities that are important to safety during the project lifetime, such as siting, construction, commissioning and operation and decommissioning.

Activities

169. The Agency conducted several meetings, workshops and safety review missions to assist Member States in safely establishing new research reactors and the related safety and regulatory infrastructure. The Agency organized a Technical Meeting attended by 34 participants from 24 Member States on the Role of Research Reactor in Providing Support for Nuclear Power Programmes, held in Vienna, Austria, in June 2016.The Agency also organized expert missions, workshops and consultancy meetings on the licensing process and safety assessment, infrastructure assessment, and developing safety regulations for research reactors.

Priorities and Related Activities

170. ***The Agency will assist Member States in developing safety infrastructure for new research reactor programmes. The Agency will undertake the following activities in relation to this priority:***

- The Agency will prepare an IAEA Nuclear Energy Series report to assist Member States in developing the infrastructure and human resources necessary to introduce a research reactor programme. The report will provide guidance on the assessment of national infrastructure and the conduct of Integrated Research Reactor Infrastructure Assessment (IRRIA) missions along with training for the areas necessary to fulfil the regulatory functions and be consistent with the programme

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[61] The main objective of an INIR mission in Phase 3 is to assist the national government by providing a final review of the overall nuclear power infrastructure before the commissioning of the first nuclear power plant.

milestones. These areas include site evaluation, design, safety assessment, construction, commissioning, operation and utilization.

D. Strengthening Emergency Preparedness and Response

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

Trends

171. Member States continue to focus attention on effective information exchange and emergency communication. Feedback from Member State experts resulted in recommendations for improvements in several areas, such as the Agency's Unified System for Information Exchange in Incidents and Emergencies (USIE), the International Radiation Monitoring Information System (IRMIS), and assessment of an emergency and the prognosis of a possible emergency progression.

172. States Parties to the Convention on Early Notification of a Nuclear Accident (Early Notification Convention) are obliged to inform the Agency and to other States Parties, directly or through the Agency, their competent authorities and points of contact responsible for issuing and receiving the notification and information referred to in the Convention. The Agency has requested that all Member States designate their emergency contact points in accordance with the *Operations Manual for Incident and Emergency Communication* (EPR-IEComm 2012)[62]. The Agency maintains and makes available a register of all emergency contact points in Member States and relevant international organizations on the USIE website. In 2016, four Member States designated contact points in accordance with EPR-IEComm 2012, increasing the number of such Member States to 114.

173. States Parties to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (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". A total of 31 of the 112 States Parties to the Assistance Convention (28%) have registered their National Assistance Capabilities (NAC) in the Agency's Response and Assistance Network (RANET). Denmark, Spain and Ukraine registered their assistance capabilities in RANET during 2016, while Canada added additional NAC resources.

174. The Agency launched IRMIS and requested the nomination of contact points for the coordination of IRMIS-related activities. In 2016, 20 Member States nominated IRMIS contact points.

175. The widespread use of social media reinforces the need for a timely public communication response in an emergency. The International Conference on Global Emergency Preparedness and Response, which took place in Vienna, Austria in October 2015, highlighted the need to prepare appropriate background information in advance[63] and to provide regular training on public communication.

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[62] INTERNATIONAL ATOMIC ENERGY AGENCY, Operations Manual for Incident and Emergency Communication, Emergency Preparedness and Response Series, EPR-IEComm 2012, IAEA, Vienna (2012).

[63] INTERNATIONAL ATOMIC ENERGY AGENCY, Report on the International Conference on Global Emergency Preparedness and Response, IAEA, Vienna (2015).

176. The number of Member States using the International Nuclear and Radiological Event Scale (INES) as a communication tool to rate and report the safety significance of nuclear or radiological events remains at an almost constant level.[64]

Activities

177. Several enhanced functionalities were introduced for the USIE website in 2016. A new functionality was developed, which enables the Agency and the States Parties to the Assistance Convention that have registered in RANET to update their existing registrations directly through the USIE website. Moreover, USIE forms for requesting and offering assistance were modified to implement lessons identified from the conduct of the 2015 ConvEx-2c[65] and the 2016 ConvEx-2b exercises.

178. Another new functionality enables national and international systems to exchange information automatically. This functionality, already tested with the involvement of some Member States, will be used for an automatic exchange of information to be displayed on relevant websites of the Agency and the European Commission.

179. Since 2010, the Agency has routinely conducted comprehensive training for the emergency contact points, covering the operational arrangements for implementation of the Early Notification Convention and Assistance Convention (e.g. EPR-IEComm 2012 and EPR-RANET 2013[66]). By the end of 2016, participants from a total of 126 Member States had attended the training, which began in 2010. Four workshops, with participants from 20 Member States, were conducted in 2016.

180. Information sharing arrangements for implementing the Early Notification Convention and the Assistance Convention were discussed at a Technical Meeting on Information Exchange during Nuclear or Radiological Incidents and Emergencies held in Vienna, Austria, in April 2016. The Technical Meeting was attended by participants from 75 Member States and three international organizations. The meeting provided recommendations for the Agency to consider a revision of EPR-IEComm 2012, such as the inclusion of detailed descriptions of the assessment and prognosis process, and the provision of additional information about the Agency's Incident and Emergency System.

181. The Eighth Meeting of the Representatives of Competent Authorities Identified under the Early Notification Convention and the Assistance Convention, held in June 2016. The meeting was attended by representatives from more than 80-States and 3 international organizations who discussed a range of issues, including information exchange, international assistance, communication with the public, and training and exercises. The meeting's conclusions covered the utilization of IRMIS, operationalization of the assessment and prognosis process, implementation of the ConvEx exercise regime and sharing lessons from exercises.[67]

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[64] The number of INES National Officers, who are responsible for reporting relevant events to the Agency, increased slightly in 2016, to 80 (79 National Officers in 2015).

[65] The Agency conducts regular exercises within the framework of the Early Notification and Assistance Conventions, referred to as 'ConvEx exercises'. ConvEx exercises have three levels of complexity: at level 1 (ConvEx-1) only communication tests with emergency contact points are performed; at level 2 (ConvEx-2) emergency communications as well as different parts of emergency arrangements are tested; and at level 3 (ConvEx-3) the exercise aims to test full scale emergency arrangements and capabilities at national and international levels.

[66] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Response and Assistance Network, Emergency Preparedness and Response Series, EPR-RANET 2013, IAEA, Vienna (2013).

[67] INTERNATIONAL ATOMIC ENERGY AGENCY, Report of the Eighth Meeting of the Representatives of the Competent Authorities Identified under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, IAEA, Vienna (2016).

182. The Agency organized a Technical Meeting to Review the IAEA's Assessment and Prognosis Procedures for Nuclear and Radiological Emergencies in November–December 2016, attended by 77 participants from 53 Member States and 3 international organizations. The participants reviewed and discussed the assessment and prognosis process and the associated communication procedures. The use of information resources such as the Reactor Technical Information (RTI) database[68] within the Emergency Preparedness and Response Information Management System (EPRIMS) was also discussed. Online assessment and prognosis tools developed by the Agency (such as the Reactor Assessment Tool, the Protective Actions Assessment Tool and the Radiological Source Assessment Tool) were made available to Member States.

183. Drafting of the next edition of the EPR-RANET publication commenced. When finalized, the revision will include recent developments and enhancements in the RANET mechanism, new functional areas, lessons learned from the conduct of ConvEx exercises, RANET workshops and exercises.

184. In 2016, the Agency continued the development and implementation of IRMIS. In addition, an exercise version of IRMIS was developed allowing the pre-loading of simulated radiation monitoring data onto the system for display throughout an exercise. The exercise system was successfully utilized, for the first time during the ConvEx-2d exercise hosted by Romania in October 2016.

185. The Agency organized four workshops on effective public communication in an emergency. The curriculum for the Agency's School of Radiation Emergency Management, which was conducted twice, also includes numerous lectures on public communication. The Agency also made available a comprehensive e-learning tool, based on two EPR Series publications[69, 70], which offers Member States basic and refresher training in public communication during an emergency.

186. At the Biennial Meeting of the INES National Officers, held in Vienna, Austria, in November 2016, 70 participants from over 50 Member States and two international organizations initiated a revision of *The International Nuclear and Radiological Event Scale User's Manual: 2008 Edition* incorporating guidelines from existing Agency publications.[71]

Priorities and Related Activities

187. ***The Agency will further develop operational arrangements for notification, reporting and requesting assistance in a nuclear or radiological incident or emergency. The Agency will undertake the following activities in relation to this priority:***

- The Agency will introduce further improvements to the USIE website. The automatic exchange of information on the websites of the Agency and the European Commission will also be implemented in 2017;

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[68] During 2016, the Agency hosted four online training and information sessions on the RTI database and on the Agency's assessment and prognosis process.

[69] INTERNATIONAL ATOMIC ENERGY AGENCY, Communicating with the Public in a Nuclear or Radiological Emergency, Emergency Preparedness and Response Series, EPR-Public Communications 2012, IAEA, Vienna (2012).

[70] INTERNATIONAL ATOMIC ENERGY AGENCY, Method for Developing a Communication Strategy and Plan for a Nuclear or Radiological Emergency, Emergency Preparedness and Response Series, EPR-Public Communication Plan 2015, IAEA, Vienna (2015).

[71] INTERNATIONAL ATOMIC ENERGY AGENCY, The Use of the International Nuclear and Radiological Event Scale (INES) for Event Communication, IAEA, Vienna (2014).

- The Agency will promote the wider use and further implementation of the International Radiological Information Exchange (IRIX) data standard for information exchange during nuclear or radiological emergencies, including through the updated IEComm manual to be completed in 2017;[72]

- The Agency will look at supplementary methods to deliver training for Member States' emergency contact points on the operational arrangements for notification, reporting and requesting assistance using methods such as web-based training sessions;

- Further enhancement of arrangements for international assistance in an emergency will continue. The Agency will exercise the conduct of an IAEA Assistance Mission with a Joint Assistance Team comprising Field Assistance Teams and External Based Support from various States registered in RANET;

- The Agency will continue to work with Member States and relevant international organizations to increase the utilization of IRMIS, including through bilateral finalization of the necessary administrative and technical processes with Member States that are able to provide routine data to IRMIS;

- The development of plain language information to assist Member States' demands for background material that can be shared with the public immediately in the early stages of an emergency will be completed in 2017; and

- The Agency will place greater emphasis on communication aspects in the INES training materials to enhance the effectiveness of use of INES for public communication.

D.2. Harmonization of Arrangements for Preparedness and Response

Trends

188. There is an ongoing demand from Member States for technical assistance and advice in strengthening national and regional EPR arrangements. Many requests received from Member States are related to the need for assistance and advice in the implementation of the requirements established in IAEA Safety Standards Series No. GSR Part 7.

189. At the Eighth Meeting of the Representatives of the Competent Authorities Identified under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, the representatives emphasized the importance of implementing the requirements of IAEA Safety Standards Series No. GSR Part 7, as well as the need for harmonized approaches in EPR.[73] The representatives also stressed the need to ensure consistent communication with the public. This echoed similar recommendations to support the dissemination of credible information worldwide.[74]

190. The EPRIMS has contributed to the streamlining of the self-assessment process that Member States wishing to host EPREV missions need to apply. The number of Member States that use

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[72] IRIX offers the possibility of shortening the time needed to transcribe information in national systems to systems used at the international level, such as USIE.

[73] This topic is also being addressed by the current activities of the Working Group on Emergencies of the Heads of the European Radiological Protection Competent Authorities, in which the Agency participates as an observer.

[74] INTERNATIONAL ATOMIC ENERGY AGENCY, Report on the International Conference on Global Emergency Preparedness and Response, IAEA, Vienna (2015).

EPRIMS is increasing: 78 Member States have appointed EPRIMS national coordinators leading to a total of 181 national EPRIMS users.

Activities

191. The Agency conducted one preparatory EPREV mission to Indonesia and two EPREV missions to Hungary and Indonesia utilizing IAEA Safety Standards Series No. GSR Part 7. The Agency also received 11 requests for technical assistance and advice in EPR, which were addressed by organizing specific expert missions.

192. As part of various Agency events (e.g. the meeting of Competent Authorities, Technical Meetings) presentations and practical sessions dealing with EPRIMS capabilities were held. For example, six webinars were conducted with the participation of 121 attendees from 48 Member States.

193. The Agency organized a total of 38 training events and workshops focusing on assistance with the implementation of the requirements established in IAEA Safety Standards Series No. GSR Part 7. The Agency also conducted two Schools of Radiation Emergency Management to address the need for comprehensive training on all relevant EPR topics. Two new capacity building centres for EPR were designated in 2016 in Austria and the Republic of Korea.

194. The Agency has been preparing a draft document *Protection Strategy in Response to a Radiological or Nuclear Emergency*, which is at an advanced stage of drafting. When finalized, this publication will assist in enhancing consultations between Member States at the preparedness stage to ensure the consistency of approaches in taking protective actions during an emergency.

195. A new document titled "Guidelines on the Harmonization of Response and Assistance Capabilities for a Nuclear or Radiological Emergency" was finalized and is in the publication process. Training materials to support the implementation of the guidelines were developed and reviewed by experts from Member States at a consultancy meeting. The feedback from the meeting helped in determining different methods for assisting Member States in the implementation of the guidelines, such as by conducting specific training or by incorporating relevant modules in various courses.

196. More than 250 health care professionals from 45 Members States participated in 11 national, regional and interregional events related to medical preparedness and response to nuclear and radiological emergencies. These events covered basic and specialized training, along with a description of radiological health hazards and approaches to put these hazards into perspective when communicating with the public.

197. The Agency signed Practical Arrangements with WANO to cooperate in the area of response to radiation incidents and emergencies at the nuclear installations of WANO members.

Priorities and Related Activities

198. ***The Agency will assist Member States in the implementation of IAEA Safety Standards Series No. GSR Part 7 and will develop associated Safety Guides. The Agency will undertake the following activities in relation to this priority:***

- The Agency will continue to assist Member States in their efforts to strengthen the consistency of national arrangements, improve preparedness and response, harmonize national criteria for protective actions and other response actions, as well as facilitate communication in an emergency in line with the related Agency's safety standards through various capacity building activities and missions;

- The Agency will further engage with Member States to populate the EPRIMS platform with relevant information and to build a common understanding of EPRIMS as a key tool for information sharing in the EPR area at the preparedness stage;

- The Agency will assist Member State in their utilization of online assessment and prognosis tools, developed by the Agency for implementation of its response roles; and

- The Agency will continue assisting Member States in harmonizing response and assistance capabilities through specific training for Member States registered in RANET so that they are prepared to provide international assistance, upon request, that is compatible with the requirements of a requesting State and those of any other assisting States.

D.3. Testing Readiness for Response

Trends

199. Emergency exercises have proven to be a very important tool for testing and continuously improving EPR arrangements. Member States continue to seek the Agency's assistance for improving the preparation, conduct and evaluation of national emergency exercises.

200. Timely receipt of emergency messages is a vital aspect of emergency response. However, around 20% of contact points in Member States were not reachable during simple tests of their emergency communication channels during ConvEx-1 exercises. Around 40% of the contact points responded within the time requirements.

201. The participation of Member States in ConvEx-2 exercises continued to be at a high level. In 2016, a total of 51 Member States participated in ConvEx-2a (46 in 2015); 40 Member States participated in ConvEx-2b (42 in 2015); 49 Member States (42 in 2014) and one international organization (three in 2014) participated in ConvEx-2d[75]; and ConvEx-2e exercises were conducted with six Member States (four in 2015).

202. Demands for faster and harmonized public communication in a nuclear or radiological emergency also require efficient response coordination by the relevant international organizations.

Activities

203. The Agency participated in ten national emergency exercises and assisted Member States in organizing, conducting and evaluating these exercises. Through the ConvEx-1 exercises, the Agency conducted and analysed three tests of emergency communication channels, which should be available at all times and every day of the year. Problems with establishing communication were followed up with the relevant emergency contact points after each exercise.

204. The ConvEx-2a exercise was held in 2016 with the participation of 51 Member States. This reflects an 11% increase in participation from 2015. The participation of 68% of all Member States operating NPPs demonstrated the importance which Member States attach to such exercises. A total of 171 reports were received. All participating Member States used the correct communication channels.

205. The ConvEx-2b exercise was conducted with 40 participating Member States: 16 of them tested their capabilities to request assistance and prepare for its receipt, while 24 Member States participated

[75] In accordance with the exercise arrangements defined in EPR-IEComm 2012, the ConvEx-2d exercises are conducted once per two years, hence the last exercise was conducted in 2014.

as providers of assistance. For those assisting States the response times were assessed as part of the exercise objectives.

206. The ConvEx-2d exercise was based on a full scale national emergency exercise in Romania and involved 49 Member States and one international organization. Participating Member States reviewed the emergency information exchanged, and determined appropriate actions to be taken to protect their populations. The exercise also provided an opportunity to test public communication — 12 Member States provided public communication statements to the Agency, nine of which demonstrated good practices by releasing multiple statements that addressed the evolving situation.

207. The Agency continued the series of ConvEx-2e exercises to test the assessment and prognosis process, based on national exercises in Member States with operating NPPs. A total of seven ConvEx-2e exercises were conducted and, in addition, the assessment and prognosis process was tested in other exercises such as the ConvEx-2d exercise.

208. Within the framework of the Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE), the Agency began preparations for the ConvEx-3 (2017) large-scale exercise, which will last for 36 hours and is based on a scenario of a severe accident at an NPP. Hungary offered its national exercise, hosted by the Paks NPP, to be used as the basis of the ConvEx-3 (2017) exercise. In preparing the exercise, a ConvEx-3 Task Group was formed by IACRNE comprising representatives from interested international organizations that are members of IACRNE, as well as from Hungary and neighbouring Member States.

209. In the context of the Joint Radiation Emergency Management Plan of the International Organizations[76], the Agency signed Practical Arrangements with the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization in 2016. The arrangements describe cooperation that may be pursued subject to the Parties' respective mandates, governing regulations, rules, policies and procedures in the case of a nuclear or radiological emergency, particularly with an actual or potential atmospheric release of radioactive materials.

210. To test and improve the public communication arrangements based on JPLAN the Agency conducted a tabletop exercise with nine public information officers from seven international organizations that are members of IACRNE. The lessons learned from the exercise will contribute to further improvements of the standard operating procedure defined for the coordination of public communication.

Priorities and Related Activities

211. ***The Agency will implement an active exercise programme to test EPR at the international level and support national EPR exercise programmes. The Agency will undertake the following activities in relation to this priority:***

- The Agency will continue assisting Member States in the preparation, conduct and evaluation of their emergency exercises;

- The Agency will continue to test and evaluate its international arrangements for information exchange, communication and assistance. The Agency will continue to encourage Member States to engage in the ConvEx exercises;

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[76] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Radiation Management Plan of the International Organizations, Emergency Preparedness and Response Series, EPR-JPLAN 2013, IAEA, Vienna (2013).

- Through the conduct of communication tests, the Agency can identify the most efficient and reliable communication channels to reach Member States of different regions and test them regularly. The Agency will adapt its communication procedures to reflect the needs and capabilities of all Member States. All communication failures will continue to be followed up;

- The Agency will further develop and test the inter-agency EPR arrangements and bilateral protocols for response coordination and information exchange and will promote harmonization of the EPR arrangements among relevant international organizations within IACRNE; and

- The Agency will continue to test the international arrangements based on the JPLAN, including arrangements to coordinate public communications, to ensure an effective and harmonized international response.

E. Improving Management of the Safety and Security Interface

Trends

212. The International Conference on Effective Nuclear Regulatory Systems: Sustaining Improvements Globally underlined the importance of managing the interface between safety and security in a number of areas, in particular, in the establishment of strong nuclear safety and security cultures, the design of nuclear installations, and the management of disused sealed radioactive sources.

213. Many Member States rely on a single regulatory body for the safety and security of radioactive sources. As a result, the Code of Conduct on the Safety and Security of Radioactive Sources and the supplementary Guidance on the Import and Export of Radioactive Sources are increasingly being implemented in a coordinated manner which ensures efficient use of resources and addresses safety and security in an integrated manner.

214. The safe and secure management of disused sealed radioactive sources remains a challenge for many Member States where there are no available options other than returning them to the supplier. As an increasing number of radioactive sources become disused and are no longer considered an asset, they may become vulnerable and may not be subject to regulatory control. Ensuring continuous safe and secure management options for disused sealed radioactive sources remains an important priority for Member States.

Activities

215. In 2016, the Interface Group, comprising representatives of the Safety Standards Committees and the Nuclear Security Guidance Committee, conducted a review of seven proposed Agency safety standards and nuclear security guidance publications to identify whether there were any safety and security interfaces. The Interface Group documented the nature of the interfaces and referred them to the appropriate committee(s) for further review and approval. Draft safety standards and nuclear security guidance identified previously as such ‘interface documents’ have been reviewed systematically at meetings of the Safety Standards Committees and the Nuclear Security Guidance Committee throughout 2016.

216. In 2016, the Agency developed draft Guidance on the Management of Disused Radioactive Sources (see section B 2). This guidance is based on the Agency’s safety standards and nuclear security guidance, and addresses safety and security in an integrated manner similar to that of the Code of Conduct on the Safety and Security of Radioactive Sources.

Priorities and Related Activities

217. ***The Agency will ensure that safety standards and nuclear security guidance take into account the implications for both safety and security whenever appropriate, recognising that the activities that address nuclear safety and security are different. The Agency will undertake the following activities in relation to this priority:***

- The Agency will continue to develop publications related to security applicable throughout the lifetime of nuclear facilities, including computer security for nuclear security, security of radioactive material in use, storage and transport, and response to nuclear security events. These documents will address the interfaces such that safety and security are mutually supportive where possible and will not adversely affect the functions of each other;

- The Agency will conduct international and regional training courses to assist Member States' understanding of the safety–security interface. The Agency will conduct a regional workshop and tabletop exercise on managing the response to a nuclear security event at an NPP involving both safety and security response organizations; and

- The Agency will continue to support the development by Member States of comprehensive national strategies for the management of disused sources, including recycling, return to supplier, and national storage pending disposal, as appropriate, to ensure effective and efficient use of resources while providing sustainable solutions. The Agency will conduct regional workshops and training courses to support the national regulatory bodies and other competent authorities with responsibilities for managing disused radioactive sources.

F. Strengthening Civil Liability for Nuclear Damage

Trends

218. 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 due to a nuclear incident, as well as to establishing a global nuclear liability regime.

219. Despite the fact that a number of States are party to the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention of 1988, and although the Convention on Supplementary Compensation for Nuclear Damage (CSC) entered into force on 15 April 2015, the absence of treaty relations between States Parties to the different conventions, as well as the comparatively low number of adherences to some of those conventions, have so far prevented the achievement of a global nuclear liability regime.[77]

220. In this context, the IAEA General Conference has recognized the valuable work of the Agency's International Expert Group on Nuclear Liability (INLEX) and, in particular, at its 60th regular session

[77] The status lists of the conventions deposited with the Director General of the IAEA are available at: https://www.iaea.org/resources/treaties/treaties-under-IAEA-auspices. As regards the status of the conventions under the auspices of the OECD-NEA, see: http://www.oecd-nea.org/law/multilateral-agreements/liability-compensation.html.

in September 2016, took note of the recommendations on how to facilitate achievement of a global nuclear liability regime, which were adopted by INLEX in 2012.[78]

Activities

221. The 16th regular meeting of INLEX took place in Vienna, Austria, in May 2016. The Group reiterated its recommendation that, although there was no need for a specific international liability regime covering radioactive sources, licenses for at least Categories 1 and 2 sources should include a requirement that the licensee take out insurance, or other financial security, to cover its potential third-party liability. The Group also discussed, inter alia, liability issues relating to long-term storage and disposal facilities, and identified in this context a number of issues that will need further discussion. In addition, the Group discussed the scope of application of the nuclear liability conventions deposited with the IAEA with respect to fusion installations and SMRs.

222. A revision of the Explanatory Texts for the 1997 Vienna Convention on Civil Liability for Nuclear Damage and the CSC[79] was finalized in 2016 and is in the process of publication. This revision was prepared by the Secretariat in the light of the entry into force of the CSC in 2015 and of the aforementioned recommendations adopted by INLEX in 2012.

223. The Fifth Workshop on Civil Liability for Nuclear Damage was held in Vienna, Austria, in May 2016, and was attended by 45 participants from 31 Member States. The purpose of the workshop was to provide the participants with an introduction to the international legal regime of civil liability for nuclear damage. In addition, a joint Agency–INLEX mission was conducted in China in March 2016 to raise awareness of the international legal instruments relevant for achieving a global nuclear liability regime.

Priorities and Related Activities

224. ***The Agency will continue to facilitate the establishment of a global nuclear liability regime and assist Member States, upon request, in their efforts to adhere to and implement the international nuclear liability instruments, taking into account the recommendations adopted by INLEX in 2012. The Agency will undertake the following activities in relation to this priority:***

- The Agency and INLEX will undertake further outreach activities, such as regional and sub-regional workshops on civil liability for nuclear damage, and IAEA/INLEX missions that may be requested by individual Member States in order to raise awareness of the international regime of civil liability for nuclear damage and facilitate its national implementation; and

- The Agency will also continue to support Member States, upon request, in adopting and revising legislation on civil liability for nuclear damage, in the context of its legislative assistance programme.

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[78] See: https://ola.iaea.org/ola/documents/ActionPlan.pdf. These recommendations were adopted by INLEX following a request contained in the IAEA Action Plan on Nuclear Safety (GOV/2011/59-GC(55)/14).

[79] INTERNATIONAL ATOMIC ENERGY AGENCY, The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Convention on Supplementary Compensation for Nuclear Damage — Explanatory Texts, IAEA International Law Series No. 3, IAEA, Vienna (2007).

Appendix

The IAEA Safety Standards Activities during 2016

A. Summary of the Agency's Safety Standards Activities during 2016

1. Seven Safety Requirements publications were issued in 2016 after approval by the Board of Governors. All take into account lessons arising from the Fukushima Daiichi accident:

— GSR Part 1 (Rev. 1): *Governmental, Legal and Regulatory Framework for Safety* (DS462) — revision by amendment of Safety Requirements publication GSR Part 1;

— NS-R-3 (Rev. 1): *Site Evaluation for Nuclear Installations* (DS462) — revision by amendment of Safety Requirements publication NS-R-3;

— SSR-2/1 (Rev. 1): *Safety of Nuclear Power Plants: Design* (DS462) — revision by amendment of Safety Requirements publication SSR-2/1;

— SSR-2/2 (Rev. 1): *Safety of Nuclear Power Plants: Commissioning and Operation* (DS462) — revision by amendment of Safety Requirements publication SSR-2/2;

— GSR Part 4 (Rev. 1): *Safety Assessment for Facilities and Activities* (DS462) — revision by amendment of Safety Requirements publication GSR Part 4;

— GSR Part 2: *Leadership and Management for Safety* (DS456) — revision of Safety Requirements publication GS-R-3; and

— SSR-3: *Safety of Research Reactors* (DS476) — revision of Safety Requirements publication NS-R-4.

2. Five Safety Guides were also published in 2016 after endorsement by the Commission on Safety Standards (CSS):

— SSG-41: *Predisposal Management of Radioactive Waste from Nuclear Fuel Cycle Facilities*;

— SSG-40: *Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors*;

— SSG-39: *Design of Instrumentation and Control Systems for Nuclear Power Plants*;

— SSG-34: *Design of Electrical Power Systems for Nuclear Power Plants*; and

— SSG-36: *Radiation Safety for Consumer Products*.

3. The CSS started its sixth four-year term in January 2016. Ten new Member State representatives were appointed. The first two meetings of this new term were dedicated particularly to a discussion on the priorities in a number of areas on the basis of the recommendations proposed in the end-of-term report on the fifth term of the CSS.

4. The CSS met twice in 2016 and endorsed the following draft safety standards for submission for publication:

— DS456: Draft Safety Requirements on *Leadership and Management for Safety* (revision of GS-R-3);

— DS476: Draft Safety Requirements on *Safety of Research Reactors* (revision of NS-R-4);

— DS399: Draft Safety Guide on *Radiation Protection and Safety in Medical Uses of Ionizing Radiation* (revision of RS-G-1.5);

— DS454: Draft Safety Guide on *Predisposal Management of Radioactive Waste from the Use of Radioactive Material in Medicine, Industry, Research, Agriculture and Education* (revision of WS-G-2.7);

— DS455: Draft Safety Guide on *Establishing a National Radiation Safety Infrastructure*;

— DS432: Draft Safety Guide on *Radiation Protection of the Public and the Environment*;

— DS427: Draft Safety Guide on *Prospective Radiological Environmental Impact Assessment for Facilities and Activities* (revision of NS-G-3.2);

— DS442: Draft Safety Guide on *Regulatory Control of Radioactive Discharges to the Environment* (revision of WS-G-2.3); and

— DS452: Draft Safety Guide on *Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities* (revision and combination of WS-G-2.1 and WS-G-2.4).

5. The CSS also approved the following document preparation profiles in 2016:

— DS495: Draft Safety Requirements on *Regulations for the Safe Transport of Radioactive Material*, 20xx Edition (revision of SSR-6);

— DS494: Draft Safety Guide on *Protection against Internal Hazards in the Design of Nuclear Power Plants* (revision and combination of NS-G-1.7 and NS-G-1.11);

— DS469: Draft Safety Guide on *Preparedness and Response for an Emergency during the Transport of Radioactive Material* (revision of TS-G-1.2 (ST-3));

— DS496: Draft Safety Guide on *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material* (revision of SSG-26); and

— DS497: A draft revision of eight closely interrelated Safety Guides supporting the Safety Requirements publication SSR-2/2 (Rev. 1): NS-G-2.2 to 2.8 and NS-G-2.14.

6. One additional Safety Requirements publication is being revised and will take into account lessons arising from the Fukushima Daiichi accident: DS478 for the revision of NS-R-5 (Rev. 1) on the *Safety of Nuclear Fuel Cycle Facilities*, which was approved by the Safety Standards Committees, cleared by the Nuclear Security Guidance Committee in November 2016 for submission to the CSS early in 2017.

7. For the Safety Guides, with regard to the review of the Agency's safety standards taking into account lessons arising from the Fukushima Daiichi accident, a number of drafts are being prepared:

— DS449: *Format and Content of the Safety Analysis Report for Nuclear Power Plants*;

— DS468: *Remediation Process for Areas with Residual Radioactive Material*;

— DS472: *Organization, Management and Staffing of a Regulatory Body for Safety*;

— DS473: *Functions and Processes of the Regulatory Body for Safety*;

— DS474: *Arrangements for the Termination of a Nuclear or Radiological Emergency*;

— DS475: *Arrangements for Public Communications in Preparedness and Response for a Nuclear or Radiological Emergency*;

— DS481: *Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants*;

— DS482*: Design of Reactor Containment Structure and Systems for Nuclear Power Plants*;

— DS483: *Severe Accident Management Programmes for Nuclear Power Plants*;

— DS489: *Storage of Spent Nuclear Fuel*;

— DS486: *Establishing the Safety Infrastructure for a Nuclear Power Programme*;

— DS487: *Design of Fuel Handling and Storage Systems for Nuclear Power Plants*;

— DS488: *Design of the Reactor Core for Nuclear Power Plants*;

— DS490: *Seismic Design and Qualification for Nuclear Power Plants*;

— DS491: *Deterministic Safety Analysis for Nuclear Power Plants*;

— DS494: *Protection against Internal Hazards in the Design of Nuclear Power Plants*;

— DS497: revision of NS-G-2.2 to 2.8 and NS-G-2.14; and

— DS498: *External Events Excluding Earthquakes in the Design of Nuclear Installations*.

8. In addition, a new complete revision of the Safety Requirements publications on *Site Evaluation for Nuclear Installations* (DS484) is being prepared to incorporate other lessons and newly available information. A revision of *Regulations for the Safe Transport of Radioactive Material* (DS495) is also being prepared.

9. Similarly, several Safety Guides are being revised or prepared:

— DS477: *The Management System for the Predisposal and Disposal of Radioactive Waste*;

— DS440: *Design of Auxiliary and Supporting Systems in Nuclear and Power Plants*;

— DS492: *Human Factors Engineering in the Design of Nuclear Power Plants*;

— DS479: *Operating Experience Feedback for Nuclear Installation*s;

— DS485: *Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants*;

— DS434: *Radiation Safety of Radioisotope Production Facilities*;

— DS419: *Radiation Protection and Safety in Well Logging*;

— DS420: *Radiation Protection and Safety in Nuclear Gauges*;

— DS471: *Radiation Safety of X-ray Generators and Radiation Sources Used for Inspection Purposes and for Non-Medical Imaging*;

— DS470: *Radiation Safety of Radiation Sources Used in Research and Education*;

— DS403: *Decommissioning of Medical, Industrial and Research Facilities*; and

— DS493: *The Structure and Information to be Included in a Package Design Safety Report (PDSR) for the Transport of Radioactive Material*.

10. The NSS-OUI platform provides the user with a tool to access and browse the content of IAEA Safety Standards Series and IAEA Nuclear Security Series publications with advanced search capabilities. It also constitutes a centralized platform to collect and retrieve feedback on the use of current publications in both series. It provides information on the relationship between the publications to help navigate from one publication to other relevant publications that provide additional related recommendations.

11. The main objective of the NSS-OUI platform is to establish a knowledge and content management system so as:

— to ensure that the review and revision of published safety standards are based on a systematic feedback collection and analysis process;

— to ensure that any revision of the safety standards or part of the safety standards is justified by the feedback process mentioned above, thereby also ensuring the continued validity of those parts of the standards that remain unchanged;

— to maintain technical consistency among the standards through the management of the standards as a complete collection rather than by individual management of individual standards;

— to enhance semantic consistency through the systematic use of harmonized terminology;

— to ensure the completeness of the collection safety standards; and

— to support harmonized use and application of the safety standards by enhancing their user-friendliness.

12. All IAEA Safety Standards Series and IAEA Nuclear Security Series publications that are not at the end of a revision process will be imported in full text onto the platform, offering the capability to search their content with the use of an advanced search tool or simply through a full text search.

13. The implementation of this content management system resulted in a proposal to revise eight interrelated Safety Guides in a single revision process, thus allowing for greater efficiency and better ensuring the consistency of the final products.

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