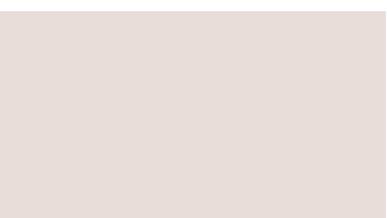


Nuclear Security Review 2022



NUCLEAR SECURITY REVIEW 2022

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Nuclear Security Review 2022
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Foreword

The Nuclear Security Review 2022 includes the global trends and the Agency's activities in 2021. It also presents priorities for 2022 and beyond, as identified by the Agency based on Member States' needs and priorities, for strengthening nuclear security globally.

A draft version of the Nuclear Security Review 2022 was submitted to the June 2022 session of the Board of Governors in document GOV/2022/20. The final version of the Nuclear Security Review 2022 was prepared in light of the discussions held during the Board of Governors and also of the comments received from the Member States.

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Nuclear Security Review 2022

Executive Overview

1. The *Nuclear Security Review 2022* reflects the global trends in 2021. It shows that the nuclear community continued to make steady progress in improving nuclear security throughout the world. It also presents planned Agency activities for 2022 and priorities, as identified by the Agency and its Member States, including through the *Nuclear Security Plan 2022-2025*, for strengthening nuclear security globally. Agency activities undertaken in 2021 can be found in Appendix A.

Nuclear Security Priorities	
	<ul style="list-style-type: none">• Hosting the Conference of the Parties to the Amendment to the Convention on the Physical Protection of Nuclear Material, and continuing efforts to promote further adherence to, and full implementation of, the CPPNM and its Amendment with the aim of its universalization;• Assisting Member States, upon request, in developing, maintaining and implementing national nuclear security regimes, including legislative and regulatory frameworks; physical protection of nuclear and other radioactive material, insider threat mitigation and nuclear security culture; security of radioactive sources throughout their life-cycle; and detection of and response to nuclear security events;• Assisting States, upon request, in strengthening the protection of sensitive information and computer-based systems, recognizing the threats to nuclear security and from cyber-attacks at nuclear related facilities, as well as their associated activities including the use, storage and transport of nuclear and other radioactive material;• Continuing to assist Member States to implement the Nuclear Security Series guidance, such as through education and training in nuclear security, including by utilizing national Collaborating Centres and Nuclear Security Support Centres, as well as the International Nuclear Security Education Network;• Continuing to develop and establish the Nuclear Security Training and Demonstration Centre at the Agency's Seibersdorf laboratories;• Providing proactive support to Member States in the safety and security of radioactive sources throughout their life cycle, including hosting the International Conference on the Safety and Security of Radioactive Sources – Accomplishments and Future Endeavours;• Continuing to keep abreast of scientific, technological, and engineering innovations with a view to confronting current and evolving challenges and risks to nuclear security, and also considering opportunities to enhance nuclear security from these innovations;• Continuing to facilitate, in close cooperation with Member States, upon request, a coordination to address the management of the interface between nuclear safety and security, as appropriate, and to develop safety and security publications, as well as joint publications, as appropriate, to ensure consistency and foster nuclear security culture among Member States accordingly; and• Continuing strengthening communication with the public and Member States about its nuclear security activities and how these activities can assist Member States in improving nuclear security globally.

2. The *Nuclear Security Review 2022* complements the *Nuclear Security Report 2022* which will focus on the activities undertaken by the Agency to implement the relevant General Conference resolutions and will cover the period 1 July 2021 to 30 June 2022.

3. The Executive Overview provides a summary of significant nuclear security issues and trends covered in this period of reporting. The Agency's priorities regarding nuclear security, as identified by the Agency and its Member States, including through the *Nuclear Security Plan 2022–2025*, are also provided in this Executive Overview.

4. The risk of nuclear or other radioactive material being used for malicious purposes continues. The responsibility for nuclear security within a State rests entirely with that State. Member States have consistently recognized the central role of the Agency in strengthening the nuclear security framework globally and in coordinating international cooperation in nuclear security activities, while avoiding duplication and overlap of such activities.

5. During 2021, the Agency continued to implement activities, with due regard to the protection of confidential information, under the *Nuclear Security Plan 2018–2021*, approved by the Board of Governors in September 2017 and taken note of by the General Conference at its 61st regular session in September 2017.

6. As the period covered by the *Nuclear Security Plan 2018–2021* ended in December 2021 the Agency initiated consultations in March 2021 with Member States on the development of the *Nuclear Security Plan 2022–2025*. Seven virtual consultations were held with Member States to develop this Plan, which was approved by the Board of Governors in September 2021 and taken note of by the General Conference at its 65th regular session in September 2021.



7. During 2021, despite the challenges posed by the COVID-19 pandemic, the Agency continued to carry out its mandate through routine and novel ways of working, including webinars, e-Learning, and other virtual tools. The use of these virtual tools is expected to continue when normal levels of international travel resume, as long as such tools can improve the effectiveness and efficiency of Agency activities.

8. The Agency continued its efforts to strengthen international norms supporting nuclear security, through its activities that support States in joining relevant legally binding international agreements and implementing obligations under them, such as the Convention on the Physical Protection of Nuclear Material (CPPNM) and its Amendment, the International Convention for the Suppression of Acts of Nuclear Terrorism and United Nations Security Council Resolution 1540, as well as through activities that support States in implementing the provisions of legally non-binding instruments such as the Code of Conduct on the Safety and Security of Radioactive Sources and the Code's supplementary Guidance on the Import and Export of Radioactive Sources and Guidance on the Management of Disused Radioactive Sources.

9. Member States continue to support Agency activities aimed at the universalization of the CPPNM and its Amendment, and that there is a need to continue such activities with the involvement of both Member States which are party to the CPPNM and its Amendment, to the CPPNM only and those which are not yet party, in order to share experience and feedback about the process and benefits.



The Agency will:

- Assist Member States in meeting the requirements of the CPPNM and its Amendment and continue its efforts to promote universal adherence to the CPPNM and its Amendment;
- Strengthen its nuclear security guidance and assist with their application by, inter alia, strengthening its peer review and advisory services;
- Assist States in providing, through INSSPs, a comprehensive framework for systematically identifying and prioritizing States' nuclear security needs;
- Assist Member States in strengthening capacity through nuclear security and education programmes;
- Assist Member States in raising awareness of the threat of cyber-attacks and support States in taking effective security measures against such attacks and improving their relevant nuclear security capabilities;
- Assist Member States in exchanging and sharing nuclear security information on a voluntary basis; and
- Assist Member States in utilizing the outcomes of CRPs for enhancement of States' technical capabilities.

10. The Advisory Group on Nuclear Security (AdSec) continued to advise the Director General on nuclear security matters, including on the Agency's nuclear security programme. AdSec and the International Nuclear Safety Group also highlighted the importance of the safety and security interface, including working on a joint publication on this topic.

11. The Agency continued to place considerable emphasis on the development and publication of comprehensive guidance as part of the Nuclear Security Series, with the involvement of Member States, including through the Nuclear Security Guidance Committee (NSGC) and in accordance with the road map drawn up in consultation with the NSGC. These publications are consistent with, and complement, international nuclear security instruments, and form the basis of the Agency's nuclear security assistance to Member States. Three new IAEA Nuclear Security Series guidance publications and three revisions of existing publications were issued in 2021, bringing the total number of publications in the Nuclear Security Series to 42.

12. Member States continued to actively utilize the Agency's International Physical Protection Advisory Service (IPPAS), despite the challenges posed internationally by the COVID-19 pandemic. There is a strong interest from Member States in utilizing the information of the Agency's IPPAS Good Practices Database, coordinated through the designated Point of Contacts in countries.

13. Member States continued to benefit from Integrated Nuclear Security Support Plans (INSSPs), which provide a systematic and comprehensive framework for reviewing the requesting State's national nuclear security regime and identifying areas where it needs to be strengthened, and are tailored specifically for each State. The Agency continued to provide targeted assistance to States to address needs identified within the INSSP framework, upon request, and taking into account new and updated priorities of Member States, in line with the INSSP review cycle.

14. Secure web-based systems continue to provide valuable services to States for information exchange. The Nuclear Security Information Portal (NUSEC), which is a web-based information tool for Member States that supports the exchange of information across the nuclear security community, continues to be used by a growing number of registered users.

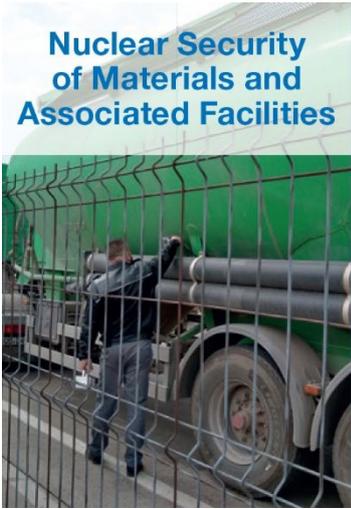
15. The Incident and Trafficking Database (ITDB), through which States voluntarily report incidents of nuclear and other radioactive material out of regulatory control, continues to represent a valuable key component of information exchange. In the period between the inception of the ITDB in 1993 and 31 December 2021, States had reported — or otherwise confirmed to the ITDB — a total of 3928 incidents.



IAEA Incident and Trafficking Database (ITDB) 2021 Factsheet

Fig. 1. The ITDB Factsheet is published annually to inform about confirmed incidents, as voluntarily reported by the participating States, and present a cross-section of aggregated ITDB data.

16. Information and computer security remain a concern for Member States, as the nuclear industry increasingly uses digital technologies to control, monitor and protect the various aspects of operations at nuclear power plants, other fuel cycle and spent fuel storage facilities, non-power reactors, radioactive source applications, novel advanced reactors, including SMRs, and decommissioned nuclear facilities. Vulnerability to theft and/or manipulation of sensitive information or operational technology via cyber-attack is an issue across all aspects of the digitally-connected world. Member States have noted the Agency's efforts to raise awareness of the threat of cyber-attacks, and their potential impact on nuclear security; and has encouraged the Agency to continue its efforts to strengthen computer security, to improve international cooperation, to bring together experts and policy-makers to promote the exchange of information and experiences, to develop appropriate guidance and to assist Member States, upon request, in this area by providing training courses and hosting further expert meetings specific to computer security for nuclear security.



Nuclear Security of Materials and Associated Facilities

The Agency will:

- Assist Member States, upon request, in enhancing nuclear security of facilities and activities involving nuclear and other radioactive material under regulatory control, including during transport;
- Assist Member States, upon request, to address matters related to nuclear security of SMRs;
- Assist Member States in enhancing nuclear security of materials using accounting and control, including by addressing the need to counter insider threats;
- Assist Member States in the security of nuclear and other radioactive material during transport;
- Assist States in the security of radioactive material and associated facilities, including in the lifecycle management of radioactive material; and
- Assist Member States in the implementation of the Code of Conduct on the Safety and Security of Radioactive Sources.

17. The Agency continues to respond to increased demand from Member States for the development of practical technical guidance and training on the security of nuclear and other radioactive material and associated facilities, including during transport. Development or enhancement of regulatory infrastructures for nuclear security; nuclear material control and accounting systems at nuclear facilities for security purposes; and specific guidance on insider threats, nuclear security culture, threat-based and

risk informed approaches, the safety–security interface, and contingency planning continue to be important nuclear security elements. A further increase in State requests for technical assistance for risk-reduction activities, advisory services and assessment missions on the physical protection of nuclear and other radioactive materials, facilities and activities is also anticipated.

18. An increasing number of radioactive sources are becoming disused. There is a growing need for Member States to have appropriate arrangements for the control of sources and the safe and secure management of disused sealed radioactive sources, including their secure protection. In addition, Member States require further guidance on the application of the Code of Conduct on the Safety and Security of Radioactive Sources. The number of Member States committed to acting harmoniously with the supplementary Guidance on the Import and Export of Radioactive Sources remains at 123, and the number of Member States who have committed to implementing the supplementary Guidance on the Management of Disused Radioactive Sources grew by 5 in 2021 to a total of 44.

19. Many Member States in different regions continue to benefit from the Agency’s activities aimed at assisting States in developing or enhancing their national regulatory infrastructure for radiation safety and the security of radioactive material; enhancing safe and secure end-of-life management of sealed radioactive sources; and strengthening physical protection measures at facilities with high activity radioactive sources in use or storage.

20. Each year, more than 20 million packages containing radioactive material are transported worldwide. There is a notable achievement of international adherence to the Agency’s *Regulations for the Safe Transport of Radioactive Material*, which have helped to keep people and the environment safe from radiological hazards for six decades. To date, no one has been injured by radioactive material in transit, but there is a need to remain vigilant, as transport is a potentially vulnerable phase of domestic and international commerce. Over the period 1993–2021, Member States reported to the ITDB 631 thefts of radioactive material, 49% of which occurred during transport and in more than half of these transport related cases (178 incidents) the stolen radioactive material has yet to be recovered.

 <p data-bbox="215 1272 513 1377">Nuclear Security of Materials Out of Regulatory Control</p>	<p data-bbox="571 1272 801 1303">The Agency will:</p> <ul data-bbox="571 1317 1364 1662" style="list-style-type: none">• Assist Member States in establishing and sustaining effective infrastructure and arrangements to protect people, property, the environment and society in response to criminal or intentional unauthorized acts involving MORC;• Assist Member States in strengthening and maintaining effective national nuclear security detection architectures, and in enhancing and improving capabilities in detecting, locating and interdicting MORC;• Assist Member States in preparation and conduct of MPEs through utilizing nuclear security measures for MPEs; and• Assist Member States in building capacities for managing radiological crime scenes, collecting evidence for use in subsequent legal proceedings, and undertaking nuclear forensics examinations to support investigations and help determine the origin and history of the material.
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21. The Agency’s programme to support States’ major public events (MPEs), which was launched in 2004 to support large sporting events, has evolved over the years and is currently supporting a wide variety of MPEs, including major international conferences, and international cultural and religious events. The programme consists of the following elements: coordination meetings to determine a State’s precise needs following its request for assistance; national workshops to provide training on various aspects of nuclear security at MPEs, including hands-on training on the use of relevant equipment; technical visits; expert missions to support the development of concepts of operations for MPEs; the loan of hand-held radiation detection equipment; and the provision of regional analysis of nuclear security information based on the data in the ITDB, to support a State’s nuclear security threat assessment and risk informed process for the preparation of an MPE.

22. The increase in demand for MPE support continues to grow at a significant rate. The Agency supports on average 7 MPEs annually and loans around 600 items of radiation detection equipment.

23. The Agency continues to receive a high volume of requests for support in education and training, across all technical areas of nuclear security. To address these requests and to help States establish and sustain national nuclear security regimes more broadly, the Agency has developed a comprehensive approach to its human resource development programme. Training activities based on a systematic approach support States in providing managers and personnel with the knowledge, skills and attitudes necessary to discharge their duties and perform their jobs and tasks in various areas of nuclear security.

24. The Agency's capacity building activities in the area of nuclear security continue to be implemented in close collaboration with States through the activities of the International Nuclear Security Education Network (INSEN), the national Nuclear Security Support Centres (NSSC) and the International Network for Nuclear Security Training and Support Centres.

25. Over time, a variety of international trends and needs have informed the growth, development, and strengthening of the Agency's capacity building activities in the area of nuclear security. The Agency has analysed the needs of Member States and capabilities of NSSCs in different regions and completed the feasibility determination process for establishing a Nuclear Security Training and Demonstration Centre (NSTDC) at the Agency's Seibersdorf laboratories, in order to provide optimal support to States in certain areas through the use of state-of-the-art technical infrastructure and equipment. Once completed, this specialized training facility will complement and fill gaps in capabilities that do not commonly exist among institutions in States, including NSSCs, and will focus on new Agency capabilities, further enhancing the capacity building programme in nuclear security with advanced technology and expertise to respond to States' requests.



Fig. 2. Ground breaking ceremony for new Nuclear Security Training and Demonstration Centre (NSTDC) at Seibersdorf, July 2021.

26. The Agency continued to increase its external communication on nuclear security. This included providing nuclear security-related communications and outreach through its media platforms, including

social media. Indicatively, the Agency published 28 articles, 5 press releases and 2 videos on nuclear security-related topics on the Agency’s website. Nuclear security was also mentioned in many Agency communications and outreach not primarily focused on nuclear security.

27. Further, to build and maintain the framework needed for States to effectively communicate and exchange information with one another, the Agency undertook activities such as planning and implementing major conferences and organizing virtual and/or hybrid technical meetings and webinars on nuclear security topics, and convened virtual Information Exchange Meetings to encourage communication among organizations active in various aspects of nuclear security.

28. Implementation of activities relevant to nuclear security depends on close interaction with States, other international organizations and within the Agency. Effective mechanisms are required for coordination, including planning and monitoring, and for narrative and financial reporting to Member States and organizations that provide voluntary contributions to the Nuclear Security Fund. Interactions with States are facilitated through the establishment of nuclear security support arrangements between the Agency and individual States. Some Member States implement nuclear security support programmes on a bilateral basis. The Agency continues to bring together experiences available in States and share information, as appropriate, as well as to implement joint activities, in order to improve both the effectiveness of the Agency-wide programme on nuclear security and the efficient use of resources.

29. Being the only international organization having a central and coordinating role in nuclear security activities with competence in the various technical subjects that promote nuclear security, the Agency contributes to the work of the dedicated Committees of the United Nations, such as the 1540 Committee, and specialized agencies within the United Nations system, such as the United Nations Office of Counter-Terrorism, United Nations Office on Drugs and Crime, and United Nations Office for Disarmament Affairs, and has established formal arrangements for cooperation with a number of international organizations.

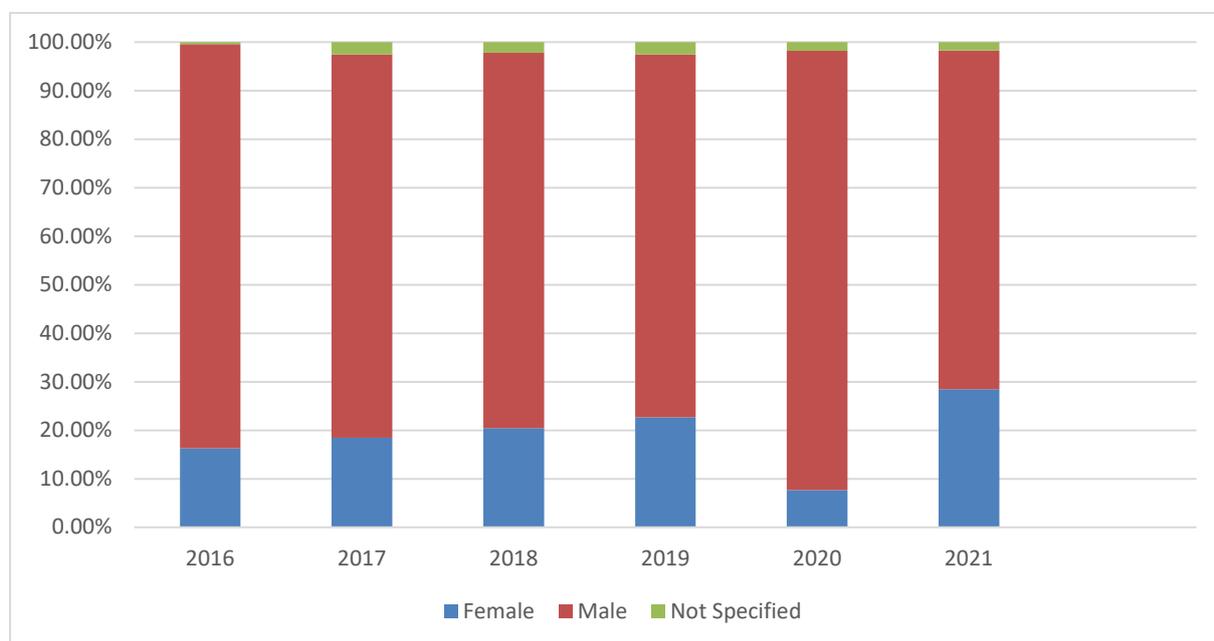
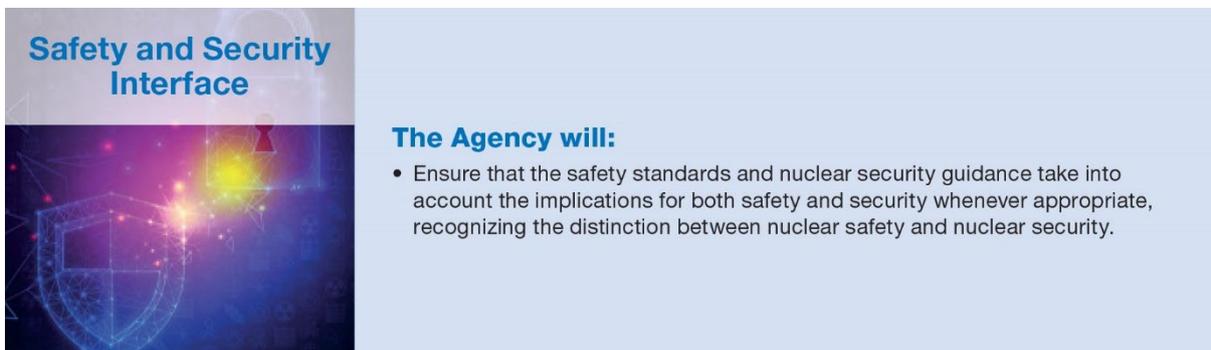


Fig. 3. Gender equality in participation in Agency nuclear security training.

30. The Agency continued to strengthen its work to promote workforce diversity, including gender equality and geographical diversity, in the context of its nuclear security activities. In March 2021, the Agency launched the Women in Nuclear Security Initiative to contribute to the Director General’s vision of the Agency being a global voice to promote gender parity and equality in the nuclear sector. This initiative aims to promote and strengthen the involvement of women in nuclear security worldwide and

to enhance the attractiveness of nuclear security careers for women, especially the next generation. In addition, participation by women in Agency nuclear security training increased from over 16% in 2016 to over 28% in 2021.

31. Twenty four fellows of the Agency's Marie Skłodowska-Curie Fellowship Programme (MSCFP), which aims to help increase the number of women in the nuclear field, are currently enrolled in master's programmes related to nuclear security. In addition, the Agency hosted two Schools on Nuclear Security and one workshop on the CPPNM and its Amendment for MSCFP fellows.

The graphic features a blue and purple abstract background with a glowing shield icon on the left. The text 'Safety and Security Interface' is positioned at the top left in blue. To the right, the heading 'The Agency will:' is followed by a bullet point: 'Ensure that the safety standards and nuclear security guidance take into account the implications for both safety and security whenever appropriate, recognizing the distinction between nuclear safety and nuclear security.'

32. In 2021, the Agency accepted pledges and received contributions to the Nuclear Security Fund (NSF) from the following Member States: China, Czech Republic, Denmark, Finland, France, Japan, the Republic of Korea, the Netherlands, New Zealand, Norway, the Russian Federation, Spain, Switzerland, the United Kingdom, the United States of America as well as from other contributors. The total amount pledged in 2021 accounted for €34 million, which was approximately at the same level as in 2018 and 2019 (€33 million and €38 million respectively) and less than in 2020 (€45 million).¹ In implementing activities in 2021, the Agency utilized funds from those contributions, as well as from previous contributions, most notably those received in 2020 from Canada, China, Estonia, the European Union, Finland, France, Germany, Japan, the Republic of Korea, the Netherlands, Norway, the Russian Federation, Saudi Arabia, Spain, Sweden, Switzerland, the United Kingdom and the United States of America as well as other contributors.

The majority of pledges and contributions included certain restrictions – thematic, geographic or time constraints - on how they can be utilized. Some of those unique programming and reporting requirements have increased in complexity and frequency over recent years, which has an effect on the Agency's ability to plan, implement and resource the full range of nuclear security activities as efficiently as possible and in line with the principles of results-based management.

Ongoing efforts to further improve the effectiveness and efficiency of the management of the NSF were discussed during the reporting period at the Agency's bilateral donor meetings with nine contributing Member States and the first in a series of new donor coordination meetings of Member State contributors to the NSF, in December 2021.

¹ Amounts rounded to nearest million Euros.

Abbreviations

A/CPPNM	Amendment to the Convention on the Physical Protection of Nuclear Material
AdSec	Advisory Group on Nuclear Security
AI	artificial intelligence
ASEAN	Association of Southeast Asian Nations
CPPNM	Convention on the Physical Protection of Nuclear Material
CRP	coordinated research project
DBT	design basis threat
DSRS	disused sealed radioactive source
INIR	Integrated Nuclear Infrastructure Review
INSAG	International Nuclear Safety Group
INSEN	International Nuclear Security Education Network
INSServ	International Nuclear Security Advisory Service
INSSP	Integrated Nuclear Security Support Plan
IPPAS	International Physical Protection Advisory Service
ITDB	Incident and Trafficking Database
M-INSN	Mobile-Integrated Nuclear Security Network
MORC	nuclear and other radioactive material out of regulatory control
MPE	major public event
MSCFP	Marie Skłodowska-Curie Fellowship Programme
NSF	Nuclear Security Fund
NSGC	Nuclear Security Guidance Committee
NSS-OUI	Nuclear Safety and Security Online User Interface
NSSC	Nuclear Security Support Centre
NSTDC	Nuclear Security Training and Demonstration Centre
NUSEC	Nuclear Security Information Portal
NUSIMS	Nuclear Security Information Management System
RPM	radiation portal monitor
SAT	systematic approach to training
SMR	small and medium sized or modular reactors

TECDOC	IAEA Technical Document
TRACE	Tool for Radiation Alarm and Commodity Evaluation

Analytical Overview

A. General Nuclear Security Areas

A.1. Promoting Further Adherence to International Legal Instruments

Trends

1. The Convention on the Physical Protection of Nuclear Material (CPPNM) was adopted on 26 October 1979 and entered into force on 8 February 1987. As of December 2021, there were 164 Parties to the CPPNM, an increase of 2 compared to the end of 2020.
2. The Amendment to the CPPNM (A/CPPNM) was adopted on 8 July 2005 and entered into force on 8 May 2016. As of December 2021, there were 127 Parties to the A/CPPNM, an increase of 2 compared to the end of 2020.

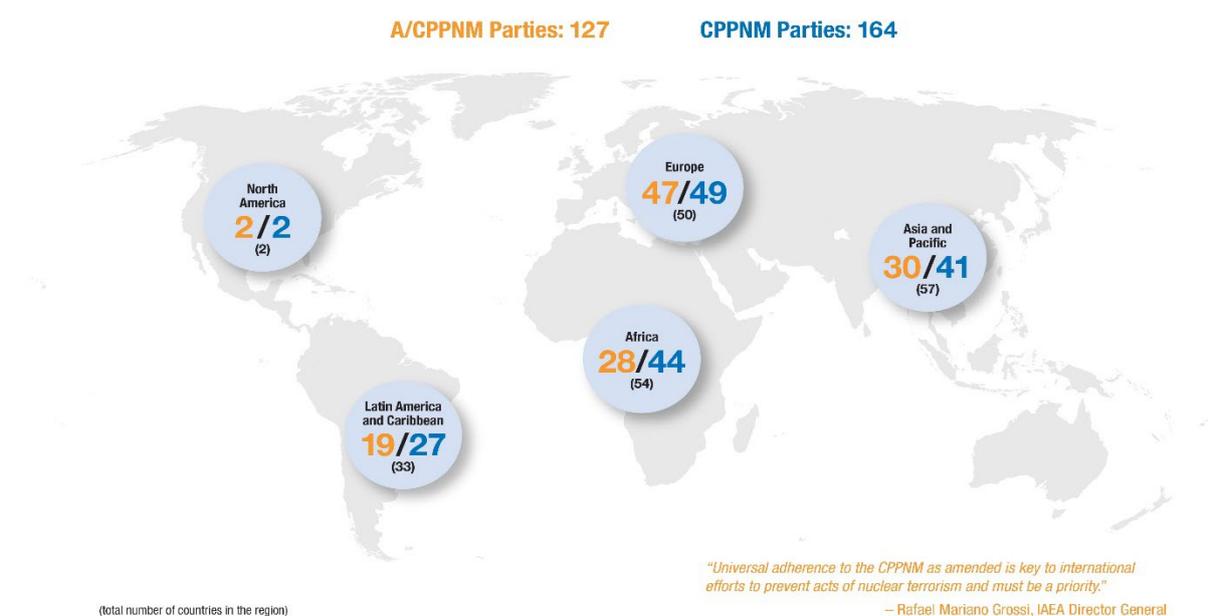


Fig. 1. Number of Parties to the CPPNM and to the A/CPPNM, as of 31 December 2021 (total number of Parties includes EURATOM).

3. Member States continued to request legislative and technical assistance on universal adherence to and full implementation of the CPPNM and its Amendment. States Parties continued to provide information on laws and regulations giving effect to the CPPNM and its Amendment, pursuant to Articles 5 and 14 of the Convention, and designated Points of Contact for the CPPNM and its Amendment. As of December 2021, 64 States had informed the Agency of their laws and regulations in accordance with Article 14, which represents an increase of 5 compared to the end of 2020. In the reporting period, 10 more States provided the Agency with details of their CPPNM and/or A/CPPNM Points of Contact bringing the total number of Points of Contact and Central Authorities designated under Article 5 to 130.

Related Activities

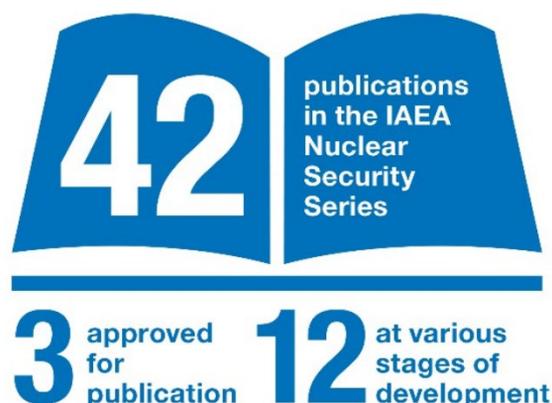
4. *The Agency will assist Member States in meeting the requirements of the CPPNM and its Amendment and will continue its efforts to promote universal adherence to the CPPNM and its Amendment. The Agency is planning to undertake the following related activities:*

- Organize the Conference of the Parties to the A/CPPNM, pursuant to Article 16.1 of the CPPNM as amended, planned for 28 March - 1 April 2022;
- Continue promoting and facilitating information exchange, on a voluntary basis of information on the implementation of nuclear security provisions of international instruments relevant to nuclear security;
- Continue supporting Member States, through the legislative assistance programme, in adhering to and implementing the provisions of the CPPNM and its Amendment as part of national nuclear legislation; and
- In consultation with Member States, consider ways of further promoting and facilitating the exchange, on a voluntary basis, of information on the implementation of nuclear security provisions of international instruments relevant to nuclear security.

A.2. Nuclear Security Guidance and Peer Review and Advisory Services

Trends

5. Work on the Agency's security guidance continued to focus on enhancing the set of Nuclear Security Series publications at all levels by covering the topics of computer security, threat assessment, physical protection of nuclear and other radioactive material, nuclear security culture and nuclear security education. To ensure that the publications remain up to date, the Agency continued its review of the Nuclear Security Recommendations with the aim of determining whether these publications should be updated in the near future.



6. By 31 December 2021, there were 42 publications in the Nuclear Security Series. In addition, 3 had been approved for publication, and 12 others, including 3 revisions, were at various stages of development, in accordance with the road map drawn up in consultation with the Nuclear Security Guidance Committee (NSGC).

7. The results of the survey to Member States on the usage of the Nuclear Security Series undertaken in 2020 were analysed and published in 2021. Member State responses indicated that *Objective and Essential Elements of a State's Nuclear Security Regime* (IAEA Nuclear Security Series No. 20) and the three Recommendations publications (IAEA Nuclear Security Series Nos 13, 14 and 15) are widely used and useful. These four publications are most commonly used for regulatory development but are also used for general awareness, legislative development, and education and training. The Implementing

Guide and Technical Guidance publications are used widely by Member States, although there is significant variation in how much individual publications are used. Their most common uses are legislative, national policy and regulatory development and education and training.

8. Challenges reported by Member States related to implementing the guidance in the Nuclear Security Series were related to the long development process, the unavailability of the publications in other languages and the absence of clear outreach materials that would present the overarching picture of the publications and their scope. In 2021, the Agency initiated several activities to address these challenges. The Agency initiated translation of the majority of the Implementing Guide level publications into Arabic, Chinese, French, Russian and Spanish, to be completed in the near term. To assist States in understanding the scope of individual Nuclear Security Series publications and their interconnections, the Agency initiated the development of a poster on these publications to identify the connections between them in a clear manner using graphics.

9. The six International Physical Protection Advisory Service (IPPAS) missions conducted in person in 2021 highlighted the continued commitment of Member States to ensure the physical protection of nuclear and other radioactive materials. Member State demand for this service remains high. Since 1996, a total of 96 IPPAS missions have been conducted upon request, in 57 Member States.



Fig. 2. Site visit during the International Physical Protection Advisory Service (IPPAS) mission in Burkina Faso in September 2021. (Photo: Autorité Nationale de Radioprotection et de Sûreté Nucléaire (ARSN), Burkina Faso).

10. There continued to be interest from Member States in the International Nuclear Security Advisory Service (INSServ) to establish and maintain effective nuclear security regimes that include elements that address nuclear and other radioactive material out of control. Since 2002, a total of 80 missions have been conducted in 66 Member States.

Related Activities

11. *The Agency will continue developing and further strengthening its nuclear security guidance to address a wide range of nuclear security topics. The Agency will assist with the application of its nuclear security guidance by, inter alia, strengthening its peer review and advisory services and related self-assessment tools. The Agency is planning to undertake the following related activities:*

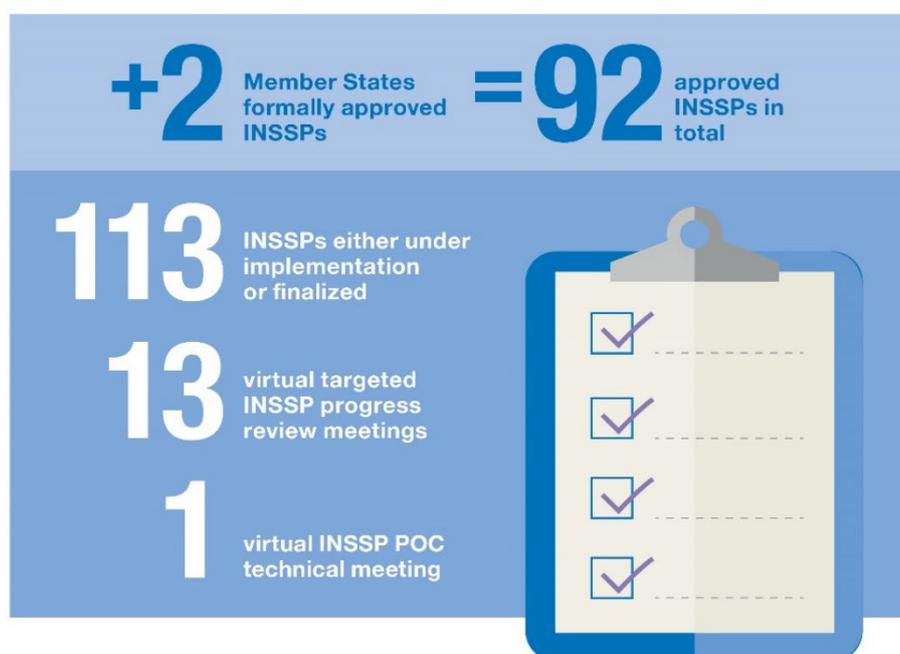
- Continue to gather and analyse feedback from Member States on the application of the top tier of the Nuclear Security Series, the Fundamentals and three Recommendation-level publications, to determine whether any revisions are needed in the near term, taking into account NSGC recommendations in this regard;
- Continue to implement IPPAS and INSServ missions upon request; and
- Continue to analyse data and feedback from States to increase the effectiveness of IPPAS missions, including the maintenance and update of good practices and lessons learned, as well as the development of self-assessment tools.

A.3. Assessing Nuclear Security Needs and Priorities

Trends

12. The Agency continued to give high priority to the development and implementation of Integrated Nuclear Security Support Plans (INSSPs) to assist States, upon request, in applying a systematic and comprehensive approach to enhancing their nuclear security regimes.

13. The total number of States with approved INSSPs increased by 2 in 2021, bringing the total number to 92. This increase is consistent with recent years. As of 31 December 2021, there were 14 INSSPs awaiting Member State acceptance and 6 INSSPs in the initial drafting stage, which is similar to the rate in previous years.



14. Member States continue to request Agency assistance to enhance their nuclear security regimes and encourage nuclear security self-assessment on a voluntary basis, including through the web-based Nuclear Security Information Management System (NUSIMS). In total, 99 Member States have nominated points of contact for NUSIMS, a number that has remained stable since 2017. NUSIMS self-

assessment questionnaires continue to be systematically used in INSSP finalization and review meetings.



Related Activities

15. *The Agency will assist States in providing, through INSSPs, a comprehensive framework for systematically identifying and prioritizing States' nuclear security needs, including through performing nuclear security self-assessments on a voluntary basis. The Agency is planning to undertake the following related activities:*

- Continue to further develop and improve the INSSP methodology as a comprehensive tool to support the planning and prioritization of the provision of Agency nuclear security assistance to States, as well as to facilitate international cooperation and coordination in meeting Member States' nuclear security needs;
- Continue to develop and promote self-assessment tools and methodologies, that are based on Nuclear Security Series publications and can be used by States on a voluntary basis to perform self-assessments of their nuclear security regimes and implement activities to ensure effective and sustainable national nuclear security infrastructure; and initiate the restructuring of the NUSIMS self-assessment tool to increase its complementarity with the established INSSP mechanism and functional areas, improve the user-friendliness of the interface and maximize the use of a systematic, structured and comprehensive approach to strengthening a State's nuclear security regime; and
- Continue to conduct technical webinars on specific nuclear security topics to provide an overview of the current status, determine challenges and needs, and identify projects and interested Member States and experts.

A.4. Capacity Building in Nuclear Security

Trends

16. The systematic approach to training methodology continued to be further implemented in developing, revising, evaluating and improving Agency training courses in the area of nuclear security.

17. Schools on Nuclear Security represent prominent Agency capacity building activities, providing early career professionals from Member States with the fundamental knowledge of nuclear security necessary to understand the international requirements in this area, as well as the measures to be taken in order to meet any obligations under the international nuclear security legal framework. Since the first International School on Nuclear Security in 2011, the average number of Schools organized has increased to four per year, conducted in different regions and languages. The Schools have benefited around 800 young professionals internationally. In 2021, in response to the COVID-19 pandemic, a major revision of the curriculum and training materials of the Schools was undertaken, enabling these events to be conducted in virtual and hybrid formats. This included new videos demonstrating the operation of physical protection systems, access control systems and radiation detection equipment, as

well as virtual practical exercises and facility visits. Breakout room discussions and quizzes were developed to enable the active involvement of participants in virtual Schools as well as interaction between students and lecturers/moderators.

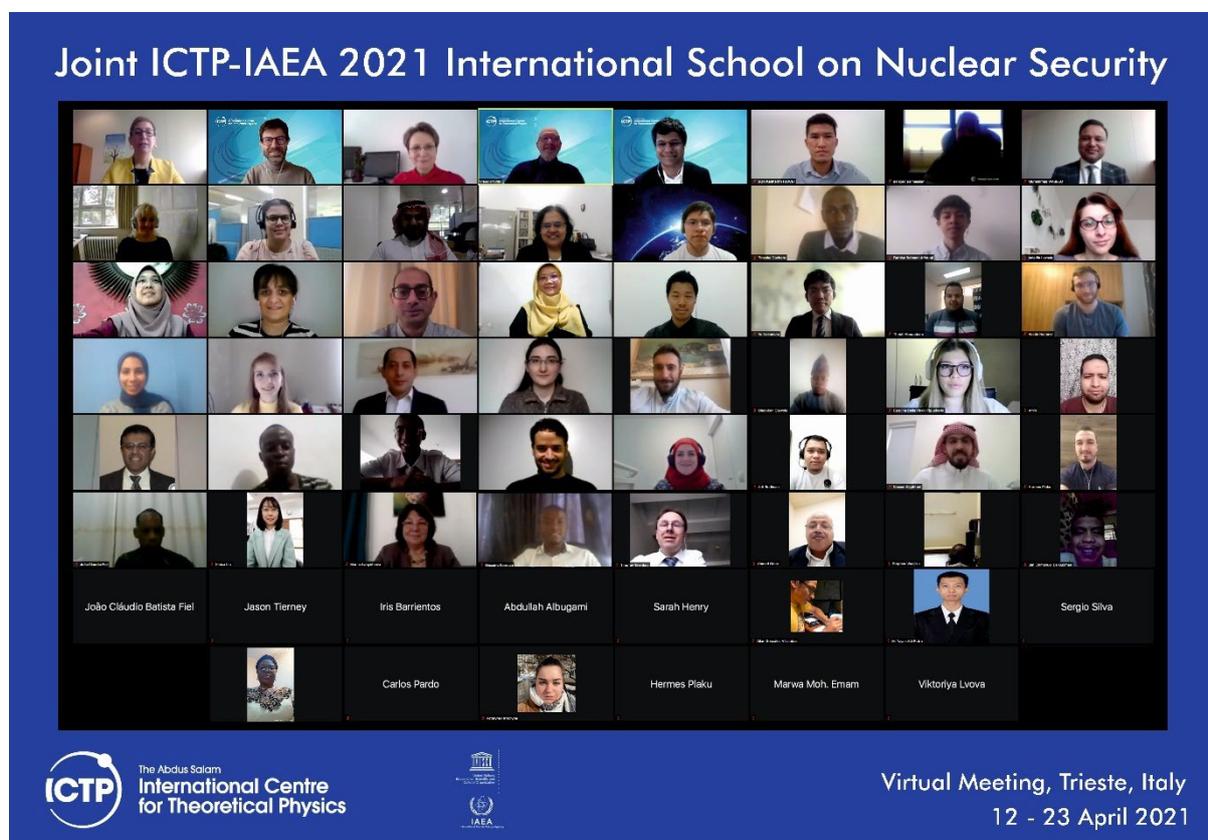
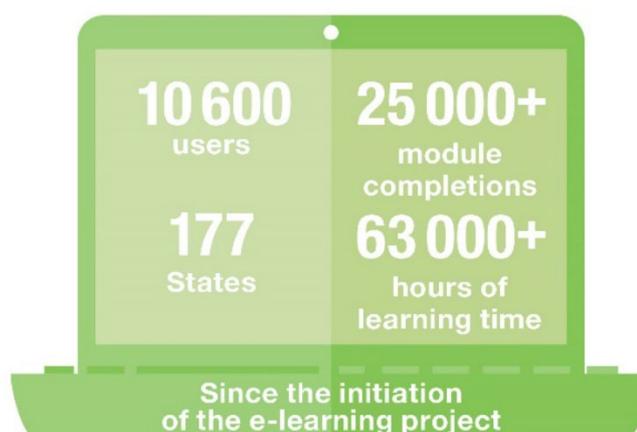


Fig. 3. Group photo of participants in the joint ICTP-IAEA International School on Nuclear Security, convened virtually in April 2021. (Photo: M. Maffione, ICTP)

18. In 2021, more than 10 000 participants from 138 States took part in 110 training activities, including 59 training courses and workshops and 51 webinars, which reflects a high level of interest and involvement despite the COVID-19 pandemic related constraints. Compared to 2020, the number of Agency training activities (including training courses, workshops and schools) and webinars more than doubled in 2021, from 42 to 110. The number of trainees in training activities nearly tripled (from 650 to 1836), the number of webinar participants increased from 1508 to 8675, and there was a significant increase in the number of countries represented in training events (from 75 to 138). In 2019, prior to the COVID-19 pandemic, the Agency held 124 training events with 3174 participants from 150 countries. Progress in 2020–2021 was achieved due to the greater number of webinar participants and wider geographical distribution of participating countries.



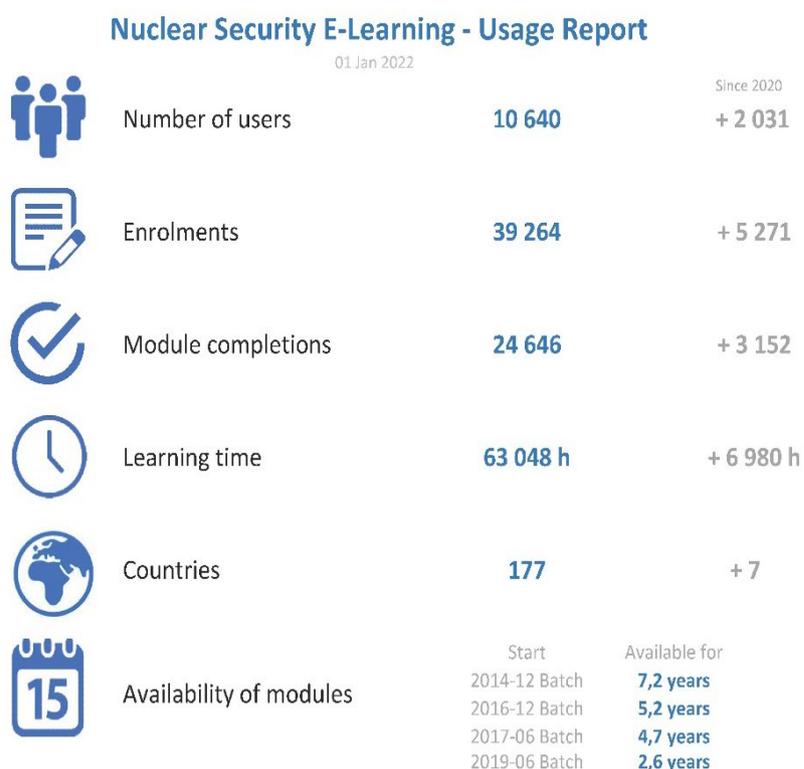


Fig. 4. Nuclear security e-learning statistics for 2021.

19. Member States remain interested in Agency activities aimed at the development, translation, revision and maintenance of e-learning courses, which play an important role in promoting and harmonizing the Agency's training efforts. The suite of nuclear security e-learning modules can be used for many purposes, including as a prerequisite for joining virtual training courses, as a part of a hybrid learning approach, as a tool to bridge the knowledge gap, or as a useful self-study or knowledge-checking tool. Since the conception of the e-learning project in 2010, around 25 000 Agency nuclear security e-learning modules have been completed by around 10 600 users from 177 States through over 63 000 learning hours.

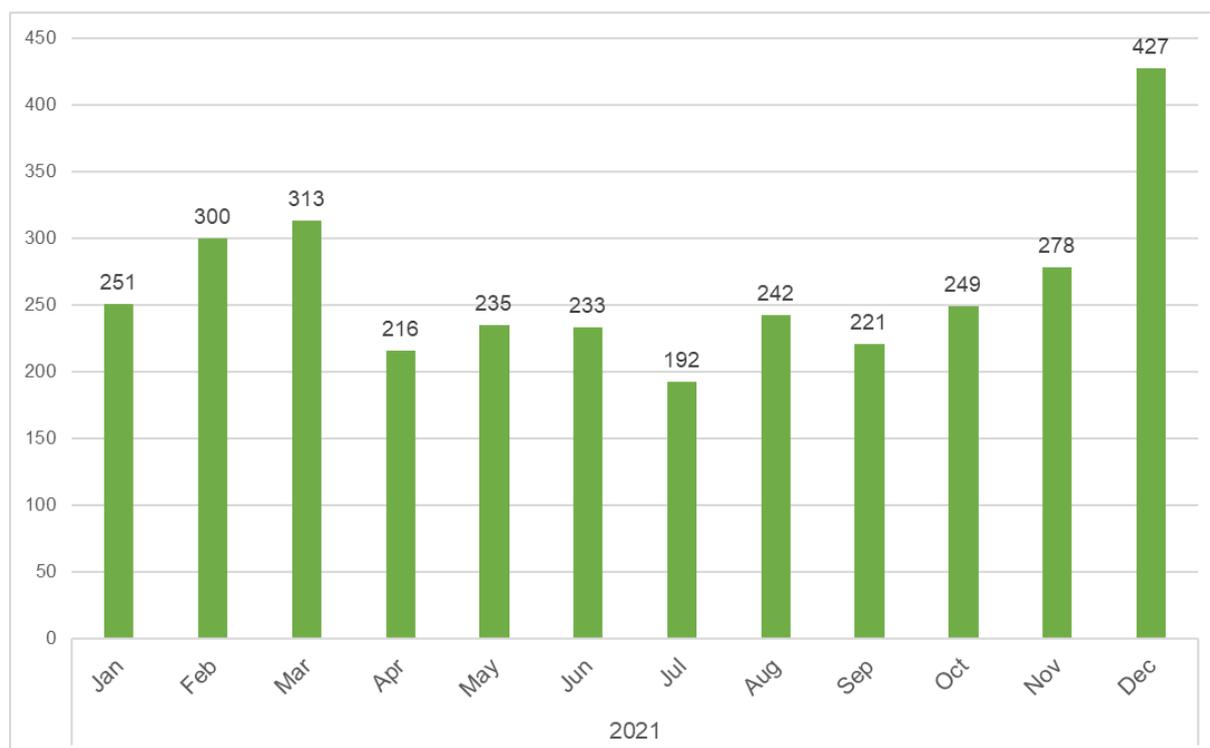


Fig. 5. Monthly timeline of nuclear security e-learning module completions in 2021.

20. There is increased demand from Member States for e-learning. In 2021, over 1200 users from 125 States completed more than 3100 e-learning modules, with the number of States using nuclear security e-learning increasing by 7. Overall, completion of e-learning modules increased from 2019 to 2020, but decreased slightly in 2021. Three e-learning modules were translated and made available in Arabic, Chinese, English, French, Russian and Spanish during the reporting period, and two new modules entitled “Introduction to the International Legal Framework for Nuclear Security” and “Introduction to Nuclear Forensics” were developed, bringing the total number of e-learning modules to 19, 18 of which are available in the above languages. The Agency will continue to use its e-learning resources in several directions: as an option for individual self-study; as a prerequisite for classroom-based or virtual learning similar to the approach already implemented for the Schools on Nuclear Security; as a part of a virtual or blended learning approach through the Agency’s Learning Management System, incorporating elements of e-learning to the curricula of Agency training courses and workshops; and encouraging competent authorities of Member States to use Agency e-learning for staff professional development.

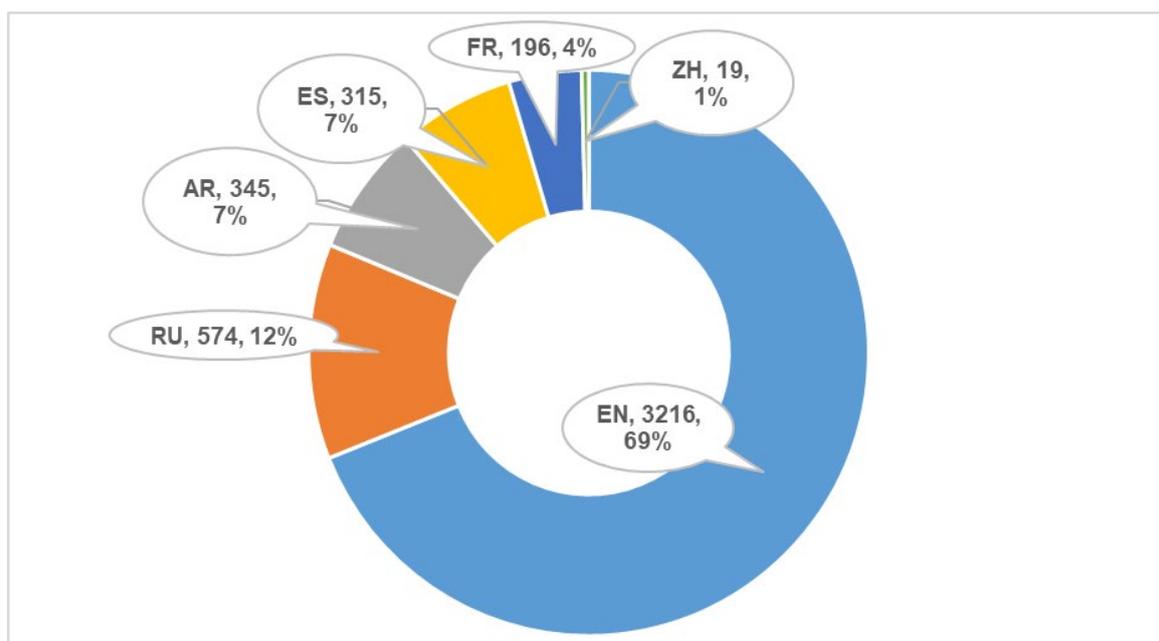
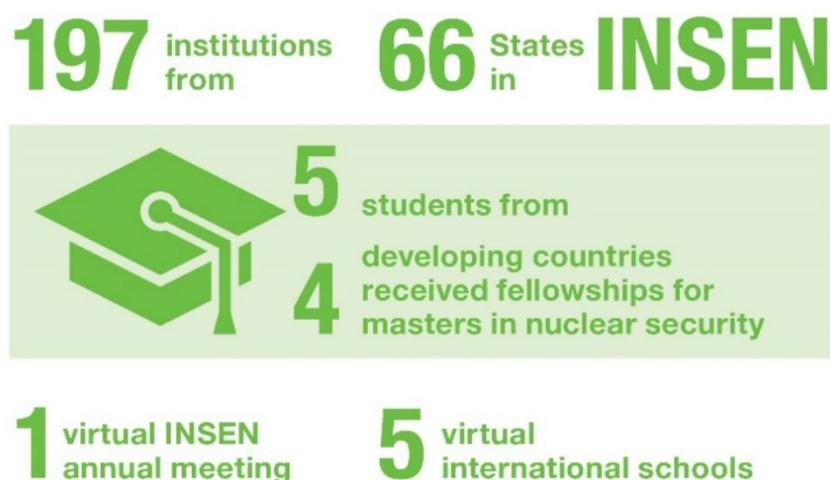


Fig. 6. Nuclear security e-learning enrolments by language in 2021.

21. Feedback summaries received on the Agency’s training courses, workshops, schools and webinars were collected and analysed. The analysis of this feedback shows that participants highly appreciate the content and quality of the training materials; the experience and teaching skills of instructors, lecturers and facilitators; and the overall implementation of training events. Evaluations typically rate the quality of the Agency’s nuclear security training events as between ‘good’ and ‘excellent’. The average rating of the Agency’s training courses on nuclear security topics, based on approximately 50 training events, was 4.70 on a scale of 1 (poor) to 5 (excellent).



22. Member States continued to request assistance in establishing and enhancing educational programmes on nuclear security based on international guidance and recommendations through its support to the International Nuclear Security Education Network (INSEN), which has 188 institutions from 66 States, and 9 observer institutions. Over 80% of INSEN members offer nuclear security programmes, which range from short courses to full Master of Science degrees, using largely INSEN-developed teaching materials based on the Nuclear Security Series and Agency support.

NUMBER OF NETWORK MEMBERS

188

(66 States)

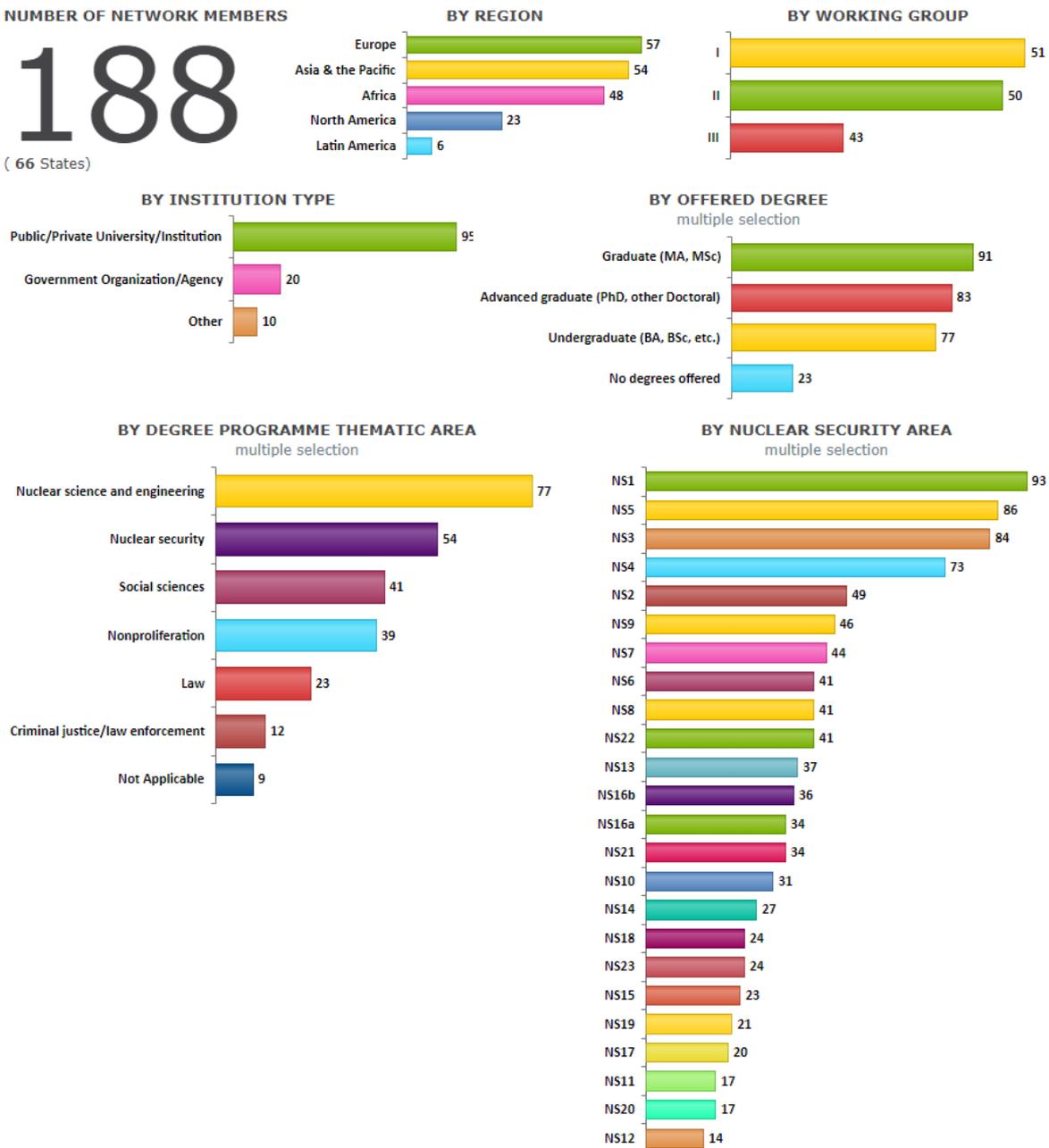


Fig. 7. Overview of INSEN.

23. Member States continue to request assistance with the development of national Nuclear Security Support Centres (NSSCs) as a means to strengthen the sustainability of nuclear security through programmes in human resource development, technical support and scientific support for the prevention and detection of, and the response to, nuclear security events.

24. Member States continued to share information and resources to promote coordination and collaboration among States with an NSSC, or those with an interest in developing such a Centre, through the International Network for Nuclear Security Training and Support Centres (NSSC Network). The Network has grown since its inception in 2012 and now has representatives from 66 Member States.

25. A survey by the NSSC Network working group of Network members identified impacts of the COVID-19 pandemic on the role and function on NSSCs. Analysis suggests that despite the cancellation and postponement of events and activities, unique approaches to conducting virtual activities have also been developed. NSSCs reported that the mitigatory actions already implemented had been incorporated in their mid-term strategies.

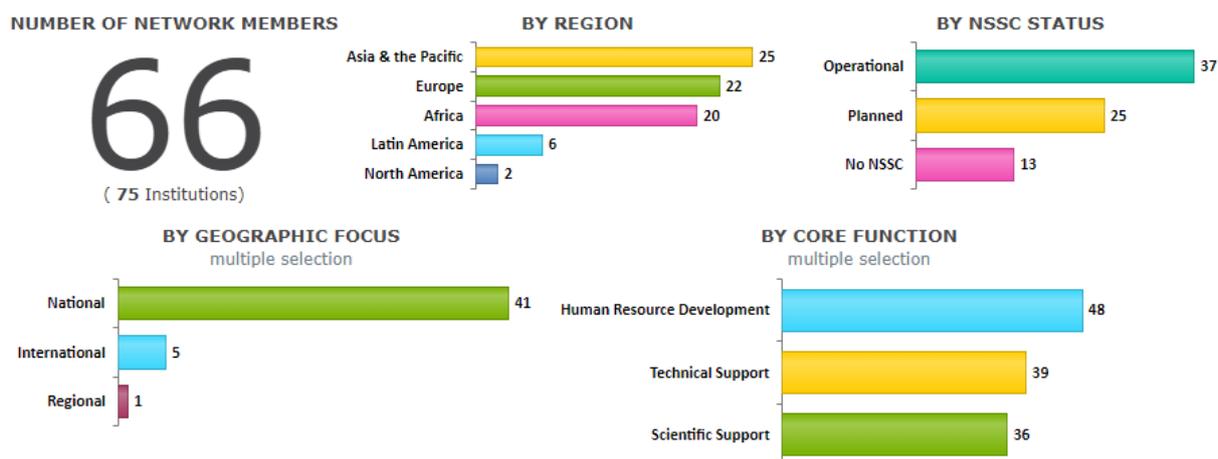


Fig. 8. Overview of the NSSC Network.

Related Activities

26. *The Agency will assist Member States in strengthening capacity through the implementation of nuclear security education and training programmes, available to all States. The Agency is planning to undertake the following related activities:*

- Continue the development of a suite of training courses, based on Nuclear Security Series guidance, and making these training courses available for delivery, including through NSSCs;
- Implement train-the-trainer programmes to increase sustainability of capacity building efforts in nuclear security;
- Continue the establishment of the Nuclear Security Training and Demonstration Centre (NSTDC) at the Agency's Seibersdorf laboratories, ensuring engagement with Member States and with due consideration to the planning of resources for the long-term sustainability of the Centre;
- Continue to regularly identify areas where new and updated training courses are needed, in collaboration with Member States and utilizing information from INSSPs and NUSIMS;
- Continue to assist States in developing NSSCs to facilitate regional and international cooperation in human resource development, technical support and scientific support for nuclear security; and
- Conduct the first session of the Leadership Academy for Nuclear Security to help managers from organizations with nuclear security functions further develop their leadership skills.



Fig. 9. A rendering of the Agency's Multipurpose Building, which will house the NSTDC, in Seibersdorf, Austria.

A.5. Information and Computer Security

Trends

27. Member States continue to recognize the threat of cyber-attacks, and their potential impact on nuclear security, as well as the need to take effective security measures against such attacks, and to encourage the Agency to continue to foster international cooperation and to assist Member States, upon request, in this regard.

28. The Agency continued its efforts to strengthen computer security in 2021 through activities to improve international cooperation in order to promote the exchange of information and experiences, to develop appropriate guidance and to assist Member States in this area, upon request, by providing training courses, completing one coordinated research project (CRP) and initiating another, and hosting Information Exchange Meetings.

Related Activities

29. *The Agency will assist Member States in raising awareness of the threat of cyber-attacks, and their potential impact on nuclear security, by promoting a computer security culture, and support States in taking effective security measures against such attacks and improving their relevant nuclear security capabilities. The Agency is planning to undertake the following related activities:*

- Assist States, upon request, in the area of computer security by providing training courses, webinars and exercises, as well as developing new or updating existing related guidance;
- Further improve international cooperation in the area by bringing together experts and policymakers to promote the exchange and sharing of information and experiences in computer security for nuclear security;
- Continue research to address computer security for nuclear security topics, including through CRPs; and

- Further develop training tools, including hands-on exercises and demonstrations to support Agency training on computer security for nuclear security, and to raise awareness of the threat of cyber-attacks, and their potential impact on nuclear security.

A.6. Information Exchange and Sharing

Trends

30. More than 280 new users were approved for access to NUSEC - the Agency’s web-based information tool for Member States that supports the exchange of information across the nuclear security community. In total, NUSEC has more than 6600 registered users from 173 Member States and 23 international organizations and non-governmental organizations.

31. Reports of 120 incidents were added to the Incident and Trafficking Database (ITDB) in the reporting period. The number of incidents voluntarily reported by participating States to the ITDB demonstrates that illicit trafficking, thefts, losses and other unauthorized activities and events involving nuclear and other radioactive material continue to follow historical averages. Overall, in the period between the inception of the ITDB and 31 December 2021, States had reported — or otherwise confirmed to the ITDB — a total of 3928 incidents.

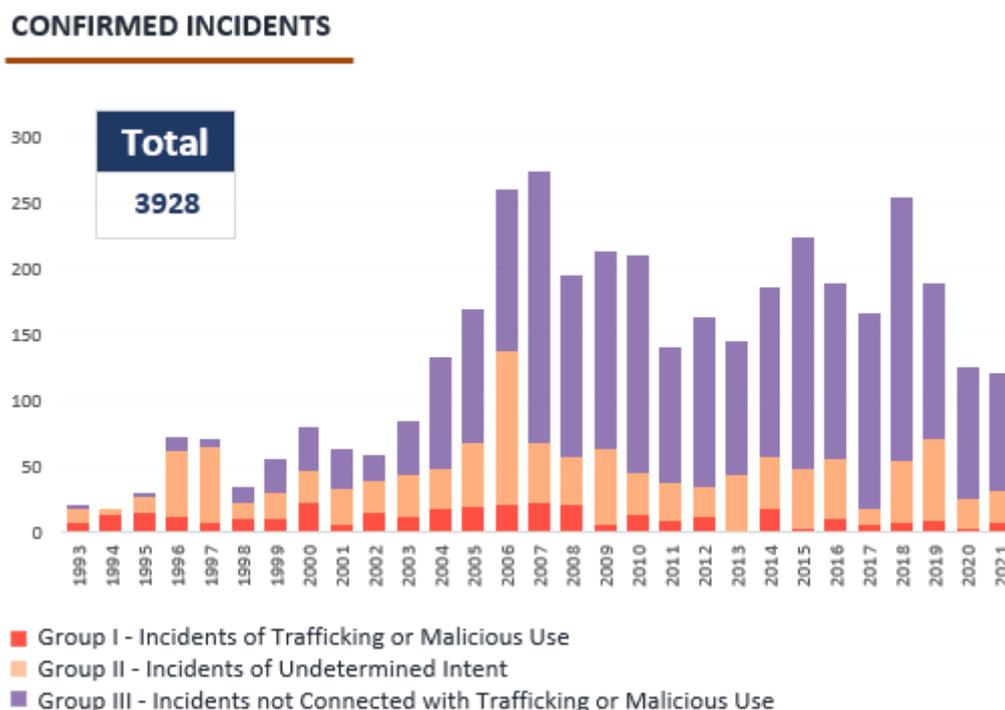


Fig. 10. Confirmed incidents reported to the ITDB by incident group (1993–2021).

32. Of the 120 newly reported incidents in 2021, 7 were related to trafficking, 4 of which involved scams (including attempts). All of the material involved in these incidents was seized by the relevant competent authorities within the reporting State. One incident involved 607 grams of low enriched uranium (attempted unauthorized trade of uranium dioxide tablets). No incidents involved plutonium or Category 1 sources. The number of incidents related to trafficking or malicious use has declined over recent years. Since the inception of the ITDB, there have been few incidents involving kilogram quantities of high enriched uranium, and these have not occurred since the 1990s. Furthermore, some incidents have involved attempts to traffic materials across international borders, although none were reported during 2021. Financial gain appears to be the principal incentive behind most confirmed trafficking incidents.

33. There were 24 reported incidents in which the intent to conduct trafficking or malicious use could not be determined. These included 14 thefts, 7 incidents of missing materials and 4 incidents of unauthorized possession. As 1 incident involved both theft and unauthorized possession, the total number of incidents is lower (24) than the total number of incident types (25) mentioned above. In 19 of the 24 incidents, the materials had not been recovered at the time of reporting. In all of these 19 incidents, the unrecovered materials involved sources with a risk lower than Category 3.

34. There were also 89 reported incidents in which the material was out of regulatory control but not related to trafficking, malicious use or scams. Most of these incidents involved unauthorized shipments, unauthorized or undeclared storage, unauthorized disposal, unauthorized possession and loss of material. There were also nine thefts not related to trafficking, malicious use or scams. A number of incidents involved the detection of manufactured goods contaminated with radioactive material. Although these 89 incidents were not related to trafficking, malicious use or scams, they do indicate potential deficiencies in the systems used to control, secure and properly dispose of radioactive material.

CONFIRMED INCIDENTS: by TYPE of MATERIAL

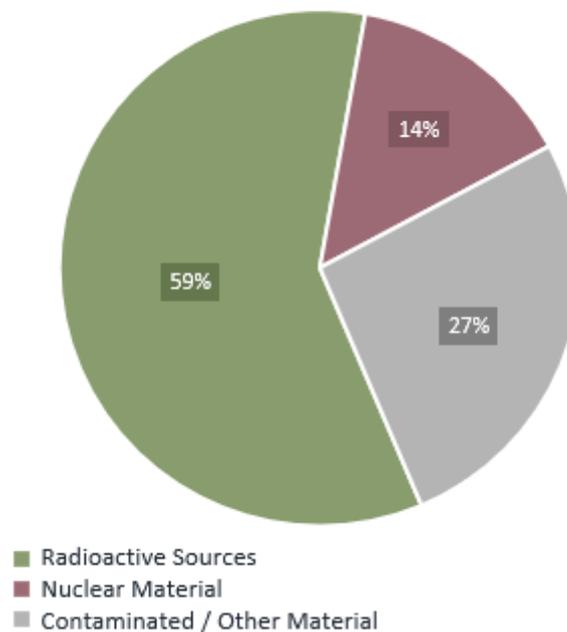


Fig. 11. Confirmed incidents reported to the ITDB by type of material (1993–2021).

35. Overall, during the reporting period, there were 23 thefts, the majority of which (21) involved Category 4–5 sources used in material analysis and industrial applications. The other two thefts involved Category 2 sources. Historically, the recovery rate for Category 1–3 sources is high, but the rate has been much lower for Category 4–5 sources.

Related Activities

36. *The Agency will continue supporting international cooperation in nuclear security through assisting Member States in exchanging and sharing nuclear security information on a voluntary basis. The Agency is planning to undertake the following related activities:*

- Continue the management and support of activities relevant to nuclear security information exchange and sharing, with due respect to confidentiality, including through convening conferences, working group meetings, and other information and technical exchanges on nuclear security matters;

- Continue to play a central and coordinating role in nuclear security activities among international organizations and initiatives, taking into account their respective mandates and memberships, and working jointly, as appropriate, with relevant international and regional organizations and institutions, including through regular Information Exchange Meetings and the coordination of cooperation and complementary activities between NSSCs;
- Continue the maintenance and further enhancement of a comprehensive and secure information management system to provide users with accurate relevant information;
- Further facilitate, including through designated points of contact, the exchange of information through secure electronic access to information contained in the ITDB; and
- Continue outreach to Member States that do not participate in the ITDB to encourage their participation.

A.7. Nuclear Security Research and Emerging Technologies

Trends

37. Member States continue to express increasing concerns in relation to existing and emerging nuclear security threats. The Agency continued to undertake efforts to assist States, upon request, to address current and evolving challenges to nuclear security.

38. The Agency continued to promote and implement CRPs and relevant technical events (webinars, workshops and Technical Meetings) to provide overviews of select topics in nuclear security and solicit input and interest from Member States. The proposals received from Member States continue to provide insight into nuclear security needs, as well as an opportunity for the Agency to support capacity building by working closely with experts in Member States. The Agency's capacity building activities and support for the development of tools and processes enable nuclear security arrangements to be maintained.



Fig. 12. CRP participants working to test scenarios using a simulator, gather the resulting datasets, and benchmark cyber anomaly detection techniques.



Fig. 13. The IAEA's Tool for Radiation Alarm and Commodity Evaluation (TRACE) assists Front Line Officers and experts in the assessment and adjudication of radiation alarms primarily generated at RPMs.

39. The increased demand by Member States for support for command and control over radiation detection equipment during operations, ranging from nuclear security for major public events to radiation source searches and from border monitoring to national inventory management, has led to the development of a Mobile-Integrated Nuclear Security Network (M-INSN). This secure system makes it possible to network individual detectors to command locations in countries, enabling the coordination, management and oversight of radiation detectors deployed for security as well as safety purposes. The M-INSN is a vendor neutral system developed by the Agency that Member States can operate on a local, regional or national level.

40. Member States continued to express the need for additional guidance in the areas of maintenance, repair and calibration of radiation detection equipment, including maintaining the capacity of experts to conduct repair and calibration.

41. Member States continued to enhance their technical capabilities using the outcomes of completed CRPs, including the smartphone application Tool for Radiation Alarm and Commodity Evaluation (TRACE). By December 2021, TRACE users were located in 175 countries, representing an increase of 15 countries since the end of 2020, with a total user base of more than 17 000 users, an increase of several thousand users since the end of 2020. Based on demand from Member States, a follow-up CRP will enable the TRACE tool to quantitatively assist in the evaluation of radiation alarms and enhance the ability of RPMs to be used in nuclear security, radiation safety and trade facilitation applications.

Related Activities

42. *The Agency will continue implementing CRPs to promote research and development in the area of nuclear security and will assist Member States in utilizing the outcomes of the CRPs for enhancement of States' technical capabilities. The Agency is planning to undertake the following related activities:*

- Continue to keep abreast of scientific, technological and engineering innovations, including through dialogues with Member States and, as appropriate, with the nuclear industry, with a view to confronting current and evolving challenges and risks to nuclear security, and also considering opportunities to enhance nuclear security from these innovations;
- Continue to initiate and manage CRPs to address emerging nuclear security threats and technologies identified through relevant conferences, Information Exchange Meetings and Technical Meetings, with due attention to the possibility of shortening their duration in order to quickly provide guidance, specifications, best practices and new tools, where appropriate, on focused topical areas of high priority.
- Continue to support and enhance the first freely available tool for Member States to characterize their RPMs and determine the alarm thresholds necessary for detection of Member State determined minimum detectable quantities (MDQs). The Agency's MDQ tool enables Member

States to use a risk informed approach for establishing alarm threshold values and estimating the operational impact of those values on traffic through a radiation portal monitor; and

- Provide RPM kits to Member States, including through NSSCs, upon their request, to support the sustainment of their RPMs; and provide initial support through train-the-trainers activities for developing and maintaining Member States' expert capacities for repairing and calibrating their detection equipment.

B. Nuclear Security of Materials and Associated Facilities

B.1. Nuclear Security Approaches for the Whole Fuel Cycle

B.1.1. Physical Protection of Nuclear and Other Radioactive Material and Associated Facilities and Activities

Trends

43. There is increased demand from Member States for the development of practical technical guidance and training on the security of nuclear and other radioactive material and associated facilities.

44. Member States continue to request assistance in establishing or further enhancing their regulatory frameworks for physical protection of nuclear material and nuclear facilities and capacity building of regulatory staff to perform regulatory functions.

45. Member States continued to request assistance on threat characterization and assessment; the development, use and maintenance of design basis threats or representative threat statements; vulnerability analysis; and the development of methodologies for performance assessment of physical protection systems.

46. Member States continued to support the Agency's efforts to enhance States' understanding of nuclear security culture and its application in practice.

47. Member States continued to request assistance in enhancing their capacities for developing and testing contingency plans for response to malicious acts, such as unauthorized removal of nuclear and other radioactive material or sabotage of such material and associated facilities.

Related Activities

48. *The Agency will continue to assist Member States, upon request, in enhancing nuclear security of facilities and activities involving nuclear and other radioactive material under regulatory control, including during transport, decommissioning and lifetime extension of facilities. The Agency is planning to undertake the following related activities:*

- Continue to support States in the implementation of nuclear security activities for the whole nuclear fuel cycle, including support for capacity building activities; and
- Continue to assist States, upon request, in the development and consolidation of nuclear security culture, including through publishing guidance, providing training and related self-assessment, and developing training materials and tools.

B.1.2. Nuclear Security of Advanced Reactors, including Small and Medium Sized or Modular Reactors

Trends

49. The growing participation of Member States in Agency activities related to small and medium sized or modular reactors (SMRs) has reflected their strong interest in various designs of SMRs and a corresponding increase in requests, from countries embarking on such technology, for the development of human resources to handle the challenges related to the secure deployment of SMRs. In this regard, the Agency continued to conduct a range of activities related to the nuclear security of SMRs, such as taking nuclear security considerations into account when developing new publications in this area and in activities related to the Agency-wide platform on SMRs and their applications.

50. There is increasing interest from Member States in Agency's efforts on SMRs and on safety, security and safeguards by design of novel advanced reactors, including nuclear security challenges and considerations.

51. Members of the Small Modular Reactor Regulators' Forum have acknowledged the need to enhance their international cooperation in dealing effectively with regulatory challenges associated with the formulation of a balanced and risk informed approach to the implementation of nuclear security measures in decision making, planning and design activities over the life cycle of SMRs in order to achieve the secure deployment of SMRs at the global level.

Related Activities

52. *The Agency will assist Member States, upon request, to address matters related to nuclear security of SMRs. The Agency is planning to undertake the following related activities:*

- Continue the development of publications addressing nuclear security of SMRs, by identifying specific features of SMRs, analysing and synthesizing the existing Nuclear Security Series publications considering how the specific features of SMRs may affect the implementation of nuclear security recommendations for such reactors;
- Continue to highlight nuclear security challenges and considerations in Agency efforts on SMRs; and
- Organize a Technical Meeting on Instrumentation and Control and Computer Security for Small Modular Reactors and Microreactors.

B.1.3. Enhancing Nuclear Security Using Nuclear Material Accounting and Control

Trends

53. There is increased demand from Member States for the development of practical technical guidance and training on nuclear material security using accounting and control for nuclear security purposes, including in the area of insider threat.

54. Coordinated research continued to enhance preventive and protective measures against insider threats at nuclear facilities and provides participating institutes with an opportunity to discuss their current progress and explore opportunities for collaboration.

55. Gamification, virtual reality and video-based training tools utilizing the simulated Shapash Nuclear Research Institute were further developed, allowing training course participants to deepen their understanding of the concepts taught through a more interactive approach.



Fig. 14. Demonstration of the virtual reality tool which features potential threats posed by insiders, at the simulated Shapash Nuclear Research Institute.

Related Activities

56. *The Agency will assist Member States in enhancing nuclear security of materials using accounting and control, including by addressing the need to counter insider threats. The Agency is planning to undertake the following related activities:*

- Continue to assist States in establishing effective and sustainable national nuclear security regimes that support countering insider threats and enhancing accounting and control for nuclear security purposes at facilities; and
- Further develop training tools, including gamification, virtual reality and video-based training tools using the simulated Shapash Nuclear Research Institute.

B.1.4. Nuclear Security in the Transport of Nuclear and Other Radioactive Material

Trends

57. There are several million shipments of nuclear and other radioactive material taking place all over the world every year. Member States continue to report thefts of radioactive material during transport. Over the period 1993–2021, Member States reported to the ITDB 631 thefts of radioactive material. Of these, 49% occurred during transport, figure that has been rising in the last decade, and; in 57% of these cases (178 incidents), the stolen radioactive material has yet to be recovered.

58. Member States continued to request assistance in strengthening transport security arrangements at the national and international levels, including in the development and improvement of relevant national regulatory infrastructures. Four Member States were supported in this area during 2021, which remains at the same level as in 2020.

59. The outcomes of and discussions from the International Conference on the Safe and Secure Transport of Nuclear and Radioactive Materials, held virtually in Vienna in December 2021, informed the Agency of the potential needs of Member States in this area, which will assist in the planning of future programmes.



Fig. 15. Closing session of the International Conference on the Safe and Secure Transport of Nuclear and Radioactive Materials in December 2021.

Related Activities

60. *The Agency will continue to assist Member States in the security of nuclear and other radioactive material during transport. The Agency is planning to undertake the following related activities:*

- Continue the review of transport security plans in Member States, upon their request, as well as planning of future activities to address Member States' needs, including activities informed by the outcomes of the International Conference on the Safe and Secure Transport of Nuclear and Radioactive Materials; and
- Continue the development of publications within the Nuclear Security Series in the area of the secure transport of nuclear and other radioactive material.

B.2. Security of Radioactive Material² and Associated Facilities

B.2.1. Assistance Provided to States to Enhance the Security of Radioactive Material in Use and Storage and Associated Facilities

Trends

61. There is an increased demand by Member States for assistance in the area of radioactive material security, with emphasis on regulatory infrastructure and risk reduction activities, such as physical protection enhancements and lifecycle management of high-activity radioactive sources.

62. The number of Member States benefiting from the Agency's assistance in enhancing national regulatory infrastructure for both radiation safety and nuclear security of radioactive material continued

² For the purpose of this section, "radioactive material" indicates "other radioactive material", as defined in IAEA Nuclear Security Series No. 20, Objective and Essential Elements of a State's Nuclear Security Regime.

to grow. In total, 53 States from Africa, and Latin America and the Caribbean participated in relevant projects, an increase of 14 compared to the end of 2020.

63. There is an increased number of requests by Member States for support in the sustainable management of disused sealed radioactive sources (DSRSs). In this respect, 18 Member States in the Africa, Latin America and the Caribbean, and Asia and the Pacific regions benefited from comprehensive assistance to ensure safe and secure management of high activity DSRS, including their repatriation or removal to authorized recipients, while 15 additional States have expressed the need to receive similar technical assistance.



Fig. 16. Experts from the IAEA and Paraguay reviewing physical protection measures proposed for the site allocated for an irradiator at the National Center for Burns and Reconstructive Surgeries (CENQUER), Asuncion, Paraguay (Photo: Radiological and Nuclear Regulatory Authority (ARRN))

Related Activities

64. The Agency will continue assisting States in the security of radioactive material and associated facilities, including in the lifecycle management of radioactive material. The Agency is planning to undertake the following related activities:

- Continue to support States in enhancing their national regulatory infrastructure for radiation safety and the security of radioactive material; in strengthening their physical protection measures at facilities with high activity radioactive sources in use or storage; and in enhancing safe and secure management of sealed radioactive sources through the provision of comprehensive guidance, technical assistance, Technical Meetings, regional and national workshops and training courses, and peer review and advisory missions;
- Continue assistance to States through the project entitled “Strengthening Physical Protection at Facilities with High Activity Radioactive Sources in Use and Storage towards Enhancing Nuclear Security Globally”, and increase the number of States benefiting from this project, upon their request;
- Continue to support States to address nuclear security matters in the end of life management of radioactive sources, notably through the implementation of projects addressing borehole disposal and assisting safe and secure storage of disused radioisotope thermoelectric generators;

- Continue to provide assistance, upon the request of States, with the aim of, inter alia, enhancing national regulatory infrastructures and building national capacities needed to ensure the safe, secure and sustainable management of disused sources, as well as the removal and repatriation of high activity disused sources;
- Organize the International Conference on the Safety and Security of Radioactive Sources: Accomplishments and Future Endeavours; and
- Hold the annual meeting of the Working Group on Radioactive Material Security.

B.2.2. Support for the Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources

Trends

65. In 2021, no additional Member States made a political commitment to implementing the Code of Conduct on the Safety and Security of Radioactive Sources, and the total number remains at 140. Since the issuance of the Nuclear Safety Review 2021, no Member States notified the Director General of their intention to act in a harmonized manner with the supplementary Guidance on the Import and Export of Radioactive Sources, so the total number of Member States that have done so remains at 123. No additional Member States nominated points of contact for facilitating the import and export of radioactive sources, for which the total number of Member States remains at 145, and 5 Member States made a political commitment to implementing the supplementary Guidance on the Management of Disused Radioactive Sources, bringing the total that have done so to 44.

Related Activities

66. *The Agency will continue to assist Member States in the implementation of the Code of Conduct on the Safety and Security of Radioactive Sources. The Agency is planning to undertake the following related activities:*

- Continue to assist States in developing plans for the life cycle management of disused radioactive sources and to meet the provisions of international instruments relevant to the security of radioactive material, such as the Code of Conduct for the Safety and Security of Radioactive Sources; and
- Continue outreach activities to communicate the benefits of implementing Code of Conduct and related Agency activities.

C. Nuclear Security of Materials Out of Regulatory Control

C.1. Nuclear Security Measures for Material out of Regulatory Control

Trends

67. Member States continued to request guidance, training and assistance to establish and further enhance the infrastructure needed to implement nuclear security measures in response to criminal or intentional unauthorized acts involving nuclear and other material out of regulatory control (MORC). Nine Member States benefited from Agency's assistance in the area, which is comparable with the level of support provided in previous years.

Related Activities

68. *The Agency will continue to assist Member States in establishing and sustaining effective infrastructure and arrangements to protect people, property, the environment and society in response to criminal or intentional unauthorized acts involving MORC. The Agency is planning to undertake the following related activities:*

- Continue to develop publications within the Nuclear Security Series on nuclear security infrastructure, addressing nuclear security measures in response to criminal or intentional unauthorized acts involving MORC; and
- Continue to support Member States in establishing and sustaining effective infrastructure through the development a 'roadmap approach' in which States, supported by the Agency, identify their specific needs related to developing plans and procedures for response to criminal or intentional unauthorized acts involving MORC, which are addressed through the provision of associated training and exercising of those plans and procedures and the procurement of equipment to support the response.

C.2. Nuclear Security Detection Architecture

Trends

69. Member States continued to request guidance, training and assistance to establish and sustain their capabilities for detecting and responding to criminal or intentional unauthorized acts involving MORC.

70. There is continued demand from Member States for loaned or donated hand-held radiation detection equipment in support of their detection systems, including nuclear security assistance for preparation and support for MPEs, and training in radiation detection equipment operation, frontline maintenance and calibration.

Related Activities

71. *The Agency will continue to assist Member States in strengthening and maintaining effective national nuclear security detection architectures, and in enhancing and improving capabilities in detecting, locating and interdicting MORC. The Agency is planning to undertake the following related activities:*

- Continue the development of publications within the Nuclear Security Series for nuclear security detection and response architecture; and
- Continue to support activities implemented to assist States in detecting nuclear and other radioactive material, including support for identifying a strategy based on risk and threat assessment and, subsequently, for the establishment of detection operations at strategic locations.

C.3. Major Public Events

Trends



Fig. 17. Hands-on training of local experts in Cameroon on nuclear security measures during MPEs in October 2021.

72. There is increased demand by Member States for support to strengthen the implementation of nuclear security measures before and during major public events (MPEs). Since 2004 the Agency has provided, upon request, support for a total of 66 MPEs in 42 States. Between 2016 and 2021, the Agency provided support to 40 MPEs, compared with 24 over the preceding 12 years, loaned over 3500 items of radiation detection equipment to States hosting MPEs, and supported an average of 7 MPEs per year, which was a trend that continued in 2021.

Related Activities

73. *The Agency will assist Member States in preparation and conduct of MPEs through utilizing nuclear security measures for MPEs. The Agency is planning to undertake the following related activities:*

- Continue to support States, upon request, in the preparation and conduct of MPEs, through the implementation of training activities, technical visits, expert missions and free-of-charge loans of radiation detection equipment;
- Refine its programme of assistance in relation to MPEs by establishing a comprehensive MPE programme at the NSTDC at the Seibersdorf laboratories, which will comprise training courses and workshops, demonstrations and exercises, and cover a wide range of scenarios at different types of MPEs, including an awareness programme for senior officials on nuclear security measures for MPEs; and

- Develop Agency reports, in cooperation with Member States hosting MPEs, describing individual MPEs, associated nuclear security arrangements and lessons learned from the preparation and conduct of those MPEs.



Fig. 18. The training of the front-line officers is part of the IAEA assistance and support to countries hosting high profile events, such as sporting events, major international summits and conferences, international cultural and religious events.

C.4. Radiological Crime Scene Management and Nuclear Forensics Science

Trends

74. Member States continue to express increasing needs and interest with regard to building capacity in the fields of radiological crime scene management and nuclear forensics science. The Agency continues to develop guidance and provide training and assistance to States, upon request, on radiological crime scene management and nuclear forensics science. Member States benefited from Agency assistance in these areas, for example through the National Foundation Workshop on Radiological Crime Scene Management in Albania, and through Agency support for international events such as a Network of Association of Southeast Asian Nations Chemical, Biological and Radiological Defence Experts Workshop held in Singapore.

75. Member States continue to request assistance in supporting the development and sustainability of national nuclear forensics capabilities as part of a nuclear security infrastructure.

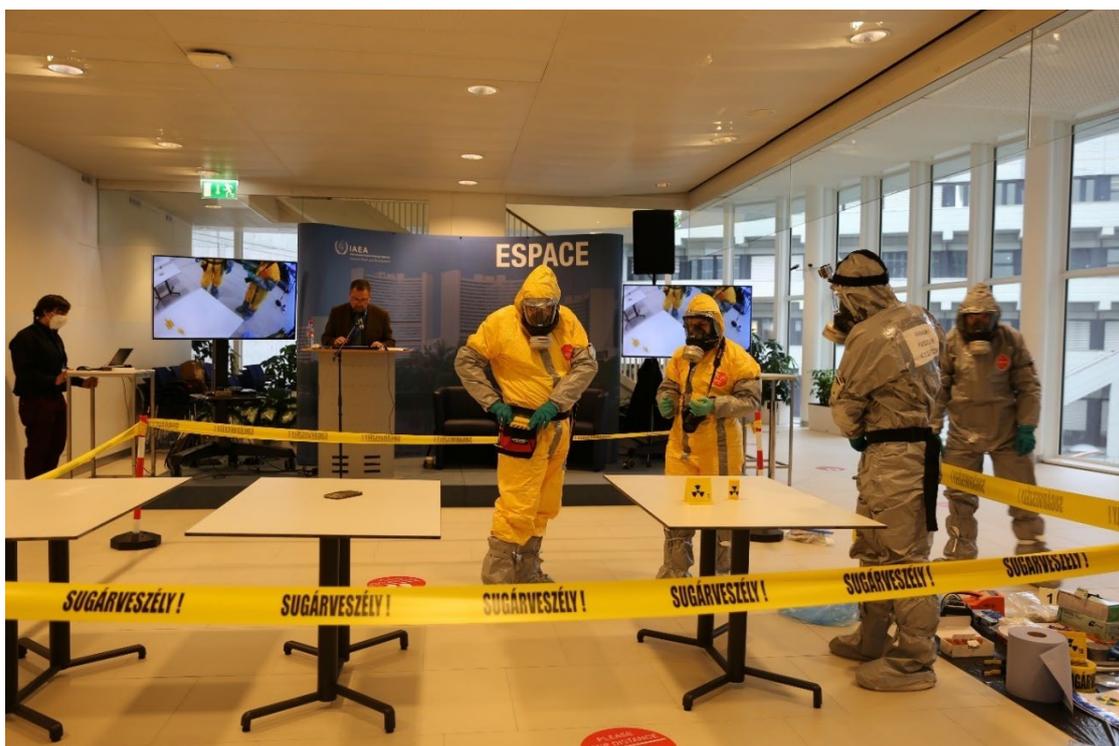


Fig. 19. Live demonstration on radiological crime scene management during the 65th regular session of the General Conference in September 2021.

Related Activities

76. The Agency will continue to assist Member States in building capacities for managing radiological crime scenes, collecting evidence for use in subsequent legal proceedings, and undertaking nuclear forensics examinations to support investigations and help determine the origin and history of the material. The Agency is planning to undertake the following related activities:

- Continue to develop publications within the Nuclear Security Series, as well as technical documents, on radiological crime scene management and nuclear forensics science to support law enforcement and nuclear security vulnerability assessments as required to investigate a nuclear security event; and
- Continue to provide capacity building activities in the areas of radiological crime scene management and nuclear forensics science, including demonstrations, exercises and fellowships.

D. Nuclear Security Interfaces

Trends

77. Member States continue to encourage the Secretariat to facilitate a coordination process to address safety and security interfaces, while recognizing their distinctions.

78. The Advisory Group on Nuclear Security (AdSec) and the International Nuclear Safety Group (INSAG) highlighted the importance of the safety and security interface, including through completing a joint publication on this topic, which was approved for publication.

79. Ensuring continuous safe and secure management options for DSRs remains an important priority for Member States, as an increasing number of radioactive sources are becoming disused and are no longer considered an asset.

80. Member States expressed an interest in applying a holistic approach to safety–security–safeguards by design for nuclear installations, in particular for SMRs, in the early stages of the design process, as well as in sharing experience in the development of technical publications and organizing educational and training activities.

81. In recent years, the Agency has increased its focus on bringing safety and security together in the area of the transport of nuclear and other radioactive materials by developing e-learning tools, guidance and training in this area.

Related Activities

82. ***The Agency will continue to ensure that the safety standards and nuclear security guidance take into account the implications for both nuclear safety and nuclear security whenever appropriate, recognizing the distinction between nuclear safety and nuclear security. The Agency is planning to undertake the following related activities:***

- Continue to address, in close cooperation with Member States, the interfaces between nuclear safety and nuclear security, while recognizing their distinctions, and to develop safety and security publications and foster culture accordingly;
- Continue to support Member States in managing the interface between nuclear safety and nuclear security for nuclear installations, radioactive sources and transport by developing new guidance, revising relevant safety standards and holding training activities;
- Continue to create synergies between nuclear safety and nuclear security for nuclear installations by facilitating the use of safety approaches for security purposes;
- Continue to support Member States in integrating safety–security–safeguards by design for nuclear installations (in particular for SMRs) by developing technical publications and organizing educational and training activities; and
- Develop practical steps to implement the joint AdSec and INSAG publication on the topic.

Appendix A

Agency Activities in 2021

A. General Nuclear Security Areas

A.1. Promoting Further Adherence to International Legal Instruments

1. The Agency continued to assist States, upon their request, in meeting the requirements of the Convention on the Physical Protection of Nuclear Material (CPPNM) and the Amendment to the CPPNM (A/CPPNM) and further increased its efforts to promote universal adherence to the A/CPPNM, including outreach efforts targeted at States that are party to the CPPNM but not yet to the Amendment, as well as at those that have not yet acceded to the CPPNM.

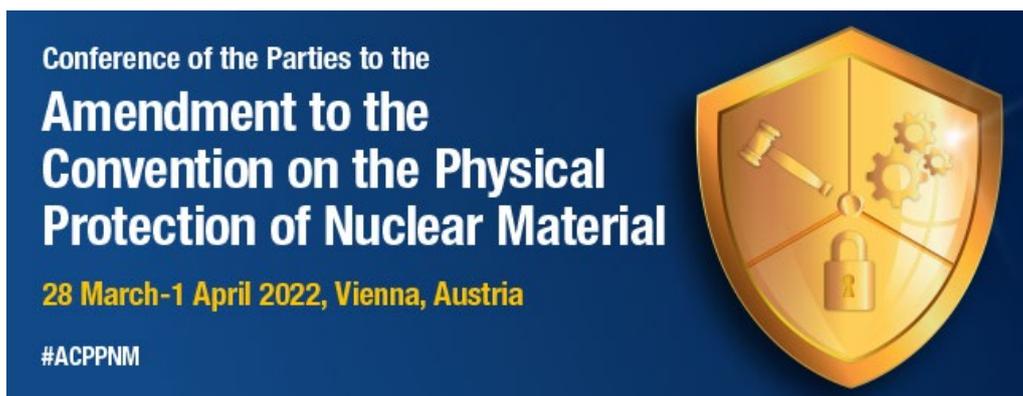
2. The Agency sent letters in March 2021 to States not party to the CPPNM, as well as those that are party to the CPPNM but not to its Amendment, urging them to join the CPPNM and/or its Amendment. The Agency conducted a series of four webinars to promote the universalization of the CPPNM and its Amendment in August 2021, attended by about 200 participants from 62 States. In addition, one virtual international seminar to encourage adherence to the CPPNM and its Amendment focused on Russian-speaking countries and Western Asia and the Middle East, was convened in May 2021. To promote further adherence to the CPPNM and its Amendment in the African region, the Agency in cooperation with the Government of Morocco held a virtual regional workshop to promote the A/CPPNM for all African States in December 2021.



Fig. A.1. IAEA and UNODC held a joint seminar in Vienna on the key legal instruments for global nuclear security.

3. The Agency, jointly with the United Nations Office on Drugs and Crime, hosted a Seminar to Promote the Universalization of the Amendment to the Convention on the Physical Protection of Nuclear Material and the International Convention for the Suppression of Acts of Nuclear Terrorism in Vienna in November 2021 attended by 37 participants from 22 States.

4. In May 2021, to mark the fifth anniversary of the entry into force of the A/CPPNM, the Director General addressed States via a video message. In addition, the Agency updated its web pages and published an updated brochure on the A/CPPNM, in Arabic, Chinese, English, French, Russian and Spanish, to further improve communication with States regarding the importance of adherence to and full implementation of the CPPNM and its Amendment.



5. The Agency intensified its efforts to assist Parties in preparing for the Conference of the Parties to the A/CPPNM, planned to be held from 28 March to 1 April 2022. The Agency held a virtual meeting of the Preparatory Committee, in February 2021, which undertook preparations for the Conference including development of a draft Rules of Procedure and a draft annotated agenda for the Conference. Over 240 participants from more than 90 Parties to the CPPNM and its Amendment, as well as Parties to the CPPNM only, participated in the meeting; a series of five regional preparatory meetings; and two rounds of open-ended consultations in October and December 2021 to assist Parties in preparing for the 2022 Conference, which were attended by 183 participants from 63 States and EURATOM.

A.2. Nuclear Security Guidance and Peer Review and Advisory Services

6. The Nuclear Security Guidance Committee (NSGC) started its fourth three-year term in 2021 and met virtually in June, August, October and December 2021, including a joint session with Emergency Preparedness and Response Standards Committee. The NSGC approved four document preparation profiles for drafts in the Nuclear Security Series, and one draft for publication.

7. The Agency analysed the results from a survey on the use of the Nuclear Security Series, distributed to Member States in January 2020, and prepared a summary report. The final report from the survey was presented to the NSGC in June 2021.

8. The Agency conducted six in-person International Physical Protection Advisory Service (IPPAS) missions in Belarus, Burkina Faso, the Czech Republic, Niger, Senegal and Türkiye in 2021, preceded by five national workshops (three virtual and two in person).

9. The Agency updated the IPPAS Good Practices Database, which comprised 532 good practices at the end of the reporting period. In total, 113 points of contact nominated by 61 Member States have access to the database.

10. The Agency hosted the third International Seminar to Share Experience and Best Practices from Conducting International Physical Protection Advisory Service Missions in Vienna in December 2021, with the possibility of remote participation, which provided a forum for sharing and discussing lessons

learned, benefits received, challenges experienced during the preparation and conduct of IPPAS missions and follow-up activities, as well as the options for further enhancement of this service. In total, 69 participants attended the Seminar.



Fig. A.2. Sharing and discussing good practices, lessons learned and benefits of IPPAS missions and follow-up activities during a hybrid international seminar in December 2021.

11. The Agency held a virtual international workshop on the International Nuclear Security Advisory Service (INSServ) guidelines in June 2021 with the aim of training experts to support future INSServ missions.

A.3. Assessing Nuclear Security Needs and Priorities

12. The Agency held 7 in person Integrated Nuclear Security Support Plan (INSSP) missions, in Georgia in December 2021, in Cote d'Ivoire in October 2021, in Moldova and Seychelles in September 2021, in Niger in August 2021 and in Albania and Senegal in July 2021. The Agency also held 13 virtual targeted INSSP progress review meetings to discuss progress achieved in implementing Member States' INSSP Implementation Plans.

13. The Agency held the second Technical Meeting of the Points of Contact for Integrated Nuclear Security Support Plans virtually in December 2021 to discuss the application of the INSSP for planning IAEA nuclear security assistance to Member States. The meeting was attended by 84 participants from 67 Member States, marking 15 years since the first INSSP has been formally endorsed by a State. The anniversary was also highlighted at a dedicated side event during the 65th regular session of the General Conference.

14. The Agency planned activities towards realignment of the Nuclear Security Information Management System (NUSIMS) self-assessment tool with the INSSP structure. Self-assessment questionnaires for INSSP Functional Areas 1 and 6 have been finalized and drafting of the three remaining functional area questionnaires has started.

15. The Agency developed a new feature for the NUSIMS country status pages, with the aim of enabling States that receive nuclear security assistance through the INSSP to account for progress made in implementing nuclear security activities. Using this new feature, States and the Agency can record achievements made between INSSP finalization or review missions, providing a view of progress achieved towards the States' objectives.

A.4. Capacity Building in Nuclear Security

16. The Agency held a series of webinars on the Global Nuclear Safety and Security Communication Network from March to September 2021 to equip regulators with relevant tools. The Agency updated and revised training materials for 30 courses and workshops in the Nuclear Security Training Catalogue and developed training materials for 9 new courses or workshops.

17. The Agency developed a set of training materials for shifting classroom-based training to a virtual format and for facilitating training in a virtual environment.

18. The Agency developed training procedures and guidelines, a glossary of training-related terms and self-assessment tools to analyse and strengthen the management of Agency training programmes and to continue to ensure their quality and relevance in meeting States' needs.

19. The Agency developed a curriculum and a set of training materials for a new training course entitled "Leadership Academy for Nuclear Security", aimed at helping middle and senior managers from organizations with nuclear security functions to further develop their leadership behaviours with regard to nuclear security.

20. The Agency started the development of an e-learning course on the systematic approach to training (SAT), to be used as a prerequisite for participation in workshops on this topic to assist States in better identifying their human resource development needs, establish human resource development plans for nuclear security and promote SAT.

21. The Agency held the 2021 International Nuclear Security Education Network (INSEN) Leadership Meeting virtually in March 2021. The INSEN secretariat also conducted an education impact assessment survey during the reporting period. The INSEN annual meeting was held virtually in August 2021, gathering over 100 participants from 41 States, at which nuclear security education activities and the impact of COVID-19 were discussed.

22. The Agency continued to support graduate education programmes in nuclear security by providing fellowships to five students from four developing Member States in the 2020–2021 and 2021–2022 academic years, and seven students from seven Member States in the 2022–2023 academic year, to attend the master's degree programme in nuclear security at the University of National and World Economy in Bulgaria. The number of fellowships increased, taking into consideration geographical distribution and gender parity.

23. The Agency updated the International School on Nuclear Security curriculum to adapt it to a virtual format. One regional and five international Schools were held virtually or in a hybrid format during the reporting period: in Russian in September 2020 and May–June 2021, with 23 participants from 8 Member States; in English in April 2021, with 52 participants from 36 Member States; in Arabic in October 2021, with 48 participants from 12 Member States; in English in November 2021, with 26 participants from 9 Member States. In addition, two Schools were held for IAEA Marie Skłodowska-Curie Fellowship Programme (MSCFP) fellows, in November and December 2021, with 51 participants.



Fig. A.3. MScFP fellows at the Agency's Nuclear Security Detection and Monitoring Equipment Laboratory during the School on Nuclear Security in December 2021.

24. The Agency held the 2021 Annual Meeting of the International Network for Nuclear Security Training and Support Centres (NSSC Network) virtually in April 2021, attended by 98 participants from 52 States and five observer organizations, to advance the work of the Network for the upcoming year. The Agency also conducted a consultancy meeting of the Bureau of the International Network for Nuclear Security Training and Support Centres in December 2021 to discuss overall Network priorities and receive updates on progress in implementing individual working group action plans.

25. The Agency continued developing the Nuclear Security Training and Demonstration Centre (NSTDC) at its Seibersdorf laboratories with an emphasis on applying the key concepts set out in *Establishing and Operating a National Nuclear Security Support Centre* (IAEA-TDL-010) to help ensure that equipment, staffing and other resources are developed sustainably and used efficiently.

26. The Agency completed a feasibility study and gap analysis for the technical scope of the NSTDC and initiated the project planning and definition of the requirements for the required equipment. Two Member State briefings, each attended by nearly 100 participants, were convened virtually in April and December 2021 to provide updates on the progress of the planning for the facility. The Agency also finalized the Multipurpose Building design and floor layout, and identified through a tender process the building construction company for the facility. The groundbreaking ceremony for the facility was hosted by the Director General on 12 July 2021.

27. The Agency conducted the Regional Workshop on Human Resource Development in Nuclear Security Programme Planning virtually in October 2021 to assist Member States in implementing best practices in human resources development in the field of nuclear security.

28. Agency Collaborating Centres, through research and development and training, continued to assist the Agency in building capacity regionally and internationally. Three new Member State institutions were designated and one Member State institution re-designated in 2021, bringing the number of Collaborating Centres in different areas of nuclear security to eight.

A.5. Information and Computer Security

29. The Agency conducted four webinars on enhancing computer security incident analysis at nuclear facilities from January to April 2021 with a total of 1270 participants.

30. The Agency conducted five webinars on the application of the Agency's information and computer security guidance from July to December 2021, with a total of 1200 participants.

31. The Agency completed a national project with Romania on computer security regulatory inspection guides in November 2021.

32. The Agency completed four training courses on information and computer security: one on conducting computer security inspections, two on conducting computer security assessments and one on computer security incident response for nuclear facilities. The Agency also collaborated with Brazil on the "Cyber Guardian Exercise 3.0", a national exercise on cyber security incidents and their impact and recovery.

33. The Agency held two hybrid consultancy meetings on Instrumentation and Control and Computer Security for Small Modular Reactors and Microreactors in March and November 2021 in preparation for the technical meeting planned in February 2022.

A.6. Information Exchange and Sharing

34. The Agency held two virtual Nuclear Security Information Exchange Meetings in April and October 2021, to coordinate activities in nuclear security and to avoid duplication in the activities undertaken by various relevant organizations. More than 20 participants from 11 organizations and initiatives exchanged information, discussed various themes within nuclear security and gained a better understanding of activities being undertaken by each organization, particularly including experiences related to conducting activities under COVID-19-related restrictions.

35. The Agency hosted a donor coordination meeting in December 2021 with representatives of Member State contributors to the NSF which provided Member States with information on the Agency's programme and budget framework as relating to nuclear security, activities supported by the NSF, the process of resource mobilization and opportunities for strengthened programming. Participants expressed interest in obtaining increased understanding, through data, of Agency planning and priorities in order to collectively respond to funding needs. The response reflected a diversity of donor priorities and the need for a shared understanding of, and alignment with, Agency efforts in results based management, resource mobilization, streamlined reporting and the relationship between nuclear security and other areas of the Agency's work.

36. Improvements to NUSEC were made mainly in the area of updating the existing content available on the portal. Members of the NSSC User Group have an improved map for viewing the members of the network and an improved interface for the database data entry fields. INSEN established a new area for the exchange of scientific papers, and this area is expected to be improved in the next year.

37. The Agency provided quarterly Incident and Trafficking Database (ITDB) analytical summary reports, an annual factsheet summarizing ITDB incidents for public information and, in response to requests from Member States, additional information services in support of one major public event (MPE).

A.7 Nuclear Security Research and Emerging Technologies

38. The Agency concluded the CRP entitled “Enhancing Computer Security Incident Analysis at Nuclear Facilities” in January 2021, which resulted in the development of enduring results and tools that will remain available for use by researchers and practitioners.

39. The Agency initiated a CRP entitled “Facilitation of Safe and Secure Trade Using Nuclear Detection Technology — Detection of RN and Other Contraband” in January 2021 to address the need for enhancing the use and sustainability of nuclear security detection systems and measures used to detect nuclear and other radioactive material out of regulatory control at points of entry and exit and other trade locations. Additionally, the CRP will support projects increasing the safety–security interface, as well as those supporting trade/customs applications, by developing and demonstrating methods using nuclear detection technologies to detect commercial fraud and public safety hazards such as explosives, illicit drugs, and contaminated goods.

40. The Agency continued implementation of the CRPs “Advancing Radiation Detection Equipment for Detecting Nuclear and Other Radioactive Material Out of Regulatory Control” and “Advancing Maintenance, Repair, and Calibration of Radiation Detection Equipment”.

41. Development of the Mobile-Integrated Nuclear Security Network was under way with the first release for testing in December 2021.

42. The Agency developed a new smartphone app, Personnel Alarm Assessment Tool (PAAT), which will be used to assist front line officers in assessments of radiation alarms caused by an individual.

43. The Agency conducted a webinar on nuisance alarms in May 2021 and a series of webinars on enhanced use of high-resolution radiation detectors in June, September and November 2021. The Agency held the first Technical Meeting on Artificial Intelligence (AI) for Nuclear Technology and Applications in October 2021, which provided a cross-cutting forum to discuss, identify and foster cooperation on AI applications, methodologies, tools and enabling infrastructure that have the potential to advance nuclear science, technology and applications. Participants identified the need for more collaboration, investigation, and information exchange on the positive and negative impact and implications of AI in nuclear security.

B. Nuclear Security of Materials and Associated Facilities

B.1 Nuclear Security Approaches for the Whole Fuel Cycle

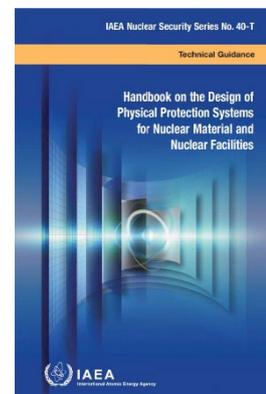


Fig. A.4. Agency activities in nuclear security for the whole fuel cycle in 2021.

B.1.1. Physical Protection of Nuclear and Other Radioactive Material and Associated Facilities and Activities

44. The Agency conducted a virtual International Training Course on the Establishment of a Nuclear Security Regime for Nuclear Power Programmes between June and July 2021.

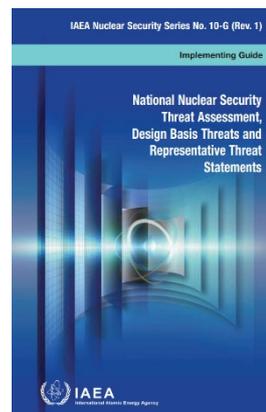
45. The Agency published the Technical Guidance publication *Handbook on the Design of Physical Protection Systems for Nuclear Material and Nuclear Facilities* as IAEA Nuclear Security Series No. 40-T in May 2021. The Agency provided support to Morocco, Rwanda and the Sudan to review and finalize their draft regulations on the physical protection of nuclear material and facilities.



46. The Agency conducted a virtual International Meeting on the Evaluation of Physical Protection Systems at Nuclear Facilities in April 2021. The Agency also conducted a virtual National Tabletop Exercise on Management of the Response to a Nuclear Security Event at a Nuclear Facility for the Democratic Republic of the Congo in March 2021.

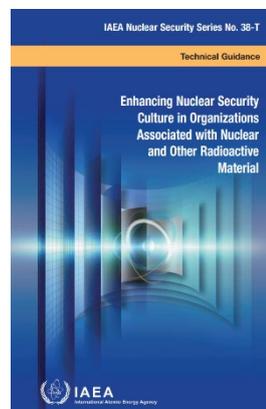
47. The Agency provided assistance to four Member States with physical protection upgrades at three research reactors and one nuclear power plant. These upgrades included specialized technical training to support the operation, maintenance and sustainability of physical protection equipment, systems and measures for detection, delay and response.

48. The Agency published *National Nuclear Security Threat Assessment, Design Basis Threats and Representative Threat Statements* (IAEA Nuclear Security Series No. 10-G (Rev 1)) in May 2021.



49. The Agency held an international workshop on threat assessment (TA) and design basis threat (DBT) virtually in September 2021 with a total of 30 participants, and two virtual regional workshops on TA and DBT for Member States in the Balkans in April 2021 with a total of 9 participants, and for French-speaking African countries in October 2021 with a total of 14 participants. The Agency also held four virtual national workshops on this topic for Botswana and Romania in March 2021, for Libya in May 2021 and for Malaysia in June 2021, attended by 85 participants in total.

50. The Agency published *Enhancing Nuclear Security Culture in Organizations Associated with Nuclear and Other Radioactive Material* (IAEA Nuclear Security Series No. 38-T) in March 2021. The Agency held a webinar related IAEA Nuclear Security Series No. 38-T in September 2021, which was attended by over 150 participants.



51. The Agency delivered a national workshop on nuclear security culture in practice for Cameroon in July 2021. The Agency also held a virtual national workshop on conducting nuclear security culture self-assessment for Malaysia in October 2021. Under the “Enhancement of Nuclear Safety, Security and Emergency Preparedness in Romania” project, the Agency conducted a national workshops and two consultancy meetings for promoting and sustaining a strong nuclear security culture for Romania in April, June and October 2021.

52. The Agency held a Technical Meeting to Share Approaches to and Experiences in the Management of Regulatory Oversight for the Operation of a First Nuclear Power Plant virtually in June 2021, where Member States shared good practices and challenges faced during the development and implementation of regulatory oversight activities at various stages in the life cycle of nuclear power plants.

53. The Agency held a hybrid national workshop involving the conduct of a table-top exercise on management of the response to a malicious act at a nuclear facility in the Democratic Republic of Congo in March 2021. The Agency held a national workshop for a newcomer country on security contingency response at nuclear facilities in Cairo in July 2021. The Agency held national workshops on contingency response performance testing in Chakri, Pakistan and in Amman in October 2021.

54. The Agency held a pilot international workshop on best practices for transport response force personnel in Vienna in November 2021, with some participants participating remotely. The NSGC approved a document preparation profile for a Technical Guidance publication provisionally entitled *Preparing Nuclear Security Response Plans for Other Radioactive Material in Use and Storage, and Associated Facilities*.

55. The Agency conducted an Integrated Nuclear Infrastructure Review (INIR) Phase 2 mission to Uzbekistan, which is planning to construct its first nuclear power plant, in May–June 2021. The INIR team evaluated the status of the nuclear power infrastructure (including nuclear security), identified gaps and provided recommendations and suggestions to Uzbekistan.

B.1.2. Nuclear Security of Advanced Reactors, including Security of Small and Medium Sized or Modular Reactors

56. The Agency established a project on nuclear security of small and medium sized or modular reactors (SMRs), under which CRPs will be established to share information on the design, implementation and evaluation of security systems of various SMRs and to analyse whether and how nuclear facility-related recommended requirements and guidance contained in the Nuclear Security Series publications can be applied to SMRs.

57. The Agency included nuclear security considerations in a draft Agency publication provisionally entitled *Review of Applicability of the IAEA Safety Standards to Novel Advanced Reactors* and a draft Technical Report provisionally entitled *Safety, Security and Safeguards by Design in Small Modular Reactors*.

58. The Agency developed a draft Technical Report on the safety–security–safeguards by design considerations of novel advanced reactors, including SMRs. The report elaborates on the gaps and challenges in this area and provides input for a draft Safety Report on the applicability of Agency safety standards to novel advanced reactors, which is currently under development. The Agency also held a virtual consultancy meeting to discuss the interfaces between the safety–security–safeguards for novel advanced reactors in September 2021.

B.1.3. Enhancing Nuclear Security Using Nuclear Material Accounting and Control

59. The Agency continued developing the publication provisionally entitled “*Content of a Facility Nuclear Material Accounting and Control Plan*”, which will describe the elements of a nuclear material accounting and control system that will enable the facility to provide current and reliable information relevant to maintaining accounting and control of the nuclear material that it possesses.

60. A document preparation profile for a Technical Guidance publication provisionally entitled “*The Establishment and Implementation of a Trustworthiness Programme in Nuclear Security*” was approved by the NSGC. The first draft of the document was completed.

B.1.4. Nuclear Security in the Transport of Nuclear and other Radioactive Material

61. The Agency organized the virtual International Conference on the Safe and Secure Transport of Nuclear and Radioactive Materials in December 2021. The conference increased Member States' awareness of the importance of effectively managing the interface between transport safety and transport security. The conference was attended by nearly 300 participants from 91 Member States and 10 organizations.



62. The Agency held a hybrid national workshop on planning, conducting and evaluating an exercise on security of nuclear and radioactive material in transport for Romania in March 2021 and a hybrid regional transport security table-top exercise in Romania in May 2021. Another hybrid regional transport security table-top exercise was held in Skopje in October 2021.

63. The Agency held two virtual national workshops on transport security planning to assist Bolivia in securing the transport of high radioactive sources to a new Nuclear Research Centre in August and November 2021.

64. The Agency held a webinar in August 2021 on the Security of Nuclear Material in Transport which was attended by nearly 500 participants.



65. The Agency provided assistance to Albania and the Republic of Moldova with physical protection upgrades for the transport of radioactive material. Technical training was also provided to support the operation, maintenance and sustainability of physical protection equipment, systems and measures.

66. The Agency drafted the Technical Guidance publication provisionally entitled *Security of Nuclear and other Radioactive Material in Transport* (NST053).

B.2. Security of Radioactive Material and Associated Facilities



Fig. A.5. Agency activities in securing radioactive material and associated facilities in 2021.

B.2.1. Assistance Provided to States to Enhance the Security of Radioactive Material in Use and Storage and Associated Facilities

67. The Agency addressed six requests to strengthen physical protection at facilities with high activity radioactive sources in use and storage. The Agency assisted in the removal of three high activity disused radioactive sources from 2 States, continued to support the ongoing removal of 32 high activity disused radioactive sources in 2 States, as well as the preparatory work for removal of additional 18 sources from 4 States, and assisted in the consolidation of 9 high activity disused radioactive sources in 1 State.

68. The Agency held two virtual regional workshops on policy and strategy for radiation safety and security of radioactive material in March 2021 for English-speaking African States and in April 2021 for French-speaking African States with 38 participants from 14 States and 41 participants from 15 States, respectively.

69. The Agency held a virtual regional workshop on strategic directions for establishing integrated management systems for regulatory bodies in March 2021 for States in Latin America and the Caribbean with 37 participants from 13 States.

70. The Agency provided support to nine Member States (Cambodia, Cameroon, Costa Rica, Kenya, Kuwait, Nigeria, the Sudan, the United Republic of Tanzania and Zambia) to assist in the review and update of draft national security regulations for security of radioactive material in use and storage and associated facilities and activities.

71. The Agency held six virtual workshops on basic concepts of physical protection systems for radioactive material in July and October 2021, and remote physical protection assessments of facilities involving high activity radioactive material were conducted for the Plurinational State of Bolivia, Iraq, Mali, Papua New Guinea, Paraguay and Turkmenistan.

72. The Agency held virtual National Training Courses on Regulatory Control of Safety and Security for Radiotherapy Practice for Uruguay in April 2021, for Ecuador in August-September 2021 and for El Salvador in November-December 2021, with 8 and 11 participants, with a female representation of 50% and 55%, respectively.



Fig.A.6. Experts from the Agency and the Centre for Nuclear Technology Research and Development in La Paz identifying potential security layers around the multipurpose irradiator. (Photo: Bolivian Nuclear Energy Agency)

73. The Agency held the International Training Course on Basic Aspects of the Design of Physical Protection Systems for Radioactive Material and Associated Facilities in Obninsk and Saint Petersburg, Russian Federation, in October 2021, with 26 participants from 15 States.

74. The Agency held a webinar entitled “Developing Regulations and Associated Administrative Measures for Nuclear Security” in October 2021 for Member States that had requested assistance in developing national security regulations.

75. The Agency conducted three virtual expert missions to the Sudan and Zambia in July 2021 and Tunisia in November 2021, upon request, to assist with review and update of draft national policy and strategy for disused sealed radioactive sources.

76. The Agency held the Second Coordination Meeting of the Nuclear Security Project on Enhancing Nuclear Security through the Sustainable Management of Disused Sealed Radioactive Sources virtually in Latin America and the Caribbean, Africa and Asia and the Pacific regions in August 2021, with 18 participants from 16 Member States.

77. The Agency initiated the conditioning of four disused radioisotope thermoelectric generators as a preventative measure to maintain radioactive source containment and ensure that the devices are suitable for safe and secure long-term storage, as part of a project to assist Member States in strengthening the safety and security of disused radioisotope thermoelectric generators.

78. The Agency held the Second Research Coordination Meeting on Improving the Security of Radioactive Material throughout its Lifecycle, Associated Facilities, and Associated Activities virtually in November 2021, with 12 participants from 5 Member States.

79. The Agency continued preparations for the International Conference on the Safety and Security of Radioactive Sources: Accomplishments and Future Endeavours, to be held in Vienna in June 2022 by convening virtual Programme Committee meetings for the Conference in April and November 2021, which received over 330 synopses.

80. The Agency organized the Ninth Meeting of the Working Group on Radioactive Material Security (WGRMS) virtually in October 2021, with 164 participants from 95 States, to share information about

Agency activities on the security of radioactive material and to explore technical topics related to regulatory challenges and lessons learned.

81. Under a new project launched in 2021, ten Member States in South East Asia started to receive additional Agency assistance in strengthening regulatory capacities for licensing, inspection, and enforcement for the security of radioactive material and associated facilities.

B.2.2. Support for the Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources

82. The Agency held two technical briefings for Member States on the formalized process for the exchange of information regarding the Code of Conduct on the Safety and Security of Radioactive Sources in February (virtually) and October 2021 to provide information related to the formalized process.

83. The Agency held four virtual Regional Meetings on the Implementation of the Guidance on the Management of Disused Radioactive Sources for Europe in January 2021, for Africa in March 2021, for Asia and the Pacific in April 2021, and for the Americas in June 2021 with overall 262 participants from 113 States.

84. The Agency held a virtual Open-ended Meeting of Legal and Technical Experts on the Implementation of the Guidance on the Management of Disused Radioactive Sources in August 2021 with 247 participants from 100 States and 1 international organization.

C. Nuclear Security of Materials Out of Regulatory Control

C.1. Nuclear Security Measures for Material Out of Regulatory Control

85. The Agency held two webinars related to *Developing a National Framework for Managing the Response to Nuclear Security Events* (IAEA Nuclear Security Series No. 37-G), in March 2021. These webinars were attended by nearly 600 participants in total.

86. The Agency piloted a virtual expert mission to support Egypt in developing its nuclear security response plan for nuclear and other radioactive material out of regulatory control (MORC) in March 2021.

87. The Agency piloted a virtual national workshop on IAEA Nuclear Security Series No. 37-G for Indonesia in November 2021, involving more than 35 participants.

88. The Agency conducted a technical visit for officials from Georgia, the Republic of Moldova and Ukraine to the joint border crossing point at the Danube Bridge in Ruse, Bulgaria, involving a total of 21 participants from 5 countries.

89. The Agency signed a Collaborating Centre Agreement with the Moroccan Agency for Nuclear and Radiological Safety and Security (AMSSNuR), covering the field of nuclear security response, in July 2021.

C.2. Nuclear Security Detection Architecture



Fig. A.7. Agency activities in nuclear security detection architecture in 2021.

90. Forty Member States received assistance in building capacity for detection of MORC, including in the specific area of detection of nuclear and other radioactive material in urban areas and sea ports. Eight Member States in Latin America and the Caribbean region benefited from Agency’s support to establish national strategies for the detection of MORC.

91. The Agency conducted four virtual regional workshops on nuclear security detection architecture awareness for Latin America and the Caribbean in February 2021, for Central American States in March 2021, for Asia and the Pacific in May 2021 and for French-speaking African States in June 2021. In addition, the Agency held a virtual national workshop for Indonesia on expert support for the assessment of alarms and alerts for MORC in February 2021.

92. The Agency conducted a regional webinar on the detection of nuclear and other radioactive material in urban areas for Spanish-speaking countries in Latin America and the Caribbean in June 2021, which was attended by 113 participants.

93. The Agency provided or loaned hand-held detection equipment and fixed radiation portal monitors for Member State nuclear security detection architectures, as well as to Spain, as part of the Collaborating Centre Agreement between the Agency and Spain’s Civil Guard.

94. The Agency procured 120 items of radiation detection equipment to support nuclear security response activities in Ecuador, Egypt, Sudan and Thailand.

95. The Agency convened a webinar on approaches for the management of nuisance alarms from radiation portal monitors in May 2021 to enhance the use and understanding of radiation detection instruments used for nuclear security, involving 250 participants. A webinar providing an overview of passive and active detection technologies for detection of chemical, biological, radioactive, nuclear and explosive threats and other contraband was held in January 2021, involving over 320 participants.

96. The Agency conducted a virtual Regional Workshop on Threat Assessment and a Risk Informed Approach for Material Out of Regulatory Control for Latin America and the Caribbean in August 2021.

97. In May 2021, the Agency conducted a virtual International Workshop on Nuclear Security Detection and Response in Maritime Areas, including a tabletop exercise, which was attended by 92 participants. The tabletop exercise was adapted from the Agency–Global Initiative to Combat Nuclear Terrorism collaboration event “Peak of Kinabalu”.

98. The Agency conducted a Regional Workshop on Sustainable Training Programmes for Nuclear Security Detection in Côte d’Ivoire in September 2021.

99. The Agency conducted three Webinars on Nuclear Security Detection Architecture Strategy Design and Planning, for Association of Southeast Asian Nations (ASEAN) Countries in July 2021, on the Perspectives of Finland and Jordan in November 2021, and for French-Speaking African States in December 2021.

100. The Agency held four Technical Meetings of the Front Line Officer Network, for the Africa Region Working Group in September 2021, the Latin America Working Group in October 2021, the Asia Region Working Group in November 2021 and the Europe and Central Asia Working Group in December 2021. The meetings provided a platform for front line officers to share best practices and lessons learned in nuclear security detection and to encourage networking and regional cooperation.

101. The Agency conducted a virtual expert mission to assess detection capabilities in the Philippines in September 2021.

102. The Agency conducted a webinar on nuclear security detection architecture planning and implementation, and evaluation of detection operations for ASEAN countries in September 2021, which was attended by 101 participants.

103. The Agency conducted three Webinars on Overview of Operation and Maintenance of Handheld Detection Equipment in 2021. These webinars aimed to raise awareness of the types of hand-held detection equipment that may be used in the detection of MORC, provide details on the operation of hand-held detection equipment and provide an overview of maintenance requirements for the sustainability of hand-held detection equipment.

104. The Agency designated the Radiation Detection Training Centre of the General Administration of Customs of the People's Republic of China as a Collaborating Centre in the area of capacity building for front line officers.

C.3. Major Public Events

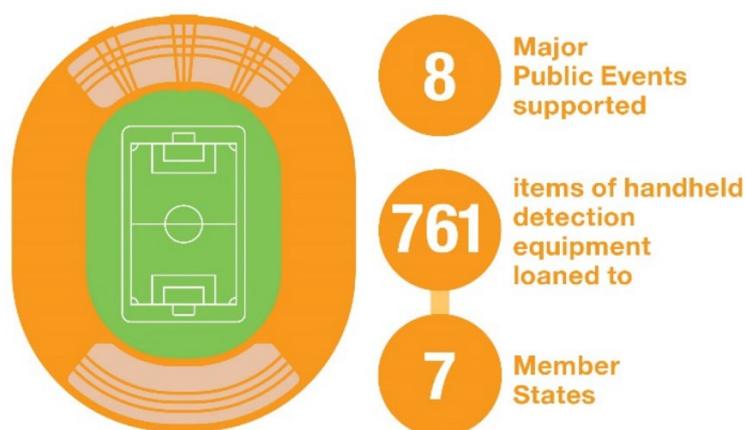


Fig. A.8. Agency activities in nuclear security for major public events in 2021.

105. The Agency held seven webinars, including in Spanish, covering various topics related to the implementation of nuclear security systems and measures for major public events, in April 2021, July 2021, and September 2021, involving around 2480 participants in total.

106. In 2021, the Agency supported the implementation of nuclear security measures for eight MPEs: the 2020 African Nations Championship in Cameroon held in January-February 2021, the 2021 Commonwealth Heads of Government Meeting in Rwanda, the 2020 UEFA European Football Championship in Romania, the 2021 Africa Cup of Nations in Cameroon, the 18th Francophone Summit

in Tunisia, the 2021 African Union Summit on Industrialization and Economic Diversification in the Niger, 2022 FIFA World Cup in Qatar and several MPEs planned in China, including the 2022 Olympic Winter Games. This support included 6 virtual coordination meetings, 9 in-person training courses and the loan of 761 radiation detection instruments.

107. The Agency collaborated with United Nations Office of Counter-Terrorism, the United Nations Interregional Crime and Justice Research Institute, and the International Centre for Sports Security within the Global Programme on Security of Major Sporting Events, and Promotion of Sport and its Values as a Tool to Prevent Violent Extremism.

108. The Agency signed Practical Arrangements with China on nuclear security systems and measures for MPEs in June 2021.

C.4. Radiological Crime Scene Management and Nuclear Forensics Science

109. The Agency continued to draft the IAEA Technical Document (TECDOC) provisionally entitled *Implementing a Nuclear Forensics Capability: Application of Analytical Techniques*.

110. The Agency encouraged international collaboration in nuclear forensics research by providing funding for the residential assignment of a Moldovan scientist and two experts from Kazakhstan at the Laboratory for Microparticle Analysis in Moscow, from November 2020 to March 2021.

111. The Agency signed Practical Arrangements with the Laboratory for Microparticle Analysis in Moscow in February 2021 to facilitate the provision of assistance in nuclear forensics science, bringing the total number of Practical Arrangements in the area of nuclear forensics sciences to eight.

112. The Agency held a webinar entitled IAEA Nuclear Security Series No. 22-G: Implementing Guide on Radiological Crime Scene Management: A Perspective from France and Germany in April 2021 and a webinar entitled “Webinar on Operational Perspectives Connecting Radiological Crime Scene Management and Nuclear Forensics” in October 2021.

113. The Agency held a National Workshop on Radiological Crime Scene Management in Tirana in November 2021.

114. The Agency launched a nuclear forensics e-learning module, which provides participants with an overview and basic introduction to nuclear forensics, on the Agency’s learning management system in September 2021.

115. The Agency held four webinars on nuclear forensics: one on the investigative perspectives of nuclear forensics in responding to a nuclear security event in May 2021, and three providing an introduction to *Nuclear Forensics in Support of Investigations* IAEA Nuclear Security Series No. 2-G (Rev. 1), in Arabic, French, and Spanish, in November and December 2021.

116. A regional exercise on forensic examination of evidence and trace amounts of nuclear material from radiological crime scenes was implemented in Moscow in June 2021.

117. The Agency facilitated a technical visit for scientists from Hungary, the Republic of Moldova and Serbia to observe the operations of the Laboratory for Microparticle Analysis in Moscow in October 2021.

118. In 2021, the Agency conducted seven webinars on the Nuclear Security Series in the areas of radiological crime scene management and nuclear forensics science; prepared the new radiological crime scene management train the trainers course for the first pilot in early-2022; submitted the revision of *Radiological Crime Scene Management* (IAEA Nuclear Security Series No. 22-G) to the internal revision committee; adopted two new Practical Arrangements (with the Netherlands Forensic Institute

and the State Nuclear Security Technology Centre of China) on cooperation in the area of nuclear forensics science; and prepared a draft non-serial publication provisionally entitled *Nuclear Forensics Analytical Techniques* for submission to the Publications Committee.

D. Nuclear Security Interfaces

119. At their October 2021 meetings, the International Nuclear Safety Group and the Advisory Group on Nuclear Security approved for publication their draft joint report *A System View of Nuclear Security and Nuclear Safety — Identifying Interfaces and Building Synergies*.

120. The Agency published *The Nuclear Safety and Nuclear Security Interface: Approaches and National Experiences* (IAEA Technical Reports Series No. 1000) in March 2021. The Agency also published *Managing the Interface between Safety and Security for Normal Commercial Shipments of Radioactive Material* (Technical Reports Series No. 1001) in September 2021.



Fig. A.9. Technical Reports Series No. 1001 helps policymakers address both nuclear safety and security needs during shipments of radioactive material.

121. The Agency held a virtual Technical Meeting on the Use of Safety Analysis Approaches for Nuclear Security Purposes in October 2021 to discuss current approaches with a focus on potential ways that insights from safety analysis, both probabilistic and deterministic, could be used to support nuclear security considerations.

122. The Agency developed two training courses, one each on medical and industrial activities, to support the implementation of the Technical Report Series publications on notification, authorization, inspection, and regulatory enforcement for the safety and security of radioactive sources.

123. The Agency drafted a TECDOC provisionally entitled *Safe and Secure End-of-Life Management of Radioisotope Thermoelectric Generators*, which will be further improved through planned consultancy meetings.

124. The Agency prepared a draft document preparation profile, submitted for approval to the NSGC and the Safety Standards Committees, for a joint Safety Guide and Implementing Guide on the management of the interfaces between nuclear safety and nuclear security.

Appendix B

The Agency's Nuclear Security Series Activities in 2021

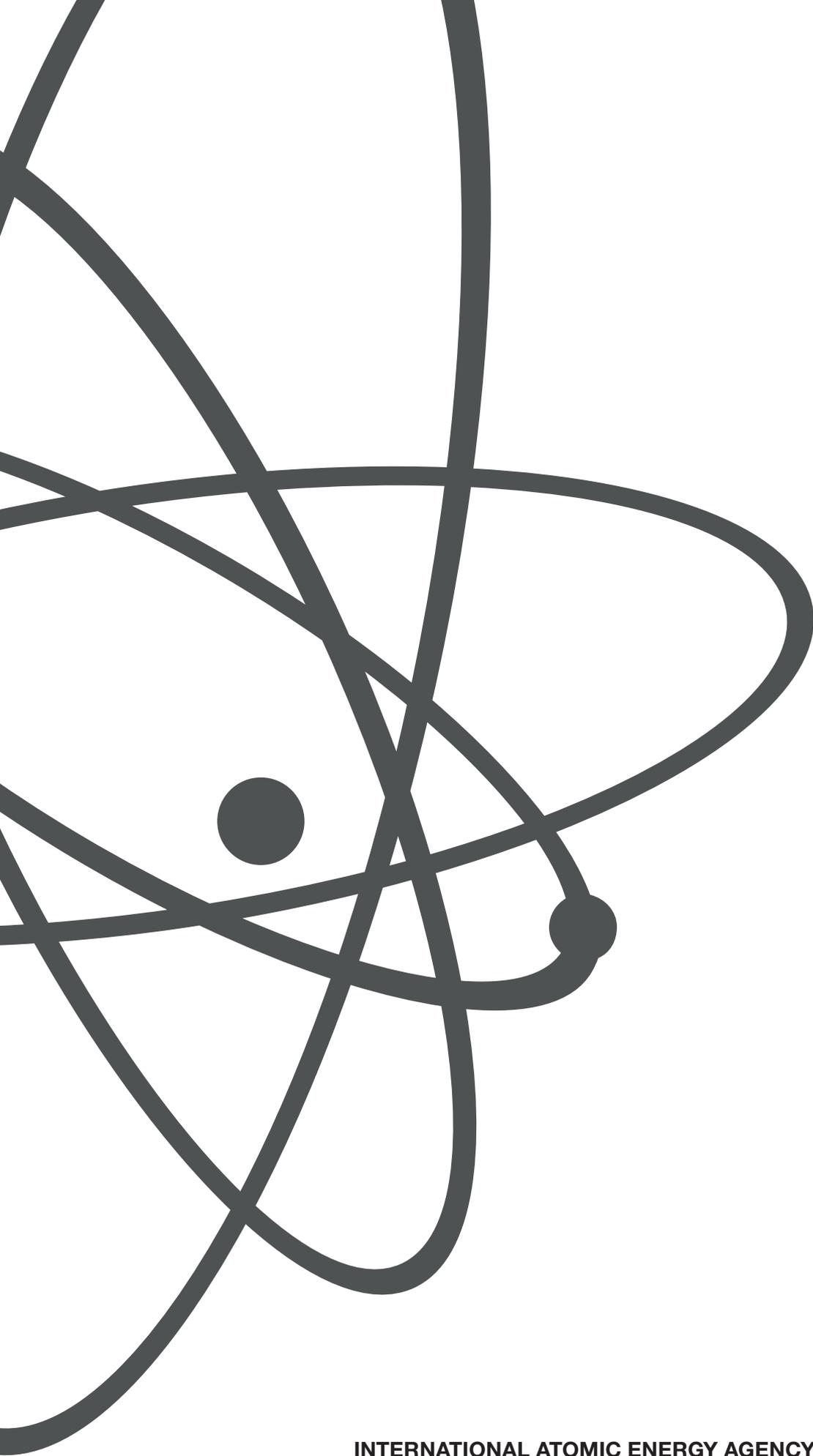
1. The Agency issued six Nuclear Security Series publications after endorsement by the Nuclear Security Guidance Committee:

- *National Nuclear Security Threat Assessment, Design Basis Threats and Representative Threat Statements* (IAEA Nuclear Security Series No. 10-G (Rev. 1));
- *Computer Security for Nuclear Security* (IAEA Nuclear Security Series No. 42-G);
- *Model Academic Curriculum in Nuclear Security* (IAEA Nuclear Security Series No. 12-T (Rev. 1));
- *Computer Security Techniques for Nuclear Facilities* (IAEA Nuclear Security Series No. 17-T (Rev 1));
- *Enhancing Nuclear Security Culture in Organizations Associated with Nuclear and Other Radioactive Material* (IAEA Nuclear Security Series No. 38-T); and
- *Handbook on the Design of Physical Protection Systems for Nuclear Material and Nuclear Facilities* (IAEA Nuclear Security Series No. 40-T).

2. The Agency continued to review the top tier of the Nuclear Security Series, the Fundamentals and three Recommendation-level publications, to determine whether any revisions are needed in the near term, taking into account NSGC recommendations in this regard.

3. The Agency included all newly issued safety standards and nuclear security guidance in the Nuclear Safety and Security Online User Interface (NSS-OUI) platform. All IAEA Safety Standards Series and IAEA Nuclear Security Series publications are available in full, are up-to-date and can be searched as a uniform knowledge base. The relationship search functionality of the platform was further enhanced in 2021. The platform contains information on the relationship between the publications and helps users to navigate from one publication to other relevant guidance and recommendations from other publications.

4. The NSS-OUI platform also enables the collection, storage and retrieval of feedback on the use of the current publications in both series. The functionality ensures that any revision of Agency safety standards or part of the safety standards is justified by the above-mentioned feedback, therefore also ensuring stability of the parts of the standards that remain valid. The NSS-OUI platform will be further used for the systematic revision of Agency safety standards.



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