

2020 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons

Distr.: General
11 November 2021

Original: English

New York, 4–28 January 2022

Activities of the International Atomic Energy Agency relevant to article III of the Treaty on the Non-Proliferation of Nuclear Weapons

Background paper prepared by the secretariat of the International Atomic Energy Agency

Executive summary

- According to its statute, the objectives of the International Atomic Energy Agency (IAEA) are to “seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world” and to “ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose”.
- The previous Review Conferences of the Treaty on the Non-Proliferation of Nuclear Weapons reaffirmed that IAEA is the competent authority responsible for verifying and assuring States parties’ compliance with their safeguards agreements. IAEA has continued to function as such, implementing safeguards and drawing and reporting its safeguards conclusions.
- The restrictions implemented worldwide to contain the coronavirus disease (COVID-19) pandemic have created unprecedented challenges to the implementation by IAEA of safeguards, primarily in the field, but also at Headquarters. The most significant impact was on the ability of IAEA to conduct some of its planned in-field verification activities. This required IAEA to take a number of measures to overcome or mitigate this impact, including prioritizing time-critical in-field verification activities, enhancing the protection of the health and safety of IAEA staff on duty travel, and strengthening collaboration with States to facilitate the necessary access to nuclear facilities and locations outside facilities). Despite the difficulties caused by the COVID-19 pandemic, IAEA has maintained a level of effectiveness of safeguards implementation consistent with previous years to meet its safeguards objectives. IAEA continues to rely on the essential cooperation of States to implement safeguards.
- In order for IAEA to continue to fulfil its mandate under article III of the Non-Proliferation Treaty, IAEA safeguards have been strengthened since the 2015 Review Conference and their implementation has continued to evolve.



Additional States have concluded comprehensive safeguards agreements, brought into force additional protocols, and modified or rescinded small quantities protocols to their comprehensive safeguards agreements. The implementation of IAEA safeguards has evolved through, for example, the further development and implementation of State-level safeguards approaches, the development of safeguards concepts and approaches for different facility types, strengthened information analysis, reinforced State evaluation processes and the use of advanced technology and techniques. Two major projects to enhance the technical capabilities of IAEA to analyse nuclear material and environmental samples and to modernize information technology were completed. New safeguards tools and equipment have been deployed. Internal processes and procedures have been adjusted as part of continual improvement and in support of quality management. IAEA has also been preparing to address future challenges and opportunities, such as emerging technologies, and has held two workshops to better understand potential opportunities and challenges posed by these technologies.

- The steps taken have strengthened the effectiveness and improved the efficiency of IAEA safeguards, at a time when the Agency's workload has continued to grow steadily while resources have not increased commensurately. The general trend of increasing safeguards responsibilities reported to the 2015 Review Conference has continued: since then, the number of nuclear facilities and the quantity of nuclear material under IAEA safeguards have continued to rise. Today, IAEA implements safeguards in over 1,300 facilities and locations outside facilities and applies safeguards to nuclear material equivalent to over 220,000 significant quantities.¹
- From 16 January 2016 (Joint Comprehensive Plan of Action Implementation Day) to 23 February 2021, IAEA has verified and monitored implementation by the Islamic Republic of Iran of its nuclear-related commitments under JCPOA. From 23 February 2021, however, IAEA verification and monitoring activities in relation to JCPOA were seriously undermined as a result of the decision of the Islamic Republic of Iran to stop the implementation of its nuclear-related commitments under JCPOA, including the Additional Protocol. IAEA continued to submit regular reports to the Board of Governors and, in parallel, to the Security Council.
- IAEA has pursued its efforts aimed at resolving significant outstanding safeguards implementation issues in three States: Iran, the Democratic People's Republic of Korea and the Syrian Arab Republic.
- Since the 2015 Review Conference, IAEA has continued to implement its mandate under the comprehensive safeguards agreement of the Islamic Republic of Iran, seeking resolution to pending safeguards implementation issues. The Director General has remained deeply concerned that nuclear material has been present at undeclared locations in the Islamic Republic of Iran, the current locations of this nuclear material are not known to IAEA and that, even after some two years, the safeguards issues in relation to the four locations in the Islamic Republic of Iran not declared to IAEA remained unresolved.
- IAEA has continued to monitor the nuclear activities of the Democratic People's Republic of Korea and has enhanced its readiness to undertake any activities that it may be requested to conduct in the Democratic People's Republic of Korea.

¹ Significant quantity – the approximate amount of nuclear material for which the possibility of manufacturing a nuclear explosive device cannot be excluded.

- The Director General has continued to urge the Syrian Arab Republic to cooperate fully with IAEA in connection with unresolved issues related to the Dair Alzour site and other locations in the Syrian Arab Republic.
- Given its safeguards responsibilities, IAEA, now and in the future, needs to continue providing soundly based safeguards conclusions in an increasingly resource-constrained environment. Therefore, it has continued to seek ways to improve efficiency in safeguards implementation by optimizing processes and making better use of modern technology.
- As safeguards implementation is a cooperative effort, IAEA has sought to further enhance assistance to and cooperation with State and regional authorities in the implementation of safeguards and to enhance partnerships in general. To this end, the Director General launched the IAEA Comprehensive Capacity-Building Initiative for SSACs and SRAs (COMPASS). COMPASS involves partnering with States to help them strengthen the effectiveness of their State or regional authorities responsible for safeguards implementation and respective systems of accounting for and control of nuclear material. Building upon existing IAEA support, COMPASS allows IAEA to provide assistance tailored to a State's needs.

Introduction

1. IAEA and its safeguards were established over 60 years ago to help ensure that nuclear energy would serve peace and development. The purpose of IAEA safeguards is to provide credible assurances to the international community that nuclear material and other specified items placed under IAEA safeguards are not diverted from peaceful uses to nuclear weapons or other nuclear explosive devices.
2. IAEA safeguards are grounded in the provisions of IAEA statute. Article III.A.5 of the statute authorizes IAEA to establish and administer safeguards designed to ensure that nuclear material, services, equipment, facilities and information made available by IAEA or at its request or under its supervision or control are not used in such a way as to further any military purpose. Article III.A.5 also authorizes IAEA to apply safeguards to any bilateral or multilateral arrangement, at the request of the parties, or to any of the nuclear activities of a State, at that State's request. Pursuant to this authority, IAEA concludes agreements with States, and with regional inspectorates, for the application of safeguards. These agreements are of three types: (a) comprehensive safeguards agreements with non-nuclear-weapon States party to the Non-Proliferation Treaty, as well as States party to the regional nuclear-weapon-free zone treaties; (b) voluntary offer safeguards agreements with the nuclear-weapon States party to the Treaty; and (c) item-specific safeguards agreements with non-Treaty States.²
3. Article III of the Non-Proliferation Treaty requires all non-nuclear-weapon States party to the Treaty to accept safeguards, as set forth in an agreement to be negotiated and concluded with IAEA in accordance with the IAEA statute and the IAEA safeguards system. Comprehensive safeguards agreements, which follow the

² The International Atomic Energy Agency (IAEA) implements item-specific safeguards agreements, which are based on INFCIRC/66/Rev.2, in States that are not party to the Non-Proliferation Treaty. Under these agreements, IAEA applies safeguards to ensure that nuclear material, non-nuclear material, facilities and other items subject to such safeguards agreements are not used for the manufacture of any nuclear weapon or to further any military purpose, and that such items are used exclusively for peaceful purposes and not for the manufacture of any nuclear explosive device.

structure and content set out in IAEA document INFCIRC/153 (Corrected),³ are also required under other bilateral or multilateral arrangements.⁴

4. Under its comprehensive safeguards agreement, each State undertakes to accept IAEA safeguards on all source or special fissionable material in all peaceful nuclear activities within the territory of the State, under its jurisdiction, or carried out under its control anywhere. For its part, IAEA has a corresponding right and obligation to ensure that safeguards are applied on all such material for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices. IAEA verifies that State declarations of nuclear material subject to safeguards are not only “correct” (i.e., that they accurately describe the type(s) and quantity(ies) of a State’s declared nuclear material), but also are “complete” (i.e., that they include all nuclear material that is required to be declared).

5. Each of the five nuclear-weapon States has concluded a voluntary offer safeguards agreement with IAEA. Under such an agreement, IAEA applies safeguards to nuclear material in those facilities or parts thereof which have been selected by IAEA from the State’s list of eligible facilities in order to verify that such material is not withdrawn from safeguards except as provided for in the agreement.⁵

6. A State with a safeguards agreement(s) may also conclude a protocol additional to its safeguards agreement. In 1997, the IAEA Board of Governors approved the Model Additional Protocol to “strengthen the effectiveness and improve the efficiency of the safeguards system as a contribution to global nuclear non-proliferation objectives”.⁶ The additional information and broader access for IAEA inspectors provided for in the additional protocol are designed to fill the gaps in information and access required under comprehensive safeguards agreements. The additional protocol is essential for IAEA to obtain a more complete picture of the existing and planned nuclear programmes and material holdings of States with comprehensive safeguards agreements. Thus, the entry into force and implementation of an additional protocol in a State with a comprehensive safeguards agreement is of vital importance for IAEA to have the necessary safeguards measures to be able to provide assurances about the exclusively peaceful nature of that State’s nuclear programme. The measures provided for under additional protocols significantly increase the ability of IAEA to verify the peaceful use of all nuclear material in States with comprehensive safeguards agreements.

7. As a means of minimizing the burden of safeguards implementation for those States with minimal or no nuclear activities, a small quantities protocol was introduced by IAEA in the early 1970s. Its practical effect was to hold in abeyance

³ The Structure and Content of Agreements between the Agency and States required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons.

⁴ These arrangements include the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Treaty of Tlatelolco); the South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty); the Agreement between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy; the Treaty on the Southeast Asia Nuclear Weapon-Free Zone (Treaty of Bangkok); the African Nuclear-Weapon-Free Zone Treaty (Treaty of Pelindaba); and the Treaty on a Nuclear-Weapon-Free Zone in Central Asia (Treaty of Semipalatinsk).

⁵ In selecting facilities under voluntary offer safeguards agreements for the application of safeguards, IAEA takes into consideration factors such as: (a) whether the selection of a facility would satisfy legal obligations arising from other agreements concluded by the State; (b) whether useful experience may be gained in implementing new safeguards approaches or in using advanced equipment and technology; and (c) whether the cost efficiency of IAEA safeguards may be enhanced by applying safeguards, in the exporting State, to nuclear material being shipped to States with comprehensive safeguards agreements in force.

⁶ Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards (INFCIRC/540 (Corrected)).

the implementation of most of the provisions in Part II⁷ of a State's comprehensive safeguards agreement as long as certain eligibility criteria were met. In 2005, the Board of Governors approved a revision to the standard text of the small quantities protocol, reducing the number of provisions held in abeyance, and modified the eligibility criteria for such a protocol, making it unavailable to a State with an existing or planned nuclear facility. Under a small quantities protocol based on the revised text, the State is required to submit to IAEA an initial report on all nuclear material and inform IAEA as soon as a decision to construct or authorize the construction of a nuclear facility has been taken, and IAEA may carry out inspections in the State. In 2005, the Board called on all States with small quantities protocols to amend or rescind their protocols, as appropriate, as soon as possible. Since 2020, the Director General has reinvigorated IAEA efforts to strengthen the safeguards system. In this regard, the Director General has communicated with all States with original small quantities protocols calling upon them to amend or rescind their small quantities protocols.

8. Every year, IAEA draws a safeguards conclusion for each State with a safeguards agreement in force. In order to draw an independent and soundly based safeguards conclusion, IAEA needs to have conducted a sufficient level of safeguards activities and a comprehensive evaluation of all safeguards-relevant information⁸ available to it about a State, including the results of IAEA verification activities. A safeguards conclusion is drawn when all the necessary safeguards activities have been completed and no indication has been found by the IAEA secretariat that, in its judgment, would constitute a safeguards concern.

9. For IAEA to be able to draw a safeguards conclusion that all nuclear material in a State with a comprehensive safeguards agreement is in peaceful activities, the State needs to have both a comprehensive safeguards agreement and an additional protocol in force, and IAEA must have been able to conduct all necessary verification and evaluation activities. For States with comprehensive safeguards agreements but no additional protocols in force, IAEA only draws a safeguards conclusion with respect to declared nuclear material.

Activities of the Agency since the 2015 Review Conference

10. This section reports on IAEA activities relevant to the implementation of article III of the Non-Proliferation Treaty, with a focus on the period since the 2015 Review Conference.

1. Conclusion of comprehensive safeguards agreements and additional protocols

11. Although it is a legal obligation under article III of the Non-Proliferation Treaty for each non-nuclear-weapon State party to bring into force a comprehensive safeguards agreement, as at the end of October 2021, eight of those States party to the Treaty had yet to conclude and bring into force such an agreement. By the end of October 2021, 138 States (including 137 States party to the Treaty) had brought additional protocols into force; 69 out of 96 States had accepted the revised small quantities protocol text and 10 States had rescinded their small quantities protocols.

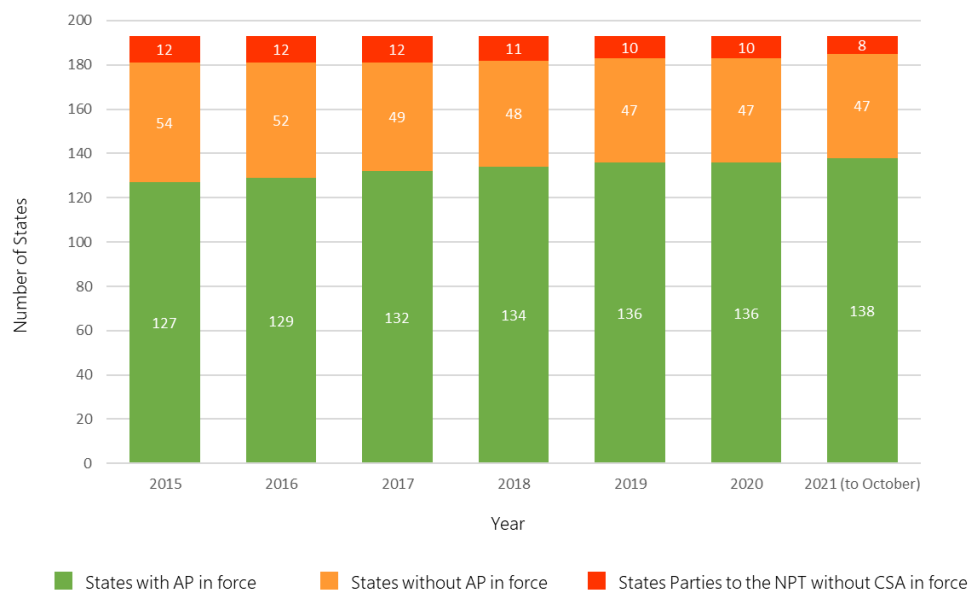
⁷ Part II specifies the safeguards procedures to be applied for the implementation of the safeguards provisions set out in Part I.

⁸ "Safeguards relevant information" refers to information relevant for the implementation of IAEA safeguards and which contributes to the drawing of soundly based safeguards conclusion. There are three main types of such information: (a) information provided by States pursuant to their safeguards agreement(s); (b) information from IAEA safeguards activities in the field and at headquarters; and (c) other relevant information (e.g., from open sources and provided by third parties).

12. IAEA has continued to implement the Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols.⁹ The outreach efforts of IAEA, which, since 2020, have been reinvigorated by an initiative of the Director General, have led to significant progress. Between the 2015 Review Conference and the end of October 2021, 5 additional States parties brought into force comprehensive safeguards agreements; 13 States parties brought into force additional protocols; 18 States parties accepted the revised small quantities protocol text; and another 5 States parties rescinded their small quantities protocols. As a result of the Director General's initiative, from 2020 to the end of October 2021, two States parties have brought into force comprehensive safeguards agreements, two States parties have brought into force additional protocols and five States parties have amended and two States parties have rescinded their small quantities protocols.

13. The Director General has stated that safeguards implementation in States with small quantities protocols based on the original standardized text is an area of difficulty, as nuclear material declarations are not provided and IAEA cannot implement in-field verification activities in those States. Therefore, IAEA ability to draw a credible and soundly based annual safeguards conclusion for those States is becoming increasingly challenging.

Status of additional protocols for States with safeguards agreements in force, 2015-October 2021 (not including the Democratic People's Republic of Korea)



Abbreviations: AP, additional protocol; CSA, comprehensive safeguards agreement; NPT, Non-Proliferation Treaty.

14. As at the end of October 2021, safeguards were applied for 185 States^{10,11} (see figure) with safeguards agreements in force with IAEA. The IAEA secretariat's findings and safeguards conclusions are reported annually by the Director General to the IAEA Board of Governors through the Safeguards Implementation Report. The

⁹ www.iaea.org/sites/default/files/20/09/sg-plan-of-action-2019-2020.pdf.

¹⁰ These States do not include the Democratic People's Republic of Korea, where IAEA did not implement safeguards and, therefore, could not draw any conclusion.

¹¹ And for Taiwan, China.

report also provides a description and analysis of IAEA safeguards activities and summarizes the challenges encountered.

15. Since 2015, IAEA has continued to apply safeguards in selected facilities in China, France, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America. Since then, the number of facilities selected by IAEA from the States' lists of eligible facilities has remained largely constant.

2. Verification and monitoring in the Islamic Republic of Iran

16. On 14 July 2015, IAEA and the Islamic Republic of Iran signed a "Road-map for the clarification of past and present outstanding issues regarding Iran's nuclear programme" as set out in the annex to the Director General's report of November 2011 (GOV/2011/65, annex). The road-map identified the necessary activities to be undertaken under the Framework for Cooperation signed by IAEA and the Islamic Republic of Iran on 11 November 2013 (GOV/INF/2013/14) in order to accelerate and strengthen cooperation and dialogue between them aimed at the resolution, by the end of 2015, of all past and present outstanding issues. In December 2015, the Director General provided a report to the Board of Governors entitled "Final assessment on past and present outstanding issues regarding Iran's nuclear programme" (GOV/2015/68). In the report, the Director General stated that all the activities contained in the road-map were implemented in accordance with the agreed schedule; IAEA assessed that, an organizational structure was in place in Iran prior to the end of 2003 suitable for the coordination of a range of activities relevant to the development of a nuclear explosive device; although some activities had taken place after 2003, they were not part of a coordinated effort; IAEA also assessed that these activities had not advanced beyond feasibility and scientific studies, and the acquisition of certain relevant technical competences and capabilities; IAEA had no credible indications of activities in the Islamic Republic of Iran relevant to the development of a nuclear explosive device after 2009; and IAEA found no credible indications of the diversion of nuclear material in connection with the possible military dimensions to the nuclear programme of the Islamic Republic of Iran. Based on all the information available to IAEA relating to nuclear material acquisition, the Agency had found no indications of an undeclared nuclear fuel cycle in the Islamic Republic of Iran, beyond those activities declared retrospectively by the Islamic Republic of Iran.

17. On 14 July 2015, China, France, Germany, the Russian Federation, the United Kingdom and the United States, with the High Representative of the European Union for Foreign Affairs and Security Policy (E3/EU+3) and the Islamic Republic of Iran agreed on the Joint Comprehensive Plan of Action (JCPOA). On 20 July 2015, the Security Council adopted resolution [2231 \(2015\)](#), in which, inter alia, it requested the Director General to "undertake the necessary verification and monitoring of Iran's nuclear-related commitments for the full duration of those commitments under the JCPOA".¹²

18. In August 2015, the Board of Governors authorized the Director General to implement the necessary verification and monitoring of the nuclear-related commitments of the Islamic Republic of Iran as set out in JCPOA, and report accordingly, for the full duration of those commitments in the light of Security Council resolution [2231 \(2015\)](#), subject to the availability of funds and consistent with the Agency's standard safeguards practices. The Board of Governors also authorized IAEA to consult and exchange information with the Joint Commission, as set out in GOV/2015/53 and Corr.1. On 16 January 2016 (JCPOA Implementation

¹² GOV/2015/53 and Corr.1, para. 8.

Day), the Agency began verifying and monitoring the implementation by the Islamic Republic of Iran of its nuclear-related commitments in accordance with the modalities set out in JCPOA, consistent with the Agency's standard safeguards practices and in an impartial and objective manner.

19. On 8 May 2018, the President of the United States of America, Donald Trump, announced that the "United States will withdraw from the Iran nuclear deal". On 8 May 2019, the Islamic Republic of Iran announced, *inter alia*, that "[...] in implementing its rights set forth in Paragraph 26 and 36 of the JCPOA, the Supreme National Security Council [of] the Islamic Republic of Iran has issued an order to stop some of Iran's measures under the JCPOA from today". Since that date, the Islamic Republic of Iran has reduced its nuclear-related commitments under JCPOA on a step-by-step basis. On 5 January 2020, Iran announced that its nuclear programme would no longer be "subject to any restrictions in the operational sphere".

20. On 23 February 2021, the Islamic Republic of Iran stopped its "implementation of voluntary transparency measures as envisaged in the JCPOA", including the provisions of the Additional Protocol, modified Code 3.1 of the Subsidiary Arrangements to Iran's Safeguards Agreement, and access pursuant to the provisions of JCPOA. Consequently, since that date, IAEA verification and monitoring activities in relation to JCPOA have been seriously undermined. IAEA has continued to submit regular reports to the Board of Governors and, in parallel, to the Security Council. Moreover, the decision by the Islamic Republic of Iran not to implement modified Code 3.1 is contrary to its legal obligations under the Subsidiary Arrangements to its Safeguards Agreement. The Director General called upon the Islamic Republic of Iran to fulfil all of its legal obligations under the Subsidiary Arrangements to its Safeguards Agreement and fully implement modified Code 3.1.

3. Safeguards implementation issues

21. There have been a number of significant safeguards implementation issues since the 2015 Review Conference. IAEA has been working to resolve outstanding safeguards implementation issues in three States.

Islamic Republic of Iran

22. In 2019 and 2020, IAEA detected the presence of multiple uranium particles of anthropogenic origin at three locations in the Islamic Republic of Iran not declared to IAEA, as well as the presence of isotopically altered particles at one of these locations. These were clear indications that nuclear material and/or equipment contaminated by nuclear material has been present at these locations. The Director General has remained deeply concerned that nuclear material has been present at undeclared locations in the Islamic Republic of Iran and that the current locations of this nuclear material are not known to IAEA. The Director General expressed his increasing concern that, even after some two years, the safeguards issues in relation to the four locations in the Islamic Republic of Iran not declared to IAEA remained unresolved.

23. The lack of progress in clarifying Agency's questions concerning the correctness and completeness of the safeguards declarations by the Islamic Republic of Iran seriously affects the ability of IAEA to provide assurance of the peaceful nature of the country's nuclear programme.

Democratic People's Republic of Korea

24. Since 1994, IAEA has not been able to conduct all necessary safeguards activities provided for in the Democratic People's Republic of Korea Non-Proliferation Treaty Safeguards Agreement. Since April 2009, IAEA has not been able to implement any

safeguards measures in the country. Therefore, IAEA could not draw any safeguards conclusion regarding the Democratic People's Republic of Korea.

25. Since April 2009, IAEA also has not implemented any measures under the ad hoc monitoring and verification arrangement agreed between IAEA and the Democratic People's Republic of Korea and foreseen in the Initial Actions agreed at the Six-Party Talks. During the reporting period, the Democratic People's Republic of Korea continued to stress the importance of its nuclear weapons programme and made a number of statements indicating its continuing nuclear activities, including statements concerning the conducting of its fourth, fifth and sixth nuclear tests.

26. Although not implementing any verification activities in the field, IAEA has continued to monitor the nuclear activities of the Democratic People's Republic of Korea and to evaluate all safeguards-relevant information available to it, including open source information and satellite imagery. Since August 2017, IAEA has enhanced its readiness to play its essential role in verifying the State's nuclear programme with the establishment of a Democratic People's Republic of Korea team within the Department of Safeguards. The team has since increased the monitoring of the State's nuclear activities through more frequent collection of satellite imagery and has enhanced the readiness of IAEA to promptly undertake any activities that it may be requested to conduct in country.

27. Since 2015, the Democratic People's Republic of Korea nuclear programme has continued. From December 2015 to December 2018 there were indications consistent with the operation of the Yongbyon Experimental Nuclear Power Plant Reactor (5MW(e)); the indications were absent from early December 2018 until early July 2021, when they were again observed. In 2016 and in 2021, there were indications of the operation of the Radiochemical Laboratory at Yongbyon, which were consistent with reprocessing campaigns for irradiated fuel discharged from the (5MW(e)) reactor.

28. At the light water reactor under construction at Yongbyon, activities consistent with the transfer of major reactor components into the reactor containment building were observed in 2018. Activities at the reported centrifuge enrichment facility at Yongbyon continued, although there were indications, for a period of time, that it was not in operation. There were indications of ongoing activities at the Kangson complex.

29. Without access to the relevant facilities or locations, IAEA has been unable to confirm either the operational status or the configuration/design features of the facilities or locations, or the nature and purpose of the activities conducted therein. IAEA continued to further consolidate its knowledge of the nuclear programme of the Democratic People's Republic of Korea and enhance its operational readiness to resume safeguards implementation in the country.

Syrian Arab Republic

30. In his report to the Board of Governors of May 2011, the Director General provided the IAEA assessment that, on the basis of all the information available to IAEA and its technical evaluation of that information, it was very likely that the building destroyed at the Dair Alzour site in the Syrian Arab Republic was a nuclear reactor which should have been declared to IAEA. In June 2011, the Board of Governors, by a vote, adopted a resolution in which, inter alia, it found that the country's undeclared construction of a nuclear reactor at Dair Alzour and failure to provide design information for the facility constituted non-compliance by the Syrian Arab Republic with its obligations under its Non-Proliferation Treaty Safeguards Agreement with IAEA in the context of article XII.C of the IAEA statute. The Board of Governors called upon the Syrian Arab Republic to remedy its non-compliance

urgently and provide IAEA with updated reporting under its Safeguards Agreement and access to all information, sites, material and persons necessary for IAEA to verify such reporting and resolve all outstanding questions so that IAEA could provide the necessary assurances as to the exclusively peaceful nature of the country's nuclear programme. The Board also decided to report, as provided for in article XII.C of the statute, through the Director General, the country's non-compliance with its Safeguards Agreement to all members of IAEA and to the Security Council and the General Assembly. The Board requested the Director General to continue his efforts to implement fully the IAEA Safeguards Agreement with the Syrian Arab Republic and to report any significant developments to the Board and to the Council, as appropriate, and decided to remain seized of the matter.

31. In September 2021, the Board was informed once again that no new information had come to the knowledge of IAEA that would have an impact on the IAEA 2011 assessment about the building destroyed at the Dair Alzour site, and urged the Syrian Arab Republic to cooperate fully with IAEA in connection with unresolved issues related to the Dair Alzour site and other locations. The Syrian Arab Republic has yet to respond to these calls.

32. On the basis of the evaluation of all safeguards-relevant information available to it, IAEA has found no indication of diversion of declared nuclear material from peaceful activities and has concluded, for the Syrian Arab Republic, that declared nuclear material remained in peaceful activities.

4. Development and implementation of State-level safeguards approaches

33. IAEA has progressively developed and implemented State-level safeguards approaches¹³ as described in the Director General report to the Board of Governors entitled "The conceptualization and development of safeguards implementation at the State level" (GOV/2013/38) and the supplementary document (GOV/2014/41 and Corr.1).

34. In response to IAEA General Conference resolutions GC(60)/RES/13 and GC(61)/RES/12, the Director General submitted in July 2018 a report to the Board of Governors entitled "Implementation of State-level safeguards approaches for States under integrated safeguards – experience gained and lessons learned" (GOV/2018/20). This report contains the secretariat's analysis of experience gained and lessons learned in the updating and implementation of State-level safeguards approaches for States under integrated safeguards, as described in Board documents.

35. As at 30 June 2021, State-level safeguards approaches have been developed for 133 States with a comprehensive safeguards agreement in force. These 133 States hold 97 per cent of all nuclear material (by significant quantity) under IAEA safeguards in States with a comprehensive safeguards agreement.¹⁴ In addition, State-level safeguards approaches were developed for two States with a voluntary offer agreement and an additional protocol in force.¹⁵ As described in the 2014 report to

¹³ The State-level safeguards approach refers to a customized approach to implementing safeguards for an individual State. The approach consists of safeguards objectives for a State as well as applicable safeguards measures, to be implemented by IAEA in the field and at Headquarters, to address those objectives.

¹⁴ These include 67 States with a comprehensive safeguards agreement and an additional protocol in force for which the broader conclusion has been drawn (of which 17 are States with a small quantities protocol); 35 States with a comprehensive safeguards agreement and an additional protocol in force for which the broader conclusion has yet to be drawn (of which 24 are States with a small quantities protocol); and 28 States with a comprehensive safeguards agreement with a small quantities protocol in force but no additional protocol in force.

¹⁵ France and the United Kingdom.

the IAEA Board of Governors, in developing and implementing a State-level safeguards approach, consultations were held with the relevant State and/or regional authority, in particular on the implementation of in-field safeguards measures.

36. To further ensure consistency and non-discrimination in the implementation of safeguards, IAEA has continued to improve internal work practices. These include better integration of safeguards activities conducted in the field with those carried out at headquarters; further development of internal procedures and guidelines for the implementation of safeguards at the State-level; adjustments to the safeguards training programme, and strengthening of the departmental oversight mechanisms relevant to the implementation of safeguards at the State level.

37. In 2019, IAEA launched a project focusing on refining internal procedures for developing State-level safeguards approaches. It is aimed at improving the development of State-level safeguards approaches using a structured approach which includes: further developing and testing internal procedures for analysing acquisition paths; standardizing the formulation and prioritization of technical objectives; and developing and testing performance targets.

5. Development of safeguards approaches, equipment and technologies

Safeguards approaches for existing facilities

38. IAEA seeks to continually improve the effectiveness and efficiency of safeguards implementation at facilities by evaluating safeguards approaches and identifying potential improvements.

39. Since 2015, enhancements to safeguards implementation at existing facilities have been achieved by, for example: deploying laser mapping techniques for containment verification of welds on spent fuel dry storage casks; measuring spent fuel assemblies with gamma tomography in order to detect missing pins or verify closed containers in spent fuel ponds; using neutron portal monitoring systems for verification of transfers of nuclear material to a low-level waste storage facility; and by conducting short-notice randomized inspections.

40. IAEA has continued to develop and improve safeguards approaches for spent fuel verification, including by applying dual containment and surveillance systems to items that are difficult to access for verification at spent fuel dry storages; modernizing sealing arrangements during spent fuel transfers; and using remote data transmission – which have helped reduce the frequency of inspections and inspector presence during transfers without compromising effectiveness.

41. Site- or facility-specific safeguards approaches and procedures have been developed or improved, e.g., for the implementation of unannounced inspections at a hot cell laboratory, and for the verification of the core fuel at a Canada Deuterium Uranium (CANDU) reactor. Short-notice random inspection schemes have been applied to a conversion plant and to verification of low burnup spent fuel at a nuclear power plant. The testing of remote data transmission equipment has been carried out at IAEA low enriched uranium bank in Kazakhstan.

42. At the damaged reactor units 1 to 3 at the Fukushima Daiichi site in Japan, IAEA has installed surveillance systems and neutron-gamma monitoring systems and has conducted short-notice inspections to ensure that nuclear material cannot be removed from the damaged reactors without the Agency's knowledge. IAEA has developed a safeguards approach for the nuclear material contained in the storage and undamaged reactor facilities on site, while reverifying nuclear material items retrieved from the damaged reactors unit. IAEA has also continued to develop an approach for safeguarding the nuclear material of damaged reactor unit 4 at the Chernobyl nuclear power plant, spent fuel conditioning facility, dry storage and new safe confinement.

In addition, a specific technical solution was provided for the verification of spent fuel transferred from Ukrainian nuclear power plants to the centralized spent fuel storage facility, currently under construction in the Chernobyl exclusion zone.

43. Taking into account the increasing number of nuclear facilities that are reaching the end of their operating life cycle and being taken out of operation, IAEA has been working with member States to develop guidelines for facilities in the post-operation phase, including on the provision of information on decommissioning activities.

Safeguards by design for new facilities

44. For the effective and efficient implementation of safeguards at new facilities, safeguards measures need to be considered from the initial design planning stages. IAEA has been working to support States and the nuclear industry in this area by providing “safeguards-by-design” guidance. Since 2015, IAEA has published such guides for enrichment plants, fuel fabrication plants, conversion plants, reprocessing plants and long-term spent fuel management. These guidance documents have been published on the IAEA website¹⁶.

45. For facilities at the design stage or under construction, IAEA works closely with the relevant State and/or regional authority, and the facility operator, to incorporate safeguards features into the design of new facilities. For example, IAEA has continued to cooperate closely with Finland, Sweden and the European Commission in the planning of safeguards implementation at encapsulation plants and geological repositories. IAEA and the Republic of Korea have continued close cooperation on planning for safeguards implementation at future pyro-processing plants. IAEA is working with China to develop safeguards approaches for the high-temperature gas-cooled pebble bed reactor. IAEA continued to develop the safeguards approach for facilities under construction at the site of the Chernobyl nuclear power plant in Ukraine and the Mixed Oxide Fuel Fabrication Plant at the Rokkasho site in Japan.

46. In addition, IAEA has initiated a new Member State Support Programme task to identify the key technical challenges for safeguards implementation involving small modular reactors and steps that can be taken to support the incorporation of safeguards-by-design principles into small modular reactor designs.

Information analysis

47. The analysis of safeguards-relevant information is an essential part of evaluating a State’s nuclear activities and drawing safeguards conclusions. In order to draw soundly based safeguards conclusions, IAEA evaluates all safeguards-relevant information, including declarations and reports submitted by States, data generated from its own verification activities in the field and at IAEA headquarters, and other safeguards-relevant information available to it.

48. The volume of safeguards-relevant information has continued to rise. On an annual basis, IAEA received some 1,300 physical inventory listings and nearly 1,300 nuclear material balance reports. It integrated and interpreted the results of over 400 environmental samples per year. IAEA has continued to increase its use of high-resolution commercial satellite imagery to improve its ability to monitor nuclear facilities and sites in support of its safeguards activities. Some 400–500 commercial satellite images were acquired and analysed on average per year for safeguards purposes, reaching a high of over 900 in 2018. A number of member States voluntarily support IAEA with information on unfulfilled procurement enquiries for nuclear-related products, outside of reporting obligations pursuant to relevant safeguards

¹⁶ www.iaea.org/topics/assistance-for-states/safeguards-by-design-guidance.

agreements. Ongoing reviews of technical cooperation projects and procurements also provided relevant safeguards input.

49. Throughout the reporting period, IAEA continued to identify new open sources of safeguards-relevant information, improve processes and enhance methodologies and tools. It continued to improve the effectiveness and efficiency of its evaluation processes by drawing on an increased amount of information from verification activities performed at IAEA headquarters and in the field, including the results from non-destructive assay, destructive assay and environmental sample analyses and remotely transmitted data.

50. Since 2015, IAEA has continued to enhance and diversify its capabilities to acquire and process data, and to analyse and evaluate information in support of preparation for in-field verification activities and the State evaluation process. IAEA continued to make improvements to the overall performance of its information system, including within the scope of an information technology modernization project, by enhancing associated applications and facilitating appropriate access of staff to data.

Safeguards sample analysis

51. The IAEA Safeguards Analytical Laboratories in Seibersdorf, Austria, is responsible for processing, screening, distributing, analysing and archiving environmental and nuclear material samples. Under the Enhancing Capabilities of the Safeguards Analytical Services project, transition activities required to move into the new Nuclear Material Laboratory were completed in December 2015. With the new facilities and infrastructure, IAEA has been able to conduct sample analysis in safe, secure, modern facilities.

52. Since 2015, the number of laboratories belonging to the IAEA Network of Analytical Laboratories increased by four. The Network currently comprises the Safeguards Analytical Laboratories in Seibersdorf and 24 other qualified laboratories of IAEA member States and the European Commission. IAEA is working to qualify additional laboratories in other member States. Timeliness of sample distribution to the Network continued to improve, with reductions in the time required for sample screening, distribution to the Network, and analysis by it. IAEA also finalized a technical specification for a prototype “tamper indicating enclosure”, the purpose of which is to securely contain environmental samples.

53. IAEA also continued work to replace the existing Large Geometry Secondary Ion Mass Spectrometer with a new instrument, to sustain particle analysis capabilities for uranium isotopes. This project has been funded through extrabudgetary contributions provided by several member States. Installation of the new Spectrometer is planned to begin in early 2022.

Safeguards information technology

54. Information technology plays an important role in the implementation of safeguards. Since 2015, information technology development activities have focused, in particular, on the modernization of software applications to help, for example, to manage nuclear material accounting data and to record data and generate reports from inspectors’ in-field activities, store results of nuclear material samples and to assist in the internal evaluation of the quality and effectiveness of the performed verification activities. In 2018, IAEA completed the Modernization of Safeguards Information Technology project on schedule, according to scope, and within budget. It has enhanced existing tools and software applications, introduced new information technology tools and software applications, and strengthened information security. Many of these modernization efforts helped IAEA to successfully adapt to the

challenges presented by the COVID-19 pandemic and the lockdown measures implemented by host countries.

55. Other benefits from the Modernization of Safeguards Information Technology project include: easier and more secure archiving and retrieval of departmental knowledge, including the digitalization of paper-based processes; improved communication between IAEA, States and regional authorities; and enhanced protection against cyberattacks and other information security threats. As part of the project, IAEA launched a new web-based system, the “State Declarations Portal”, for the secure and timely exchange of safeguards information between the Department of Safeguards and States.

Safeguards equipment

56. Safeguards implementation relies heavily on technology, which needs to be sustainable, reliable, fit for purpose and secure. IAEA has continued its efforts to improve system reliability and modularity, optimize the use of commercial off-the-shelf components and enhance the usability of portable verification instruments and systems.

57. IAEA provided uninterrupted technical support and equipment for verification activities, despite the numerous challenges and restrictions associated with the pandemic, delivering support in the field to a level comparable with recent years. All departmental requests for safeguards equipment and personal protective equipment to be used by inspectors and technicians during safeguards activities in the field were fulfilled.

58. IAEA investments in remote data transmission, unattended monitoring systems and containment and surveillance systems used in the field played an important role in maintaining continuity of knowledge on nuclear material and essential equipment at facilities where physical access to IAEA inspectors was restricted or delayed owing to the pandemic. The reliability and performance of these systems contributed significantly to the achievement of IAEA safeguards objectives.

59. Further expansion of remote data transmission also continued to enhance efficiency by eliminating the need for data retrieval by inspectors at facilities and enabled early detection of any deterioration in the performance of data collection. Since 2015, the digital surveillance, non-destructive assay and unattended monitoring systems and active seals have exceeded the target goal of 99 per cent availability. IAEA continued to develop data analysis and inspector review tools to help streamline equipment data collection and review processes.

60. IAEA has continued to install unattended monitoring systems and to implement the Next Generation Surveillance System across the globe. The number of such systems has more than doubled since 2015. IAEA has also developed, tested, authorized and deployed new instruments since 2015, including, for example, a multi-component inspector kit. Since 2018, passive gamma emission tomography units have been deployed at several nuclear power plants and in some cases were successfully operated from IAEA headquarters. The passive gamma emission tomography systems are able to detect missing or replaced rods in spent fuel assemblies and measure spent fuel in containers, thus providing IAEA with an unprecedented capability of verifying irradiated items.

61. IAEA continued cooperative efforts with member States, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the European Commission. The efforts were focused on procurement, acceptance testing, installation and maintenance of safeguards equipment designated for joint use, and staff training.

Technology foresight

62. Technology foresight activities are aimed at identifying and evaluating the potential application of emerging technologies for use in verification. Since 2015, IAEA has conducted evaluation and testing of several technologies that could support IAEA safeguards implementation. Successful deployments have included additional applications of three-dimensional laser scanning. IAEA concluded an innovative crowdsourcing exercise to gather information about image processing techniques, which led to the identification of methods to enhance the quality of results of the Cerenkov viewing device used for spent fuel verification. The new next generation Cerenkov viewing device (XCVD) was developed and authorized as at 2020 after successful testing in Japan. As a result of the “robotics challenge” three prototypes were selected, further developed and tested. The robotized CVD (RCVD), which is undergoing advanced field trials, offers a remotely operated spent fuel verification capability, reducing the inspection effort as well as the radiation exposure of IAEA inspectors. Since 2018 a new generation of gamma spectrometry instruments based on advanced-cadmium zinc telluride technology is being introduced to replace obsolete and bulky instruments and features standardized interfaces and components. A new interrogation system fast neutron collar, was authorized in 2020 to verify fresh fuel composition independent of declared burnable poison concentration.

Safeguards asset management

63. As of the end of June 2021, the Department of Safeguards had over 58,000 active items registered in its safeguards asset registry, which is a key component of broader efforts to consistently manage the life cycle of all safeguards assets, including information technology equipment, in-field equipment, laboratory equipment and software. These items cost the Department over €238 million and are deployed to support safeguards activities in more than 60 States. The enhanced asset management system also offers an intuitive incident reporting module to capture data on instrument usage and performance.

Equipment deployment

64. IAEA Equipment Radiation Monitoring Laboratory provided uninterrupted radiation monitoring, even during the COVID-19 pandemic, of items returned from verification activities in the field, prior to their return to the inventory for calibration and preparation for further use.

6. Cooperation with, and assistance to, State and regional authorities

65. The effectiveness and efficiency of IAEA safeguards depend, to a large extent, on the effectiveness of State and regional systems of accounting for and control of nuclear material (SSACs and RSACs) and on the level of cooperation between the State or regional authorities responsible for safeguards implementation (SRAs) and IAEA.

IAEA Comprehensive Capacity-Building Initiative for SSACs and SRAs (COMPASS)

66. Although States with comprehensive safeguards agreements are required to establish and maintain effective State systems of accounting for and control of nuclear material, some States have not yet done so; furthermore, not all State or regional authorities responsible for safeguards implementation have the necessary legal authority, resources or technical capabilities to exercise sufficient oversight of their State systems of accounting for and control of nuclear material and implement the requirements of safeguards agreements and additional protocols. In order to assist State or regional authorities responsible for safeguards implementation to enhance

their performance and the effectiveness of their respective systems of accounting for and control of nuclear material, the Director General launched, in September 2020, the IAEA Comprehensive Capacity-Building Initiative for SSACs and SRAs (COMPASS).

67. Building on existing IAEA support to countries in the area of safeguards, COMPASS allows IAEA to work closely with designated authorities to identify the areas that could benefit the most from further collaboration. Based on these findings, customized assistance packages are developed to specifically address each of the identified needs of State systems of accounting for and control of nuclear material and/or State or regional authorities responsible for safeguards implementation and can include tailored support in the following areas: outreach; legal and regulatory assistance; training; technical support, including the procurement of hardware, software and safeguards equipment; and expert assistance to personnel of State systems of accounting for and control of nuclear material and/or State or regional authorities responsible for safeguards implementation.

68. Seven States have been selected to join the COMPASS pilot phase through to 2022: Guatemala, Jordan, Malaysia, Rwanda, Saudi Arabia, Turkey and Uzbekistan. In order to match the identified needs of State systems of accounting for and control of nuclear material and/or States or regional authorities responsible for safeguards implementation and available support, an active consultation mechanism has secured the engagement of Member State Support Programmes that have agreed to provide financial and/or in-kind contributions to COMPASS. In-kind support coordinated by IAEA has already allowed supporting member States to share their experience, knowledge and skills on relevant topics through a number of events and services, including workshops and peer reviews, while further activities are planned for the remainder of the pilot phase (including technical visits and other consultation mechanisms). The costs associated with the implementation of COMPASS are covered mainly through the use of extrabudgetary resources.

69. The practical day-to-day implementation of safeguards for a State works best when it is conducted as a cooperative effort between IAEA and the State. A number of States have taken actions to enhance safeguards implementation. Examples of such actions include: hosting regional and international training courses; providing IAEA with early design concepts to assist in developing safeguards approaches for emerging nuclear fuel cycle technologies; performing national inspections at facilities and locations outside facilities; validating operators data and ensuring the quality of records, reports and declarations prior to submitting information to IAEA; making facilities available for training IAEA staff and for Member State training; and providing experts to facilitate and lecture at workshops and training courses.

70. IAEA has continued to assist State or regional authorities responsible for safeguards implementation in enhancing their effectiveness by providing advisory services and training and by publishing guidance documents addressing all aspects of safeguards implementation. IAEA has also continued to enhance the safeguards content of its website, providing State or regional authorities responsible for safeguards implementation and others with access to publications, as well as safeguards-related videos, guidance and reference documents, forms and templates. It has promoted an improved information technology environment for States to prepare and submit reports and declarations to IAEA.

Advisory services

71. The IAEA State System of Accounting for and Control of Nuclear Material Advisory Service provides States, at their request, with advice and recommendations on the establishment and strengthening of their State systems of accounting for and

control of nuclear material, based on in-depth evaluation of the national legislation and regulatory system related to safeguards, and national good practices. These Advisory Service missions involve a preparatory meeting followed by a mission, and result in a confidential report to the State with detailed recommendations on how any shortcomings identified in the performance of the respective State System could be rectified and/or further cooperation with IAEA could be implemented to enhance the effective and efficient implementation of IAEA safeguards. Between 2015 and June 2021, a total of five Advisory Service missions were conducted.

Training for member States

72. IAEA training activities play a vital role in building up sustainable knowledge and skills among professionals working at State or regional authorities responsible for safeguards implementation and in enhancing cooperation between the State and IAEA. To assist States in building capacity for implementing their safeguards obligations, since 2015 IAEA has conducted over 65 international, regional and national training courses for those responsible for overseeing and implementing the State and regional systems of accounting for and control of nuclear material. Altogether, more than 1,400 participants from over 135 countries have been trained on safeguards-related topics. IAEA also participated in other training activities organized by member States on a bilateral basis. In order to broaden access to safeguards-related learning opportunities, IAEA launched the safeguards e-learning site,¹⁷ integrating additional e-learning self-study modules. Over 800 users enrolled in the basic training course on IAEA safeguards and 400 in the basic concepts of nuclear material accounting in facilities course. Over 110 States have been reached via this e-learning platform.

73. Since 2015, IAEA has also organized four 10-month safeguards traineeship programmes, training a total of 27 young graduates and junior professionals from 24 different developing countries in order to prepare them for employment in their home countries in the peaceful use of atomic energy, as well as to increase the number of qualified candidates from developing countries for possible hire as safeguards inspectors, either by IAEA or by their national nuclear-related organizations. Since 2020, the traineeship programme has been offered annually.

Guidance documents

74. Guidance documents available on the IAEA website¹⁸ provide States with access to a wide variety of safeguards guidance, forms, templates and other reference documents in the area of the general implementation of IAEA safeguards and the implementation of comprehensive safeguards agreements, small quantities protocols and additional protocols. Since 2015, four guides on safeguards implementation have been published.¹⁹

7. Dialogue with States on safeguards matters

75. To engage in open and active dialogue with States on safeguards matters, IAEA has held technical meetings, briefings and seminars, in addition to its regular consultations. Since 2015, IAEA held eight educational seminars to familiarize new

¹⁷ The Agency's learning management system is available at <https://elearning.iaea.org>.

¹⁸ www.iaea.org/topics/assistance-for-states/guidance-documents.

¹⁹ IAEA, *Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols*, Service Series, No. 21 (Vienna, 2016); IAEA, *Safeguards Implementation Practices Guide on Provision of Information to the IAEA*, Service Series, No. 33 (Vienna, 2016); IAEA, *Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure*, Service Series, No. 31 (Vienna, 2018); and IAEA, *Safeguards Implementation Guide for States with Small Quantities Protocols*, Service Series, No. 22 (Vienna, 2016).

Vienna-based diplomats with IAEA safeguards and 12 technical meetings on safeguards implementation. The technical meetings covered a range of topics, including processes for and progress made in the development and updating of State-level safeguards approaches, the Modernization of Safeguards Information Technology project, the role of State systems of accounting for and control of nuclear material, the use of innovative safeguards technologies and safeguards implementation for States with small quantities protocols.

Safeguards symposium

76. In 2018, IAEA held its thirteenth Symposium on International Safeguards. The Symposium, held under the theme of *Building Future Safeguards Capabilities*, focused on identifying innovative technologies; strengthening partnerships; and improving the day-to-day work of safeguards implementation. More than 90 individuals from developing countries received travel support to attend the event, resulting in improved geographical diversity in the more than 800 participants from 90 States, in comparison with 54 States at the previous symposium in 2014. More than 42 per cent of the participants came from regions outside of Europe and North America (compared with 20 per cent in 2014) and 29 per cent were women (compared with 20 per cent in 2014). Some ideas for potential action related to innovation, partnering and improving communication and collaboration among States, industry, academia, non-governmental organizations and IAEA have been presented in a report.²⁰

77. In 2021, IAEA launched preparations for the next symposium, to be held from 31 October to 4 November 2022, providing an opportunity to reflect on 50 years since the conclusion of the first comprehensive safeguards agreement based on INFCIRC/153 (Corr.) and 25 years since the Board of Governors approved the Model Additional Protocol (INFCIRC/540 Corr.) and to consider the future ahead.

8. Preparing for the future

Strategic planning

78. IAEA has continued to carry out strategic foresight and planning activities to ensure that safeguards implementation will continue to be effective, efficient and resilient. This contributes towards addressing the increasing workload and static resources; anticipating and responding to new demands; keeping up with technology and innovation; and sustaining the safeguards workforce and institutional knowledge. Such planning also facilitates cooperation with member States. IAEA continued to develop and implement its strategic planning processes and tools for safeguards, making them more responsive and resilient to changes in the operating environment and enhancing strategy implementation, including the monitoring of progress and results.

79. In 2018, IAEA issued its “Research and development plan: enhancing capabilities for Nuclear Verification”, which outlined the capabilities that the Secretariat wishes to develop, and for which Member State research and development support is required. To that end, in 2017, the Department organized a workshop on emerging technologies to increase its awareness about and preparedness for addressing emerging technologies (nuclear and non-nuclear), learning from experts in such domains as data science, advanced nuclear fuel cycles and technologies, lasers and additive manufacturing. In 2020, a follow-on workshop on emerging technologies was held to focus on specific challenges, including improving the verification of spent fuel, and opportunities such as applying artificial intelligence or machine learning to

²⁰ www.iaea.org/sites/default/files/19/07/cn-267-symposium-report.pdf.

certain safeguards activities. The Department published reports summarizing the key takeaways from both workshops.²¹ Through its well-established coordination of the Member States Support Programmes, IAEA also developed and implemented the *Development and Implementation Support Programmes for Nuclear Verification* 2016–2017 and 2018–2019, and issued the 2020–2021 document.

Traditional and non-traditional partnerships

80. IAEA safeguards development and implementation support needs could not be met without the transfer of technology, funds and expertise provided by member States. Member States have continued to make substantial contributions (in cash and in kind) to IAEA safeguards through Member State Support Programmes. Today, IAEA is supported by 21 Member State Support Programmes participating in some 300 active tasks. IAEA relies on the unique type of assistance that the Programmes can provide, such as national laboratories to develop equipment for safeguards, facilities for training inspectors and laboratories for conducting independent analyses. Member State Support Programmes remain the principal vehicle through which IAEA achieves its safeguards-related research and development objectives. During the reporting period, IAEA also began strengthening partnerships with non-traditional entities and in 2021 concluded its first partnership framework agreements.

9. Management and resources

81. Over the past years, the general trend of increasing safeguards responsibilities has persisted: since 2015, the number of nuclear facilities and locations outside facilities under safeguards and the quantity of nuclear material under safeguards has increased. IAEA today is implementing safeguards in over 1,300 facilities, spending some 13,000 calendar days in the field carrying out inspections and other verification activities. It applies safeguards to nuclear material equivalent to over 220,000 significant quantities, as compared with some 200,000 in 2015.

Financial resources

82. While the IAEA workload continues to grow steadily, its resources have not increased commensurately. The financial resources allocated to the Nuclear Verification Programme in 2020 amounted to some €145 million from the regular budget and some €27 million from extrabudgetary contributions, both reduced from prior-year levels and resulting in cuts in staff posts for 2022–2023. IAEA has continued to be heavily focused on increasing its efforts in pursuing more efficient and effective ways of implementing safeguards.

83. Efficiency measures have been identified and applied in the areas related to verification activities in the field, upgrading/replacement of equipment and technology, changing to low maintenance engineering solutions, streamlining and optimization of organizational management processes and continuous implementation of a quality management system. For instance, IAEA finalized the Next Generation Surveillance System replacement campaign. IAEA also combined verification activities with installation of equipment in the field that has in turn resulted in reductions in travel costs and more efficient optimization of human resources. New information technology tools have been introduced which have resulted in improved staff access to information and facilitated reporting on verification activities and State evaluation. The Modernization of Safeguards Information Technology project was finalized, and the improved information

²¹ The reports are available at www.iaea.org/topics/safeguards-implementation/emerging-technologies-workshop.

technology systems and processes significantly contribute to effectiveness and efficiency.

Safeguards workforce

84. To maintain a workforce capable of meeting current and future needs, IAEA continually develops the knowledge and skills of its staff involved in safeguards activities through the delivery of an up-to-date training programme. In line with the IAEA Gender Equality Policy, the Department of Safeguards has sought to strengthen efforts to promote both gender parity in its staff and gender mainstreaming considerations in relevant programmatic activities. As at June 2021, women represented 26 per cent of the staff in the Professional and higher categories. Of the new inspector hires in 2020, 75 per cent were women.

85. Since 2015, it has held between 110 to 170 training courses per year to achieve the technical and behavioural competencies of the staff in the Department of Safeguards (inspectors, analysts, staff from technical divisions) needed to ensure that safeguards activities are carried out in an effective manner. Each year, it has held an introductory course on IAEA Safeguards for a new generation of IAEA inspectors, training a total of 124 new inspectors as at the end of September 2021. In 2018, a record of 46 new inspectors completed the course.

86. The global restrictions imposed by the COVID-19 pandemic significantly affected the IAEA training programme in 2020 and beyond. Most training had to be redesigned and adjusted to mitigate risks, and a number of courses were transitioned to an online format. The ability to conduct courses at facilities, which is essential for the qualification of new inspectors, was significantly reduced.

87. Additional training was provided at short notice to support verification in the Islamic Republic of Iran, to provide specialized training for potential inspectors identified for verification activities in the Democratic People's Republic of Korea, and to address other training needs across the Department, in response to the needs of States.

88. Support from member States has been essential to the training of IAEA safeguards staff, particularly in hosting courses involving practical exercises requiring nuclear facilities and/or nuclear material, and in supporting the development of new training tools such as virtual reality environments for facility and process familiarization, training manuals and e-learning modules and training.

Quality management and performance measurement

89. IAEA has continued to undertake activities to strengthen and improve its rigorous and comprehensive quality management system for safeguards. The system helps to ensure that all safeguards activities are performed consistently, objectively and effectively. Since 2015, IAEA has, inter alia, assessed the maturity of its quality management system; updated its policy on quality; controlled documents; introduced new procedures; strengthened functional alignment between information technology applications and safeguards processes; conducted internal audits; and conducted outreach to raise staff awareness. In addition to the quality management system, IAEA continued its initiative to identify and select safeguards key performance indicators for pilot testing, to assess more effectively its activities and their results and to monitor trends. The cost calculation methodology, which is used to estimate the cost of safeguards implementation by States, was peer reviewed and refined.

Information security

90. Information security continues to be a priority, and is of vital importance, given the sensitivity of the information in Agency's custody. The information security environment is constantly changing, and threats and cyberattacks have become more frequent, diverse and complex. Safeguards information is protected using a layered approach involving physical protection, policy and procedures, technical controls and security awareness.

91. IAEA has made significant advances in each of these areas since 2015. IAEA has reviewed related policies, procedures and practices; conducted quality audits on and updated and trained staff on procedures for the classification and handling of all safeguards information; issued a new policy defining the principles for authorizing staff access to safeguards information assets; launched an authorization management system to manage staff access to information; created a new security event management platform; conducted security assessments and security awareness campaigns; strengthened defences against targeted cyber intrusion; and organized mandatory refresher security and classification e-learning courses. In 2018, IAEA consolidated its information security activities into a coordinated programme, with better strategy in alignment with ISO 27000 and the United Nations security framework. A pilot project was initiated in 2020 to assess physical security technologies and techniques to ensure the effectiveness and efficiency of the Department of Safeguards physical security management system.

10. Conclusion

92. The previous Review Conferences reaffirmed that IAEA is the competent authority responsible for verifying and assuring States parties' compliance with their safeguards agreements. IAEA has continued to function as such, implementing safeguards and drawing and reporting safeguards conclusions. Since 2015, safeguards have been strengthened and their implementation has further evolved in order for IAEA to continue to fulfil its verification mandate effectively under article III of the Non-Proliferation Treaty.

93. By the end of October 2021, five additional States parties to the Non-Proliferation Treaty brought into force comprehensive safeguards agreements; 13 States parties brought into force additional protocols; 18 States parties accepted the revised small quantities protocol text and another five States parties rescinded their small quantities protocols, thereby enabling IAEA to apply safeguards and draw and report safeguards conclusions for a higher number of States.

94. In January 2016, following the agreement on JCPOA and the Board's authorization, IAEA began verifying and monitoring the implementation by the Islamic Republic of Iran of its nuclear-related commitments as set out in JCPOA, in accordance with the modalities set out in JCPOA and consistent with IAEA's standard safeguards practices. From 8 May 2019 and following the announcement by the United States on 8 May 2018 regarding JCPOA, the Islamic Republic of Iran began reducing its nuclear-related commitments on a step-by-step basis. Since 23 February 2021, IAEA verification and monitoring activities in relation to JCPOA have been seriously undermined as a result of the decision by the Islamic Republic of Iran to stop the implementation of its nuclear-related commitments under JCPOA, including the Additional Protocol

95. The lack of progress in clarifying the questions of IAEA concerning the correctness and completeness of the safeguards declarations of the Islamic Republic of Iran has seriously affected the ability of IAEA to provide assurance of the peaceful nature of the country's nuclear programme. The Director General has called upon the

Islamic Republic of Iran to fulfil all of its legal obligations under the Subsidiary Arrangements to its Safeguards Agreement and fully implement modified Code 3.1.

96. Since 2009, IAEA has not been able to implement any safeguards measures in the Democratic People's Republic of Korea but has continued to monitor the nuclear activities of the country and evaluate all safeguards-relevant information available to it, and to enhance its operational readiness to resume safeguards implementation.

97. In 2021, the Director General once again informed the Board of Governors that no new information had come to the knowledge of IAEA that would have an impact on its 2011 assessment about the building destroyed at the Dair Alzour site, and urged the Syrian Arab Republic to cooperate fully with IAEA in connection with the unresolved issues. The Syrian Arab Republic has yet to respond to these calls.

98. IAEA has progressively developed and implemented State-level safeguards approaches. State-level safeguards approaches have been developed for 133 States with a comprehensive safeguards agreement in force.²² These 133 States hold 97 per cent of all nuclear material (by significant quantity) under IAEA safeguards. The experience gained and lessons learned in developing and implementing State-level safeguards approaches has been analysed and reported by the Director General to IAEA Board of Governors, and IAEA continues to keep States informed.

99. The implementation of safeguards has also evolved through, for example, the further development and implementation of enhanced safeguards approaches for existing facilities and spent fuel verification and the increased use of remote data transmission and unattended monitoring systems. New approaches have been developed for new types of facilities, such as geological repositories. Guidance to support States and the nuclear industry in considering safeguards from the initial planning stages of nuclear facilities was issued. IAEA has also improved the processes, tools and workflows for collecting, processing and analysing safeguards-relevant information.

100. Two major modernization projects have been completed: the capabilities of the Safeguards Analytical Laboratories were enhanced, enabling IAEA to conduct sample analysis in safe, secure and modern facilities, and the Modernization of Safeguards Information Technology project, which enhanced existing tools and software applications, introduced new information technology tools and software applications and strengthened information security.

101. IAEA has been working to improve cooperation with States and regional authorities responsible for safeguards. The COMPASS project was launched, providing in-depth and targeted assistance to seven States. International, regional and national training courses have been held online and in person for some 1,400 participants from over 110 States.

102. To engage in dialogue with States, IAEA has held a series of meetings, briefings and seminars with member States to discuss safeguards matters. The thirteenth Symposium on International Safeguards was held in 2018 to identify innovative technologies, strengthen partnerships and improve day-to-day safeguards implementation.

103. To facilitate preparedness for the future, IAEA has continued to enhance strategic foresight and planning and partnered with Member State Support Programmes and non-traditional partners to address safeguards-related research and development and other support needs. It issued a new Research and Development

²² As at 30 June 2021.

Plan and held two workshops on emerging technologies to prepare for associated challenges and opportunities in the field of safeguards.

104. All these efforts have strengthened the effectiveness and improved the efficiency of safeguards, at a time when the IAEA workload continues to grow steadily but its resources are not increasing commensurately. The gap between workload and resources has widened in the past five years. Concurrently, IAEA was faced with significant challenges associated with COVID-19, but implemented measures enabling it to carry out necessary safeguards activities and draw soundly based conclusions for all States with safeguards agreements in force. IAEA has been enhancing its resilience, drawing upon its business continuity and disaster recovery plans and benefiting from unattended systems and remote data transmission. Management activities have focused on enhancing its workforce, strengthening quality management, improving information security and ensuring staff health and safety, as well as business continuity.

105. IAEA will continue to seek ways to improve effectiveness and efficiency by optimizing processes, by making better use of modern technology and by enhancing assistance to and cooperation with State or regional authorities responsible for safeguards implementation in the implementation of safeguards, and by strengthening partnerships at large. Continued success will require States' political, technical and financial support.
