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Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards

Report by the Director General

A. Introduction

1. The General Conference, in resolution GC(60)/RES/13 entitled 'Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards', requested the Director General to report on the implementation of the resolution to the General Conference at its sixty-first (2017) regular session. This report responds to that request and updates the information in last year's report to the General Conference (document GC(60)/13).[1]

B. Safeguards Agreements and Additional Protocols

B.1. Conclusion and Entry into Force of Safeguards Agreements and Additional Protocols

2. An additional protocol (AP) based on the Model Additional Protocol[2] entered into force for one State.[3] One State[4] acceded to the safeguards agreement between the non-nuclear-weapon States of

[1] This report covers the period between 1 July 2016 and 30 June 2017.

[2] The text of the Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards is contained in document INFCIRC/540 (Corrected).

[3] Cameroon.

[4] Croatia.

EURATOM, EURATOM and the Agency, and to the protocol additional thereto. An INFCIRC/66/Rev.2-type agreement was signed and entered into force for one State.[5] During the same period, a small quantities protocol (SQP) was amended for one State,[6] in keeping with the Board of Governors' decision of 20 September 2005 regarding such protocols. By the end of June 2017, 56 States had operative SQPs in force based on the revised standard text.

3. As of 30 June 2017, 182 States[7] had safeguards agreements in force with the Agency, 129 of which (including 123 States with comprehensive safeguards agreements (CSAs)) also had APs in force. As of the same date, 53 States had yet to bring into force APs to their safeguards agreements.

4. Twelve States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[8,9] have yet to bring CSAs into force pursuant to Article III of the Treaty.

5. The latest update of the status of safeguards agreements and APs is published on the Agency's website.[10]

B.2. Promotion and Assistance in the Conclusion of Safeguards Agreements and Additional Protocols

6. The Agency has continued to implement elements of the plan of action outlined in resolution GC(44)/RES/19 and in the Agency's updated *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*.[11]Among the elements of the plan of action proposed in resolution GC(44)/RES/19 are:

- Intensified efforts by the Director General to conclude safeguards agreements and APs, especially with those States which have significant nuclear activities;
- Assistance by the Agency and Member States to other States on how to conclude and implement safeguards agreements and APs; and
- Reinforced coordination between Member States and the Secretariat in their efforts to promote the conclusion of safeguards agreements and APs.

7. Guided by the relevant resolutions and decision[12] of the General Conference and decisions of the Board of Governors, and the Agency's updated plan of action and *Medium Term Strategy 2012-2017*,[13] the Agency has continued to encourage and facilitate wider adherence to safeguards agreements and APs, primarily using extrabudgetary funds. The Agency organized national events for

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[5] Islamic Republic of Pakistan.

[6] Saint Kitts and Nevis.

[7] And Taiwan, China.

[8] The designations employed and the presentation of material in this section, including the numbers cited, do not imply the expression of any opinion whatsoever on the part of the Agency or its Member States concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

[9] The referenced number of States Parties to the NPT is based on the number of instruments of ratification, accession or succession that have been deposited.

[10] See: https://www.iaea.org/sites/default/files/17/07/sg_agreements_comprehensive_status_list.pdf.

[11] The plan of action is available on the Agency's website: https://www.iaea.org/sites/default/files/16/09/plan-of-action-2015-2016.pdf

[12] GC(58)/RES/14.

[13] The *Medium Term Strategy 2012–2017* is available at: http://www.iaea.org/about/mts.

Sudan (Khartoum, 17-18 April 2017) and Ethiopia (Addis Ababa, 20-21 April 2017) at which the Agency encouraged these States to conclude APs and to amend their SQPs. In addition, the Agency held consultations with representatives from a number of Member and non-Member States in Dakar, Geneva, New York and Vienna during the reporting period.

C. Implementation of Safeguards

C.1. Updating and Developing State-Level Safeguards Approaches

8. General Conference resolution GC(60)/RES/13, *inter alia*, welcomed the clarifications and additional information provided in the *Supplementary Document to the Report on The Conceptualization and Development of Safeguards Implementation at the State Level (GOV/2013/38)*, and the important assurances provided therein and in the statements by the Director General and the Secretariat, as noted by the Board of Governors at its September 2014 meetings.

9. To ensure consistency and non-discrimination in the implementation of safeguards, the Department of Safeguards has continued to improve internal work practices, procedures and guidance, including on conducting acquisition path analysis, developing State-level safeguards approaches (SLAs) and consulting with States and/or regional authorities. In the course of developing, updating and implementing an SLA, the Secretariat consults with the State concerned and regional authority where relevant, particularly on the implementation of in-field safeguards measures. During the reporting period, such consultations took the form of bilateral meetings, e-mail exchanges, letters and discussions held during verification activities.

10. During 2016, the Department of Safeguards completed updating SLAs for the remaining States in the original group of 53 that were already under integrated safeguards at the start of 2015. As of the end of June 2017, SLAs had been approved for implementation for 61 States with a CSA and an AP in force, and a broader conclusion; seven States with a CSA and an AP in force but without a broader conclusion; and one State with a voluntary offer agreement and an AP in force. The Department continues to develop SLAs for all other States with safeguards agreements in force.

11. The Department of Safeguards has begun to collect information on the lessons learned and experience gained in updating and implementing the SLAs in preparation for reporting to the Board of Governors in mid-2018.

C.2. Dialogue with States on Safeguards Matters

12. The Secretariat has continued to engage in open and active dialogue with States on safeguards matters.

13. On 10 November 2016, the Secretariat held a Technical Meeting on Safeguards Implementation focussing on progress made in the Department of Safeguards' Modernizing Safeguards Information Technology (MOSAIC) project.

14. To familiarize new Vienna-based diplomats with IAEA safeguards, the Secretariat held seminars in October 2016 and February 2017, at which it presented the legal framework for IAEA safeguards; safeguards dimensions of the nuclear fuel cycle; core safeguards implementation processes; the resources and assistance available to States for capacity building in safeguards; and an overview of the structure and content of the annual Safeguards Implementation Report (SIR). During

the 2016 General Conference, the Department of Safeguards offered tours of the safeguards equipment laboratories, and distributed safeguards guidance and informational materials at its exhibit.

15. The Agency organized a safeguards side event in the margins of the First Session of the Preparatory Committee for the 2020 Review Conference of the Parties to the NPT, held in Vienna from 2–12 May 2017. The event featured a presentation on *21st Century Safeguards: Challenges and Opportunities* by the Deputy Director General for Safeguards, followed by demonstrations of three technologies recently developed by the Department of Safeguards. The event attracted more than 160 participants.

C.3. Strengthening Safeguards Implementation in the Field

16. The Agency has continued to seek improvements to the effectiveness and efficiency of safeguards implementation in the field. For example, the Agency: tested a laser mapping technique for containment verification at spent fuel dry storage facilities in Argentina and Canada; made better use of safeguards equipment in monitoring transfers of waste containing nuclear material to new storage facilities in Canada; achieved efficiencies in its verification activities in the Republic of Korea (ROK) by implementing new procedures involving the movement of surveillance cameras between facilities in the country; and began pilot testing a new barcode scanner for recording and tracking Agency equipment deployed in nuclear facilities and other locations outside Headquarters.

17. The Agency has continued to develop new safeguards approaches. Safeguards approaches were completed for the verification of spent fuel transfers in Germany and Lithuania, including the use of remote transmission and processing of data from unattended safeguards systems installed at the relevant facilities in those countries. A safeguards approach for verifying transfers of spent fuel to dry storage in Mexico is being developed, which will allow a reduction in inspector presence during the transfers without compromising effectiveness. The Agency developed arrangements with Argentina and Brazil for conducting short-notice randomized inspections (SNRIs) at fuel fabrication plants in those countries, taking into account past experience. The Agency and Ukraine finalized arrangements that enabled the Agency to carry out unannounced inspections at all operating nuclear facilities in Ukraine. The Agency and Kazakhstan agreed on the incorporation of containment and surveillance measures during the design phase of the storage facility for the IAEA Fuel Bank, which is now under construction, and have continued to negotiate practical arrangements that will enable the Agency to carry out unannounced and short-notice inspections at nuclear facilities in Kazakhstan.

18. The Agency is developing an approach to safeguard the nuclear material to be contained in the new safe confinement of the Chernobyl nuclear power plant (NPP), which is scheduled to be installed over the damaged Reactor Unit 4 in November 2017. Installation of two parts of the new safe confinement arch was completed in November 2016. For Reactor Units 1–3, the Agency completed the development of a safeguards approach for the irradiated fuel to be transferred from wet storage to interim dry storage starting in 2017.

19. Nuclear material inaccessible for verification remains in damaged Reactor Units 1–3 at the Fukushima Daiichi site in Japan. Surveillance systems and neutron-gamma monitoring systems have been installed at the site to ensure that nuclear material cannot be removed from the damaged reactors without the Agency's knowledge. The data from these systems are now being transmitted remotely to the Agency's offices in Tokyo, thereby increasing the efficiency of Agency monitoring activities. The Agency also conducted a variety of short-notice inspections at the site to confirm the absence of any undeclared movements of nuclear material.

20. The Agency has continued to prepare for implementing safeguards at new facility types, such as encapsulation plants, geological repositories and pyroprocessing plants. For example, the Agency, Finland, Sweden and the European Commission (EC) have continued to cooperate closely in the

planning of safeguards implementation at encapsulation plants and geological repositories in Finland and Sweden. Ground breaking for the encapsulation plant in Finland occurred in 2016. The Application of Safeguards to Geological Repositories (ASTOR) expert group, which was established by the Agency, met in Japan in April 2017 to finalize a report on technologies potentially useful for applying safeguards to geological repositories, which will be published later in 2017. The Agency and the ROK have cooperated closely on planning for safeguards implementation at future pyroprocessing plants, including through dialogue on safeguards measures to be identified in the early design stages of the plants. These discussions are informing the development of the Agency's approach to applying safeguards at this new type of facility.

21. The Agency is developing guidance documents aimed at enhancing the understanding of nuclear facility vendors and designers regarding safeguards needs and at encouraging the consideration of safeguards measures in the design and construction of nuclear facilities. In June 2017, the Agency published the new Guide, *International Safeguards in the Design of Fuel Fabrication Plants* (IAEA NE Series No. NF-T-4.7). Five additional facility-specific guides are in various stages of publication in the Agency's Nuclear Energy Series. Through the International Project on Innovative Nuclear Reactors and Fuel Cycles and the Generation IV International Forum, the Agency has continued to develop tools to simplify and enhance assessments of proliferation resistance, and provided information about the consideration of safeguards in the design and construction of nuclear facilities to States that are interested in beginning nuclear power programmes.

C.4. Information Technology

22. Information technology (IT) plays an increasingly important role in the implementation of Agency safeguards. Since last year's report, the Agency has continued upgrading and optimizing the IT infrastructure in the Department of Safeguards, under the MOSAIC project. During this period, the functionality of all the IT tools and software applications that were migrated from the mainframe computer to the new safeguards IT platform has been enhanced. The benefits of these enhancements include: improved processing of State reports and declarations; enhanced accessibility of staff to safeguards data; the introduction of applications that are easier for inspectors to use during field activities; improved tools to review Additional Protocol declarations; and enhanced protection of the IT system against cyberattacks and other information security threats.

23. The management and implementation of the MOSAIC project is being conducted in close cooperation between developers and users. Experienced users have been assigned as product owners within MOSAIC teams, and acceptance tests, monthly forums and other events are being used to incorporate user feedback throughout the development process. Furthermore, strengthened programme management controls have continued to be used to ensure the delivery of the products on schedule and within budget. Activities under MOSAIC are proceeding according to plan with completion of all deliverables scheduled for 15 May 2018 as described in the report to the Board of Governors *Modernization of Safeguards Information Technology* (GOV/INF/2017/8).

C.5. Information Analysis

24. In order to draw soundly-based safeguards conclusions, the Agency evaluates all safeguards-relevant information, including declarations and reports submitted by States, data generated from its own verification activities in the field and at Headquarters, and other information available to it. Throughout the reporting period, the Agency enhanced its capabilities to acquire and process data, and to analyse and evaluate information in relation to the State evaluation process and the drawing of safeguards conclusions. The Agency continued to make improvements to the overall performance of its information system, including within the scope of MOSAIC, by enhancing associated applications and facilitating appropriate access of staff to data.

25. In September 2016, the Agency informed States of the availability of the third version of its software, 'Protocol Reporter' or PR3. Since then, around a dozen States have prepared and submitted their AP declarations using this software. When fully implemented, AP declarations submitted using PR3 will be automatically loaded into a new dedicated software application which will enable the Agency to conduct more efficient and effective analyses of such declarations. States have been encouraged to use PR3 to prepare and submit AP declarations.

26. In May 2017, the Agency launched a new web-based system for the secure and timely exchange of safeguards information between the Department of Safeguards and States. This 'State Declarations Portal' (SDP) is part of MOSAIC. The SDP substantially increases productivity by saving time and effort in communicating with States on matters relating to the implementation of safeguards and reducing manual data entry and transcription errors. States have been encouraged to use the SDP to submit safeguards information.

27. The Agency has continued to utilize high resolution commercial satellite imagery to improve its ability to monitor nuclear facilities and sites worldwide. Imagery analysis continued to provide benefits for planning in-field verification and evaluation activities at Headquarters. Commercial satellite imagery remains a critical tool to monitor nuclear facilities and sites in States where the Agency has limited or no access. Open source and trade information continued to be routinely used by the Agency to support analysis of nuclear-related trade. A number of Member States voluntarily provided the Agency with information concerning procurement enquiries for nuclear-related products that were denied, which was used in assessing the consistency of nuclear activities declared by States to the Agency.

C.6. Analytical Services

28. The collection and analysis of nuclear material and environmental samples are essential safeguards activities. The analysis of such samples is performed at the Agency's Safeguards Analytical Laboratories (SAL) in Seibersdorf, which consist of the Nuclear Material Laboratory (NML) and the Environmental Sample Laboratory (ESL). Analyses are also performed at the other laboratories of the Agency's Network of Analytical Laboratories (NWAL) (see next paragraph).

29. In 2016, key performance indicators were introduced to monitor the efficiency of sample logistics and analysis. Timeliness of sample distribution to the NWAL continued to improve, with sample distribution time reduced by 75% over the past five years. The Agency also finalized a technical specification for a prototype 'tamper indicating enclosure', the purpose of which is to securely contain environmental samples collected from hot cells, and nuclear material samples collected for destructive analysis.

30. The NWAL currently consists of the Agency's SAL in Seibersdorf and 22 other qualified laboratories in ten Member States and the EC. NWAL expansion continues for both nuclear material analysis and environmental sample analysis. Laboratories in the following countries are undergoing

qualification for NWAL: Belgium, Canada and the Netherlands, for nuclear material analysis; Hungary, for environmental sample analysis; Argentina, for heavy water analysis; and Germany, for reference material production.

C.7. Equipment and Technology

31. Verification activities rely heavily on the use of equipment, including both equipment installed at facilities and portable equipment. Remote data transmission continued to enhance efficiency by eliminating the need for data retrieval by inspectors at facilities and enabled early detection of any deterioration in system performance. Significant efforts were dedicated to preventive maintenance and performance monitoring to ensure the reliability of Agency equipment. At present, the reliability of digital surveillance, NDA and unattended monitoring systems and active seals exceeded the target goal of 99 per cent availability. This level of reliability was achieved through preventive maintenance policies and through redundancy designed into systems and their components.

32. The Agency continued to conduct acceptance testing, installation, training and maintenance of safeguards equipment, including those authorized for joint use, in cooperation with State and regional authorities. Such cooperation also supported the field testing of new safeguards equipment. For example, the prototype passive gamma emission tomography system, which can be used to detect missing or replaced fuel rods in irradiated light water reactor (LWR) fuel assemblies, was deployed to three facilities for in-field measurement campaigns in the first quarter of 2017. These campaigns are an important step in the process of authorizing new equipment for safeguards use. Within the framework of the sealing and containment modernization programme, the Agency continued to pursue implementation of new sealing technologies and enhance the overall security of these devices.

33. Technology foresight activities aim to identify and evaluate the potential application of emerging technologies for use in verification. In late 2016, the Agency concluded an innovative crowd sourcing exercise to gather information about image processing techniques, which led to the identification of methods applicable to enhancing the quality of the Cerenkov viewing device results.

C.8. Cooperation with, and Assistance to, State and Regional Authorities

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

35. SRAs need legislative and regulatory systems to be able to exercise the necessary oversight and control functions, as well as resources and technical capabilities commensurate with the size and complexity of the State's nuclear fuel cycle. Recognizing the challenges faced by some States in establishing an effective SSAC, the Agency continued to provide assistance to strengthen their technical capabilities to implement the requirements of their safeguards agreements and APs.

36. A number of States have taken actions to enhance safeguards implementation. Examples of such actions include: hosting regional workshops to raise awareness of Agency safeguards; providing the Agency with early design concepts to assist in developing safeguards measures for emerging new nuclear fuel cycle technologies; performing national inspections at facilities and LOFs; validating operator data and assuring the quality of records, reports and declarations prior to submitting information to the Agency; making facilities available for training of Agency staff; and providing experts to facilitate and lecture at workshops and training courses.

37. In 2017, the Agency published Arabic versions of the *Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols* (IAEA Services Series No. 21) and the *Safeguards Implementation Guide for States with SQPs* (IAEA Services Series No. 22). The Agency continued to enhance the safeguards pages of its website, providing SRAs and others with access to these new publications as well as safeguards-related videos, photos, guidance and reference documents, forms and templates.

38. The IAEA SSAC Advisory Service (ISSAS) provides States, at their request, with advice and recommendations on the establishment and strengthening of their SSACs, based on an in-depth evaluation with respect to safeguards obligations, guidance and good practices. ISSAS missions provide constructive recommendations for improving the regulatory, administrative and technical elements of the SSAC and to enhance cooperation with the IAEA. Since last year's report, the Agency has conducted an ISSAS mission to Jordan.

39. The Agency has continued to provide training to personnel of SRAs as well as operators of facilities and LOFs. In a seminar organized by Denmark in August 2016, the Agency delivered presentations on the legal framework and practical implementation of safeguards with respect to Greenland. Inspectors from the Agency and from EURATOM participated in joint safeguards training in Luxembourg in October 2016. Over the past year, the Agency has conducted eleven training courses at international, regional and national levels. Three international SSAC courses were conducted — two in the ROK (for States in the Asia and Pacific region preparing to introduce nuclear power programmes) and one in the United States of America (USA).

40. Upon the request of Member States, six training courses were organized at the national level. These included: a course on safeguards implementation in Georgia; a course on nuclear material accounting and control in Indonesia; a course on safeguards by design in Jordan; a course on information management for safeguards in Nigeria; and two dedicated training workshops in Thailand and Viet Nam, to enhance the capabilities of their respective State authorities in areas such as the conducting of national inspections and implementing an AP.

41. The 2016 Safeguards Traineeship Programme, involving six participants from Cambodia, Iraq, Nigeria, Thailand, Viet Nam and Zimbabwe, concluded in November 2016. The Agency provided lecturers and conducted table top exercises to support training courses organized by Member States. Topical training courses on safeguards implementation were organized by the USA and held in Bahrain, Malaysia, Morocco, Myanmar, Senegal, the United Arab Emirates and Zambia. A regional SSAC training course was organized by and held in Japan and one international training course on Fundamentals of Nuclear Safeguards was organized by and held in the ROK. Since last year's report, safeguards-related issues were discussed with officials in Ghana, Kazakhstan and Malaysia during Agency-led Integrated Nuclear Infrastructure Review (INIR) missions. Department of Safeguards staff participated in the plenary meeting of the Asia Pacific Safeguards Network, held in Tokyo, Japan in November 2016.

C.9. Safeguards Workforce

42. Since last year's report, nine new inspectors have completed the Introductory Course on Agency Safeguards (ICAS), with modules on NDA techniques, containment and surveillance, radiation protection, design information verification, and negotiation and communication skills. The ICAS course concluded with a comprehensive inspection exercise at an LWR and the presentation of a case study. Preparations are being made for a second ICAS course to begin in October 2017.

43. Courses for safeguards staff continued to be offered on the full range of safeguards activities conducted at facilities and Agency Headquarters to develop both technical and behavioural skills. The training programme was implemented as planned and additional training was provided at short notice

to support verification in Iran and to address verification challenges at the Fukushima Daiichi site in Japan.

44. To ensure the health, safety and security of Agency staff in the field, particularly in light of elevated security levels in some locations, procedures specifying communication protocols during in-field emergencies were updated and information cards are now issued to staff. Training on radiation protection for staff in the Department of Safeguards is regularly delivered.

C.10. Quality Management

45. The Department of Safeguards continued to implement and improve its quality management system. Staff training was conducted to raise awareness of quality management, including managing and controlling documents, using the condition report system, and continual process improvement. Three internal quality audits were completed on: the integrity of the primary safeguards databases stored on the Department's internal secure environment; compliance with information security procedures; and preparations for an external certification audit at SAL. The Department of Safeguards continued to use its condition report system to identify and prevent recurrence of non-conformities and radiological and industrial safety concerns. The Department's cost calculation methodology, which is used to estimate the cost of safeguards implementation by State, was peer reviewed and refined. In the fourth quarter of 2016, a project was launched to evaluate and ensure the alignment between departmental processes and the applications being developed under the MOSAIC project.

C.11. Information Security

46. In 2016, the Department conducted an internal quality audit of its policies and procedures for proper classification and handling of all safeguards information. The audit identified areas for improvement which the Department has started addressing. Additionally, the Safeguards Access and Authorisation Management policy was launched, aimed at enhancing control of, and streamline access and associated authorisations to, all safeguards information assets. As part of MOSAIC, a new tool to streamline, manage and authorize staff access to safeguards information on a need-to-know basis will be launched in August 2017. Enhancements continue to be made through both institutional and technical measures to better protect safeguards information and equipment in the field.

47. Security awareness campaigns have continued in cooperation between the Department of Safeguards and the Chief Information Security Officer. The enhanced Information Security e-learning course was launched in 2017 and mandatory classroom training courses on information classification, handling and protection were held during the reporting period.

C.12. Safeguards Reporting

48. The Secretariat reported the safeguards conclusions for 2016 in *The Safeguards Implementation Report for 2016* (GOV/2017/23),[14] which also provided data on the number of facilities and LOFs under safeguards, the inspection effort and related cost of safeguards implementation. At its June 2017 meeting, the Board of Governors took note of the report and authorized the release of the Safeguards Statement for 2016 and of the Background to the Safeguards Statement and Summary.

[14] The Safeguards Statement for 2016 and the Background to the Safeguards Statement and Summary of *The Safeguards Implementation Report for 2016* are published on the Agency's website at: https://www.iaea.org/sites/default/files/sir_2016_statement.pdf.

C.13. Strategic Planning

49. The Secretariat carries out strategic planning to ensure that safeguards implementation will continue to be both effective and efficient. To this end, the Department of Safeguards conducts long-, medium-, and short-term planning to ensure that its processes and technical capabilities (e.g. equipment and infrastructure) remain fit-for-purpose and its human and financial resources are sufficient to carry out its work. Such planning also facilitates communication and cooperation with Member States. In 2016, the Department of Safeguards adapted its strategic planning processes to make them more responsive to changes in the operating environment and updated its strategic plan.

50. The Department continued to implement its *Long-Term R&D Plan 2012–2023*, with assistance from Member State Support Programmes, and initiated an update of this document to take into account new technological challenges and opportunities. To this end, in February 2017, the Department organized an Emerging Technologies Workshop to increase its awareness about and preparedness for addressing emerging technologies (nuclear and non-nuclear) expected to have an impact on the work of the Department, learning from experts in such domains as data science, advanced nuclear fuel cycles and technologies, lasers and additive manufacturing.