

General Conference

GC(68)/9

General Distribution
Original: English

Sixty-eighth regular session

STRENGTHENING THE EFFECTIVENESS AND IMPROVING THE EFFICIENCY OF AGENCY SAFEGUARDS

Report by the Director General

General Conference

GC(68)/9

Date: 19 July 2024

General Distribution

Original: English

Sixty-eighth regular session

Item 17 of the provisional agenda

(GC(68)/1 and Add.1)

Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards

Report by the Director General

A. Introduction

1. The General Conference, in resolution GC(67)/RES/11 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 68th regular session. This report responds to that request and updates the information in last year’s report to the General Conference (document GC(67)/16).¹

¹ This report covers the period between 1 July 2023 and 30 June 2024.

B. Safeguards Agreements and Additional Protocols

B.1 Conclusion and Entry into Force of Safeguards Agreements and Additional Protocols²

2. Between 1 July 2023 and 30 June 2024, an additional protocol (AP) entered into force for the Plurinational State of Bolivia. Another AP was approved by the Board of Governors for Nauru. Small quantities protocols (SQPs) based on the original standard text were amended for Fiji, Nauru and Sierra Leone, in keeping with the Board of Governors' decision of September 2005 regarding such protocols. In addition, an SQP was rescinded for the Plurinational State of Bolivia.

3. As of 30 June 2024, 190 States^{3,4} had safeguards agreements in force with the Agency, 142 of which (including 136 States with comprehensive safeguards agreements (CSAs)) also had an AP in force. Forty-eight States had yet to bring into force APs to their safeguards agreements. As of 30 June 2024, 81 States⁵ with CSAs had an operative SQP in force based on the revised standard text, and 18 States⁶ with CSAs had an operative SQP in force based on the original standard text.⁷

4. Four non-nuclear-weapon States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)⁸ have yet to bring CSAs into force pursuant to Article III of the Treaty.

5. Safeguards were also implemented with regard to declared nuclear material in selected facilities in the five nuclear-weapon States under their respective voluntary offer agreements, each of which has an AP in force. The Agency implemented safeguards in facilities in three States pursuant to item-specific safeguards agreements based on INFCIRC/66/Rev.2, one of which has an AP in force.

As of 30 June 2024,

190 States^{3,4}
had safeguards
agreements in force with
the Agency,

of which
142 States

(including 136 States
with CSAs)
also had an AP in force.



² GC(67)/RES/11, OP 17.

³ And Taiwan, China.

⁴ The designations employed and the presentation of material in this report, 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.

⁵ This number does not include two operative SQPs reproduced in INFCIRC/718/Mod.1 and INFCIRC/366/Mod.1, respectively.

⁶ This number does not include one operative SQP reproduced in INFCIRC/229.

⁷ For States with a CSA in force with an operative SQP based on the original standard text, the Agency's ability to draw a credible and soundly-based annual safeguards conclusion is significantly affected. This is due, inter alia, to the fact that the original standard text of the SQP holds in abeyance the requirement for these States to provide to the Agency an initial report on all nuclear material as well as the Agency's right to perform verification activities in these States. In light of such limitations, and given the significant lapse of time since the decision of the Board of Governors in 2005 authorizing the Director General to conclude with each State with an SQP based on the original standard text an exchange of letters giving effect to the revised standardized text and the modified criteria, the Agency will no longer be able to continue to draw a safeguards conclusion for such States.

⁸ 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.

Between 1 July 2023 and 30 June 2024, SQPs based on the original standard text were amended or rescinded for

4 States

As of 30 June 2024,

81 States⁵

had an operative SQP in force based on the revised standard text, and

18 States⁶

had an operative SQP in force based on the original standard text.⁷



6. The latest status of safeguards agreements and APs is published on the Agency's website.⁹

B.2. Promotion and Assistance in the Conclusion of Safeguards Agreements and Additional Protocols¹⁰

7. 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 having substantial nuclear activities under their jurisdiction;
- Assistance by the Agency and Member States to other States by providing the knowledge and technical expertise necessary 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.

8. Pursuant to the guidance of the Agency's Policy-Making Organs and the Agency's updated plan of action, the Agency has continued to encourage and facilitate wider adherence to safeguards agreements and APs, and amendment and rescission of SQPs. The Agency also held consultations with representatives from a number of Member and non-Member States in Geneva, New York and Vienna.

C. Implementation of Safeguards

C.1. The Development and Implementation of State-Level Safeguards Approaches¹²

9. The Agency has progressively developed and implemented State-level safeguards approaches (SLAs) as set out in the *Supplementary Document to the Report on The Conceptualization and Development of Safeguards Implementation at the State Level (GOV/2013/38)* (document GOV/2014/41 and Corr. 1 – also known as the 'Supplementary Document'). The development and implementation of

⁹ <https://www.iaea.org/sites/default/files/20/01/sg-agreements-comprehensive-status.pdf>

¹⁰ GC(67)/RES/11, OP 17 and 18.

¹¹ The plan of action is available on the Agency's website at: https://www.iaea.org/sites/default/files/23/10/action_plan_1_july_2022_to_30_june_2023_final.pdf

¹² GC(67)/RES/11, OP 28, 31 and 32.

an SLA for a State enables the Agency to better focus the Agency's verification efforts on the attainment of relevant safeguards objectives for that State.

10. The Agency completed its project focused on refining the internal methodology for conducting acquisition path analyses and developing SLAs for States with a CSA and an AP in force for which the broader conclusion has been drawn. During the year, the departmental methodology for setting performance targets for technical objectives continued to be implemented through the use of a dedicated software application to support and simplify acquisition path analysis and the development of SLAs. Additionally, guidance relating to the updated methodology was completed and refinements relating to the optimization of the verification activities at facilities and other locations under safeguards in the State were developed for increased efficiency. Application of the updated guidance, and the enhanced software tools confirmed their benefits in further improving the consistency of acquisition path analysis and SLA development.

11. During the improvement project, internal standards and procedures for analysing acquisition paths and developing SLAs were strengthened. This included defining a standard methodology for assessing the time required for a State to develop new nuclear fuel cycle capabilities, standard assumptions regarding the capacity of possible undeclared facilities, and a standardized methodology for time assessments relating to the potential undeclared production or processing of nuclear material at key nuclear fuel cycle facilities (reactors, enrichment plants and reprocessing capable hot cells). These standardized procedures ensure that assessments of States' nuclear fuel cycle and related technical capabilities are conducted in a rigorous and uniform manner, thus providing consistent results.

12. To further ensure consistency and non-discrimination in the development and implementation of SLAs, the Agency has continued to improve internal work practices taking into account experience gained and lessons learned in performing acquisition path analysis and the development of SLAs for States under integrated safeguards. These refinements of the SLA development process improve the link between the planning and implementation of safeguards activities and the State evaluation process, and increase consistency in the development of SLAs for States with a broader conclusion.

13. Based on the refined methodology, as of 30 June 2024, the Agency has developed or updated SLAs for 30 States with the broader conclusion. This brings the total number of States with a CSA in force for which an SLA has been developed to 135. These 135 States hold 97% of all nuclear material (by significant quantity) under Agency safeguards in States with a CSA in force. These 135 States are comprised of 71 States with a CSA and an AP in force for which the broader conclusion has been drawn for 2023 (of which 18 are States with an SQP); 39 States with a CSA and an AP in force for which the broader conclusion was not drawn for 2023 (of which 26 are States with an SQP); and 25 States with a CSA with an SQP in force but no AP in force. In addition, there are two States with a voluntary offer agreement and an AP in force for which an SLA has been developed. As described in the Supplementary Document, in developing and implementing an SLA, consultations were held with the relevant State and/or regional authority, particularly on the implementation of in-field safeguards measures.

C.2. Dialogue with States on Safeguards Matters

14. The Secretariat has continued to engage in open and active dialogue with States on safeguards matters during the reporting period, as follows:¹³

- A technical meeting for Member States in August 2023 focused on the Agency's process for drawing safeguards conclusions;

¹³ GC(67)/RES/11, OP 29.

- Two in-person side events and two in-person tours on the margins of the 67th IAEA General Conference, and a side event jointly organized with Finland to exhibit the PGET system;
- Regular in-person tours of the Safeguards Analytical Laboratory (SAL) in Seibersdorf, as well as in-person tours of the safeguards equipment workshops and the Equipment Radiation Monitoring Laboratory (ERML), at Agency Headquarters;
- A side event on the margins of the First Preparatory Committee for the 2026 NPT Review Conference in August 2023, highlighting the efforts by the Agency to promote and encourage the conclusion of safeguards agreements and related protocols, as well as the assistance offered to States by the Agency to build capacity in meeting their safeguards obligations;
- The ‘Seminar on IAEA Safeguards’ was held in May 2024 for diplomats based in Vienna.



Massimo Aparo, Deputy Director General and Head of the Department of Safeguards, presenting to Member State representatives at the Seminar on IAEA Safeguards, May 2024. (Photo: IAEA)

C.3. Strengthening Safeguards Implementation in the Field

15. The Agency has continued to seek improvements to the effectiveness and efficiency of safeguards implementation in the field. These improvements include advances related to both safeguards equipment and safeguards approaches.

16. Site or facility-specific safeguards approaches/procedures were developed or improved for:

- The application of a dual containment and surveillance system with routine use of remote data transmission at two nuclear material storage facilities, one in Mexico and one in Slovenia;

- The routine use of remote data transmission at light-water reactors and a nuclear material storage facility in Switzerland;
- The safeguards approach at two facilities with nuclear power reactors, one in Argentina and one in India;
- The verification of nuclear material and other safeguards activities at a site with reprocessing and fuel fabrication facilities in Japan.

17. The Agency continued to prepare, with Member States' support, for the future application of safeguards to new types of facilities (e.g. geological repositories and encapsulation plants, pyroprocessing facilities, molten salt reactors, floating reactors, micro modular reactors and pebble bed modular reactors). These preparations, involving 'safeguards by design' (SBD), included evaluating safeguards concepts, investigating prospective safeguards technologies and equipment, and identifying safeguards measures and potential efficiencies through design modification early in the design stages of a facility, as part of several Member State Support Programme (MSSP) tasks particularly on SBD for small modular reactors. During the reporting period, the interdepartmental working group on SBD continued to foster knowledge sharing and enhanced cooperation within the Agency on this subject.

18. In Ukraine, the safeguards approach for the conditioning, encapsulation, and transfer from wet to dry storage of the spent fuel generated at the Chornobyl nuclear power plant continued to be implemented in accordance with the operational conditions of the site. Transfers of spent fuel from the Rivne, Khmelnytsky and South Ukraine nuclear power plants to the new centralized dry storage facility on the Chornobyl site continued for the second year.

19. The Agency continued to develop a safeguards approach (including unattended monitoring equipment with remote data transmission) for the new safe confinement facility enclosing the damaged reactor Unit 4 of the Chornobyl nuclear power plant. Installation of equipment at the site was delayed due to a decision to strengthen certain planned safeguards measures. The revised set of technical requirements is expected to be finalized in 2024. The installation of the associated technical infrastructure and the required safeguards equipment is still envisioned to be completed in advance of planned operation and in any case before the activities related to the stabilization or dismantling of the existing reactor shelter commence.

20. Finland and Sweden are working towards the construction of an encapsulation plant and a geological repository (EPGR) for disposal of spent fuel. The Agency's EPGR project coordinates the development of specific safeguards approaches for EPGRs, assesses verification methods, and identifies the needs for new safeguards equipment and techniques necessary for safeguarding these facilities to optimize safeguards measures at the time these facilities become operational.

21. In Finland, construction of the encapsulation plant is nearing completion, and the main operational equipment has been installed. The Agency continued to verify the status of the EPGR through design information verification activities, and continued to engage with the European Commission, the Radiation and Nuclear Safety Authority of Finland (STUK) and the facility operators of the EPGR and the spent fuel wet storage to develop an effective safeguards approach for these facilities.

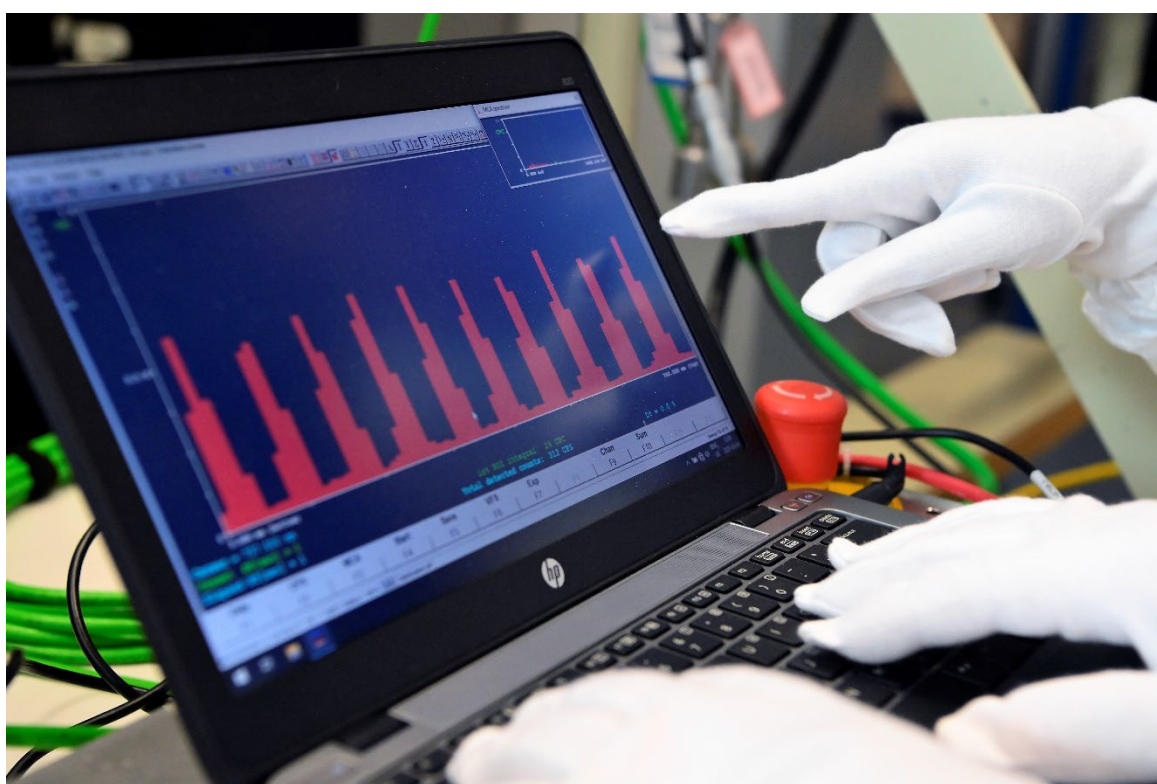
22. In Sweden, the licensing process for the construction and the operation of the EPGR continued. The final design of the encapsulation plant is expected in 2024, and the construction is expected to commence in 2028. The Agency continues to cooperate with the European Commission to define the requirements and specifications for the installation of safeguards equipment at the encapsulation plant.

23. The construction of the main process building at the Japan Mixed-Oxide Fuel Fabrication Plant continued through the reporting period and is scheduled for completion in 2025, after which the facility will move to a commissioning phase. The Agency continued to deploy the necessary resources to

develop and implement the required safeguards systems to meet the safeguards objectives at the facility taking into consideration the operator's official schedule.

24. Under the CANDU Equipment Based Approach (CEBA) project, the Agency and Canada are cooperating to enhance the technical safeguards measures implemented at operating CANDU nuclear reactors. Through further expanding the use of video surveillance and unattended monitoring systems, the verification and monitoring of spent fuel transferred from reactors to dry storage facilities will become more effective while the presence of inspectors in the field may be reduced.

25. In 2021, the United States of America requested the Agency to consider applying safeguards during the future disposition of plutonium into a long-term geological repository. The plutonium involved is currently subject to safeguards pursuant to the State's Voluntary Offer Agreement (INFCIRC/288). In the reporting period, the Agency and the United States of America continued to make progress towards the implementation of the relevant safeguards approach and associated verification techniques, which include extensive reliance on surveillance and unattended monitoring systems.



IAEA nuclear safeguards inspectors demonstrate techniques used in the field to account for and control nuclear material (Photo: IAEA)

C.4. Information Technology

26. In line with the Department's strategic goals, the Agency continued its commitment to improving existing safeguards software capabilities and innovating with new software functionalities. The Agency focused on seamlessly integrating applications, automating repetitive processes, and increasing analytical capabilities supported by cutting-edge technologies.

27. The Agency continued to enhance its IT capabilities in the areas of analysis, services, collaboration with States and verification activities, thereby increasing the efficient use of resources, such as staff time. Noteworthy among the newly implemented and improved IT capabilities were:

- The material balance evaluation report user interface was redesigned and integrated with the verification report, resulting in an improved user experience and reduced maintenance effort. The verification review process was streamlined and combined with the verification report, resulting in increased usability and efficiency;
- A flexible data processing capability was implemented to import facility operator general ledgers and compare them with State provided reports, allowing inspectors to adapt to changing operator data formats without the need for IT support and considerably speeding up the onboarding of new facilities;
- The enhanced State Declaration Portal (SDP) successfully replaced the legacy records management system, optimizing the management and efficient tracking of all correspondence;
- The IT support for the development of SLAs was significantly expanded to encompass more facility types, materials, and procedures, while the acquisition path analysis capabilities were enhanced to improve accuracy, efficiency, procedural support, and standardization;
- Electronic work plans were implemented in the Division of Technical and Scientific Services to replace manual processes for technical travel work plans and approvals;
- Advanced analytical capabilities were provided for nuclear material accountancy data allowing simple yet powerful dynamic query capabilities with enhanced data aggregation and improved visualization to expedite data processing.

C.5. Information Analysis

28. The analysis of safeguards relevant information is an essential part of evaluating a State's nuclear activities and drawing safeguards conclusions. In drawing its safeguards conclusions, the Agency analyses the consistency of State declarations and compares them with the results of Agency verification activities and other safeguards relevant information available to it. In support of this process, the Agency draws on an increasing amount of information from verification activities performed at Headquarters and in the field, including the results from non-destructive assay (NDA), destructive analysis (DA), environmental sampling analysis and remotely-monitored equipment. The Agency also draws on a diverse range of other sources of safeguards relevant information, including commercial satellite imagery and trade information. Throughout the reporting period, the Agency continued to identify new safeguards relevant open sources of information (e.g. new satellite imagery data services, trade and scientific technical information), improve processes and enhance methodologies and tools for information collection and analysis. The integration of innovative technologies into existing tools and processes has led to increased effectiveness and efficiency in reviewing safeguards relevant information identified in open sources.

29. Substantial adjustments continued to be made to a number of processes and workflows related to information analysis activities. These adjustments, including organizational measures, enhanced IT support and database modifications, allowing evaluators and analysts to increase the number of deliverables produced over the year. Agency staff continued to perform information analysis throughout the reporting period; the processing of State reports, declarations, and associated feedback were performed in accordance with the Agency's obligations; the evaluation of nuclear material balances and the evaluation of environmental samples analysis results were maintained at levels required to support the increasing demand; and the Agency continued to collect, process and evaluate other safeguards relevant information.

30. To continually improve the quality of the information on which it relies, the Agency monitored the performance of laboratories and measurement systems and organized international technical meetings, training and workshops for various States on nuclear material accounting, including measurement data analysis, statistical methodologies and material balance evaluation concepts. The results of this monitoring were included in yearly departmental assessments of measurement quality.

31. Material balance evaluation reports are prepared routinely by the Agency for all nuclear material bulk handling facilities with an inventory or throughput of more than one significant quantity of nuclear material. The objectives of material balance evaluations are to evaluate the consistency of State declarations with the result of the Agency's verification, through the processing, reconciliation and statistical analysis of NDA and DA measurements. Information analysis also encompasses the evaluation of all samples collected for safeguards purposes, which is performed by the Agency at its Headquarters.

32. In the reporting period, the Agency continued to use new satellite imagery data services and technology, including online streaming of satellite imagery, synthetic aperture radar sensors and satellites with a high revisit rate. These services enhance the Agency's capabilities in this area, including, inter-alia, the possibility for the Agency to select directly from the provider's online catalogue the imagery most relevant to support the State evaluation process.

C.6. Analytical Services

33. The Agency collects, analyses and evaluates DA and environmental samples to verify States' declarations and reports. Nuclear material samples are used for material balance evaluation to verify State accounting reports, or for material characterization purposes. Environmental samples are used to detect possible indications of undeclared nuclear activities or nuclear material.

34. Environmental and nuclear material samples collected by safeguards inspectors are analysed by the Agency's SAL in Seibersdorf, Austria – consisting of the Nuclear Material Laboratory (NML) and the Environmental Sample Laboratory (ESL) – and by other laboratories within the Agency's Network of Analytical Laboratories (NWAL). The NWAL includes 25 qualified laboratories in Australia, Brazil, China, the Czech Republic, France, Germany, Hungary, Japan, the Republic of Korea, the Russian Federation, the United Kingdom, the United States of America and the European Commission. In addition, the Agency operates the On-Site Laboratory (OSL) in Rokkasho, Japan, for the analysis of nuclear material samples collected at this site.



Nuclear material sample analysis at the Agency's Safeguards Analytical Laboratory in Seibersdorf, Austria (Photo: IAEA)

35. The Agency also provides logistical support for the collection, transport and analysis of nuclear material and environmental samples. Key performance indicators are used to monitor all stages of this process in order to identify potential problems and make improvements in timeliness. Moreover, the Agency administers a rigorous quality control programme, which includes regular inter-laboratory comparison exercises covering the major analytical techniques relevant to safeguards, to confirm the quality of analytical results across the NWAL.

36. MSSPs provided reference materials and support to advance analytical techniques and also contributed to cooperation projects in support of the Agency's quality control effort. Moreover, the Agency's ESL, as well as other members of the NWAL, continued to develop uranium particle age determination capabilities. In-field verification activities continued for the ABACC-Cristallini UF6 sampling method in three States.

37. The number of environmental samples collected continues to increase, doubling over the past decade. Moreover, a sizeable and growing fraction are submitted with high priority. Due to limitations in the capacity of the NWAL, the result was that overall timeliness for environmental samples analysis has steadily declined from 2019 to 2022. This trend was recently reversed (i.e. improved), thanks to efforts made by key NWAL members to expand their sample throughputs. The Agency recognizes that this is not a sustainable solution, nor is there much additional capacity available should the sample load continue to increase. Therefore, the Agency is actively seeking new laboratories that would be capable of performing bulk or particle analysis of environmental samples.

38. The demand for analysis of environmental samples had surpassed the capacity of the network. As a result, the Agency began seeking new laboratories capable of performing bulk analysis of environmental samples, or particle analysis using Large-Geometry Secondary Ion Mass Spectrometry (LG-SIMS) or Fission-Track Thermal Ionization Mass Spectrometry (FT-TIMS), and encouraging them

to join the NWAL to provide support for environmental sample analysis. Efforts to expand the NWAL continued. Two laboratories in the United States of America completed qualification for the provision of reference materials. Laboratories in Belgium, Canada and the Kingdom of the Netherlands continued qualification for nuclear material analysis. In addition, a laboratory in Argentina was undergoing qualification for heavy water analysis. However, none of these ongoing qualification efforts pertain to environmental sample analysis, which is the area where the capacity of the network needs to be enhanced the most.

C.7. Equipment and Technology

39. In the reporting period, the Agency continued to provide uninterrupted technical support and equipment for safeguards verification activities. The Agency continued to deliver technical assistance for activities in the field, and conducted the scheduled field technical work necessary to maintain the required performance of the deployed safeguards equipment.

40. The Agency's effort to ensure the personal protection of all Agency staff on duty travel and that of personnel at inspected facilities and other safeguarded locations continued to result in the distribution of a large amount of personal protective equipment (PPE). Furthermore, non-standard items continued to be provided in support of the Agency's missions in Ukraine, including armoured vests and helmets, travel sets for Agency vehicles utilized to reach facilities and other safeguarded locations in Ukraine from Agency Headquarters, sleeping bags and mattresses, thermal clothing, food and water supplies, and special medical emergency kits.

41. Despite the increased shipping rates, the overall shipment expenditures decreased, due to the introduction of efficiency gains within the shipment process, such as a centralised and streamlined safeguards shipment function, consolidation of shipments, and regular review of applied shipment fees.

42. The Agency's investment in resources for enhancing data analysis, remote data transmission consolidation, unattended monitoring systems (UMS), and containment and surveillance systems applied in the field, continued to play a vital role in maintaining continuity of knowledge on nuclear material and essential equipment at facilities where physical access to Agency inspectors is impacted, particularly in Ukraine. During the reporting period, the reliability of digital surveillance systems, NDA systems, UMS and electronic seals used in the field met the target of 99.9% availability. This high level of infrastructure availability has been regularly achieved over recent years through robust safeguards system architecture — implying redundancy and modularity — and implementation of preventive maintenance policies. The performance of these systems contributed significantly to the attainment of Agency safeguards objectives for the reporting period.

43. State and regional authorities responsible for safeguards implementation (SRAs) continued to support the Agency by providing resources and solutions in the area of system design, data security and maintenance of safeguards equipment, including equipment authorized for joint use. During the reporting period, support provided by SRAs included:

- The provision of surveillance cameras and associated hardware for installation and maintenance of joint-use safeguards equipment;
- The development of software for the review and the analysis of data collected in the field; and
- The design of UMS at new facilities, including the EPGR in Finland and other facilities in Belgium, Italy and Slovakia.

44. The Agency continued to perform integration and coordination activities related to the installation of multisystem safeguards equipment in 18 facilities in nine States, while also interacting with nine Member States in the context of SBD for new reactor types.

45. The scheduling tool for safeguards in-field activities was enhanced to provide online preparation and clearance of technical travel supporting safeguards verification activities, thus increasing the efficiency of this cross-divisional process. The new module of the scheduling tool also provides a customizable format for the preparation of the technical workplan that is required by facility operators to logistically support the safeguards technical activities planned at their facilities.

46. The ERML provided uninterrupted radiation monitoring of items returned from verification activities in the field, including components of safeguards systems, seals, and environmental samples.

47. In the reporting period, NDA system capabilities were expanded by the following:

- A portable gamma spectrometry system based on a PC running the multi-channel analyser touch screen software and a Cadmium Zinc Telluride detector module (MCCM) has been authorized and deployed for safeguards use. This innovative instrument integrates enhanced spectrometric performance with a compact design. The MCCM supports gamma spectrometry applications used in different nuclear facilities including enrichment and fuel fabrication plants. The new instrument is now progressively replacing a number of Agency's gamma spectrometric instruments, thus creating efficiencies by reducing the pool of required safeguards instruments and improving standardization;
- Development of the next generation gamma spectrometric handheld instrument (HM6-) was pursued with competitive selection of an industrial supplier and development of the application software under the auspices of the German Support Programme. HM6- implementation is planned to start in 2025.
- The next generation Cherenkov viewing device (XCVD) was authorized for partial defect verification of spent fuel, providing efficiency gains in large-scale spent fuel verification campaigns. Consequently, the pool of available XCVD was expanded to support routine use at facilities around the world;
- The robotized Cherenkov viewing device (RCVD) was used for verification in three facilities in two States, allowing for the verification of otherwise inaccessible fuel assemblies while reducing both operator's and inspector's radiation exposure;
- COMPUCEA continues to be used to determine enrichment on samples of highly enriched UF₆ taken from enrichment plants, enhancing the capability for the rapid detection of undeclared production of nuclear material;
- The passive gamma emission tomographic system (PGET) was used in one facility to verify damaged spent fuel pins in closed containers;
- With support provided by the Swiss and the Finnish Support Programmes, the PGET was tested for the first time for the verification of spent fuel assemblies inside a hot cell at a facility in Switzerland.



*The next generation of IAEA gamma spectrometry instruments:
MCCM (left) and HM6- (right) (Photo: IAEA)*

48. The Agency has almost completed the transition to cameras based on DCM-C5/DCM-A1 by replacing the camera systems that are reaching their end-of-life cycle.

49. Deep-learning based analysis of surveillance images was further developed and provides a substantial reduction in the time spent by Agency inspectors to perform surveillance review. Deep-learning based analysis of surveillance images is already integrated in the next generation surveillance review tool.

50. The use of Remote Data Transmission (RDT) enables greater verification efficiency by relieving inspectors from the task of collecting data at facilities, and allows early detection of any deterioration in systems' performance. The Agency continued to further develop the automation of data processing and inspector review systems to help streamline equipment data collection and increase the efficiency of the review process.

51. Within the framework of the sealing and containment modernization programme, the new Field Verifiable Passive Seal (FVPS) is starting to replace the historical passive seal (E-CAP), providing inspectors the possibility to verify in-situ the seal integrity, thus reducing the need to return the seals to Agency Headquarters for verification.

52. The new Laser Curtain for Containment (LCCT) system utilizes a laser-based technology to maintain continuity of knowledge on nuclear material in storages by detecting intrusions into defined containment areas, thus providing an efficient alternative to individual cask sealing. In 2023, the LCCT was authorized for safeguards use worldwide.

53. The Agency in close cooperation with MSSPs continued to identify and evaluate emerging technologies that could improve the effectiveness and efficiency of safeguards instrumentation. This activity was performed under the umbrella of instrumentation technology foresight activities. During the reporting period:

- The RCVD and the latest version of XCVD underwent simultaneous testing over the course of several days at a nuclear facility, thanks to the support provided by the Swiss Support Programme;
- The Australian Support Programme coordinated a series of meetings with the objective of enhancing the autonomy of RCVD through the development of new computer vision modules;
- A new support task was initiated to improve data analysis capabilities for the new generation of Cherenkov viewing devices;
- The use of muon imaging as a new technique to safeguard geological repositories continued to be assessed via computer simulations;
- Substantial enhancements were brought to the miniaturized prototype of the portable Monochromatic Micro-focusing X-ray Fluorescent system (MMXRF), in collaboration with the Support Programme of the Republic of Korea;
- A robotic payload designed for performing radiological surveys in high-dose environments was successfully utilized for a survey conducted at the Fukushima Daichi site in Japan.

C.8. Asset Management

54. Under the Integrated Lifecycle Management of Safeguards Assets (ILSA) project, the Department has created an asset management strategy to provide guidance and ensure consistency for managing the lifecycle of all safeguards assets, including IT equipment, safeguards equipment supporting in-field activities, laboratory equipment and software. Moreover, through the ILSA project, the use of estimating the whole-life costs of owning assets has been promoted and reinforced within the Department of Safeguards by requiring a whole-life cost estimation to access ILSA funding.

55. By the end of June 2024, the Department of Safeguards had approximately 55 000 active items registered in the safeguards asset registry, SEQUOIA. These items cost the Department over €258 million and are deployed to support safeguards implementation activities in about 65 States.

56. The ILSA project continued the practice of an annual review of the costs, operational lifetime, and other key parameters to improve the departmental ability to plan for asset replacements. The Department of Safeguards supported the Department of Management in the creation of an asset management plan for the infrastructure at the IAEA's Seibersdorf laboratories.

57. A new methodology based on the remote equipment serial number collection was validated and started to be implemented in order to verify the asset inventory of deployed safeguards equipment. This methodology contributes to increasing the departmental efficiency by significantly reducing the effort of inspectors and technicians performing asset inventory verification in the field.

At the end of June 2024, the Agency had nearly

55 000

active items registered in the safeguards asset registry



These items cost the Agency over

€258 million

and are deployed to support safeguards activities in approximately

65 States

58. The Department will continue to improve its asset management system to ensure that it obtains the maximum value from its assets and provide strong quantitative justification should additional funding be required.

C.9 Evaluation of the Effectiveness of Safeguards Implementation

59. Effectiveness evaluation is a process involving every step of safeguards implementation to assess the extent to which safeguards objectives were attained by verification activities conducted in the field and at Headquarters. Effectiveness evaluation of safeguards implementation is based on internal documents, such as the approved safeguards approaches and other related safeguards documentation, which are reviewed by departmental committees and safeguards evaluators.

60. In the reporting period, internal evaluation of the effectiveness of safeguards implementation was performed through departmental reviews of Annual Implementation Plans (AIPs) and State evaluation reports.

61. The AIPs approved at the beginning of the year are reviewed to assure that safeguards activities conducted in the field and at Headquarters are planned to a level sufficient to achieve the safeguards objectives for the year. Afterwards, the AIPs are reviewed to assure that planned safeguards activities were successfully conducted and, whenever safeguards implementation issues were encountered, actions related to their resolution were properly taken.

62. State evaluation reports are regularly reviewed by inter-departmental committees. As an additional review mechanism, every year ad hoc departmental teams are appointed by the Deputy Director General to conduct peer reviews of the State evaluation for a selected number of States.

63. Results from effectiveness evaluation activities are recorded and reported to senior management within the Department, identifying good practices and areas for improvement, and highlighting recommended actions.

C.10. Cooperation with, and assistance to, SRAs¹⁴

64. The effectiveness and efficiency of Agency safeguards depend, to a large extent, on the effectiveness of State systems of accounting for and control of nuclear material (SSACs), and regional systems of accounting for and control of nuclear material (RSACs), as well as on the level of cooperation between SRAs and the Agency.

65. The Agency regularly conducts events dedicated to strengthening the effectiveness of SSACs/SRAs. These events included international, regional and national training courses, as well as technical visits, virtual training events, and other activities for personnel responsible for overseeing and implementing safeguards in States.

66. The Agency provides the International Safeguards and SSAC Advisory Service (ISSAS) to States, at their request, with advice and recommendations on the establishment and strengthening of SSACs. The Agency conducted one ISSAS mission for Ghana and one for Türkiye during this reporting period.

¹⁴ GC(67)/RES/11, OP 11.

67. The Agency also continued to host and expand its offerings on CLP4NET¹⁵. This is a platform for e-learning open to all with a NUCLEUS account. The platform, which counts over 8 000 registered users, provides access to a password-protected virtual classroom for participants through which the electronic version of instructional materials, including Agency safeguards-related guidance documents, can be easily downloaded.

68. The Agency continues to conduct a series of interactive webinars aimed at enhancing national authorities' understanding of their IAEA safeguards obligations, and supporting effective and efficient safeguards implementation.

69. Upon completion of the pilot phase and the decision to continue to offer the IAEA Comprehensive Capacity-Building Initiative for SSACs and SRAs (COMPASS) as part of the suite of assistance projects for States, COMPASS was opened for applications to all States. Four States¹⁶ were selected to participate in the next implementation cycle that began in January 2024.

70. In the new cycle, COMPASS implementation starts with an IAEA Safeguards and SSAC Advisory Service (ISSAS) mission in order to assess the State's precise needs. Ghana received an ISSAS mission and both Cameroon and Bolivia are in preparation, while Bangladesh received an ISSAS mission in 2022 and is engaging actively with the IAEA in a discussion on implementation activities. As of 30 June 2024, COMPASS implementation is supported by 17 partners¹⁷.

C.11. Safeguards Workforce

71. In the reporting period, approximately 50 distinct training courses often with multiple course offerings were held, helping to provide safeguards inspectors, analysts and support staff with the necessary core and functional competencies.

72. The Introductory Course on Agency Safeguards (ICAS), a six-month course consisting of ten modules, was completed by 15 new inspectors, and three comprehensive inspection exercises were held.¹⁸ A new ICAS commenced in March 2024 for 11 inspectors.

¹⁵ Available at <https://elearning.iaea.org>

¹⁶ Bangladesh, the Plurinational State of Bolivia, Cameroon and Ghana.

¹⁷ In-kind support is offered by Argentina, Australia, Belgium, Canada, Czech Republic, European Commission, Finland, France, Germany, Hungary, Japan, Russian Federation, Singapore, Sweden, United Arab Emirates, United Kingdom and the United States. Except Singapore, all partners provide support through their Member State Support Programme.

¹⁸ The 10-module ICAS is counted as one course.



The IAEA Safeguards Inspectors of ICAS class 74. (Photo:IAEA)

73. In the reporting period, over 25 course offerings were held outside Agency Headquarters, mainly at Member States' nuclear facilities. Courses held at nuclear facilities are designed to enhance practical competencies for safeguards implementation in the field. They enable effective and integrated training of safeguards staff in a realistic environment. In particular they improve inspectors' ability to prepare for, conduct and report on inspection, design information verification and complementary access activities. These courses rely heavily on the provision of access to facilities and human resources by supporting Member States.

74. In order to build capacity and establish a culture of continuous learning for all staff in the Department, the *Safeguards Webinar Series* provided staff with four sessions on key topics in safeguards implementation, including privileges and immunities of IAEA inspectors and property, SBD, knowledge management and the SDP. The webinar recordings are made available to the staff in the Department, and can be viewed on demand.

75. Training needs analyses and training effectiveness evaluations for selected courses are conducted according to the Systematic Approach to Training methodology as part of a continuous improvement plan. In the reporting period, following a needs analysis, a new safeguards induction programme was developed and deployed, addressing the needs of the new hires into the Department of Safeguards.

76. Following the training needs analysis on industrial health and safety, the Agency has requested the support of Member States to help design and develop a basic industrial safety module which includes hazard recognition, human performance and knowledge transfer from mentors.

77. The Agency has over 90 training-related MSSP tasks and continues to engage with MSSPs in the development of training methodologies and tools, as well as in the conduct of courses both at Headquarters and at nuclear facilities. The ongoing support for staff training by MSSPs enables the Department of Safeguards to ensure access to facilities, which is critical for inspectors to practice and develop their skills.

78. In addition to Agency staff training, the Agency conducted the 2023 Safeguards Traineeship Programme for Young Graduates and Junior Professionals for eight participants — four of them women — from Bangladesh, Georgia, Lesotho, Madagascar, Sierra Leone, Sudan, Viet Nam and Zambia. Since 1983, the Agency has trained 183 Safeguards trainees from 73 States. This programme continues to provide young professionals with knowledge and skills to return to work in the area of

peaceful nuclear energy and safeguards in their State and provides them the foundation upon which to build a career in the field of Agency safeguards. The programme is supported by the Czech Republic, Finland, France, Hungary, the United Kingdom, the United States of America and the European Commission.

79. In line with the Agency Gender Equality Policy, the Department of Safeguards is committed to supporting gender equality and is seeking to strengthen efforts to promote both gender parity in its staff and gender mainstreaming considerations in relevant programmatic activities.

80. As of 30 June 2024, 40% of all regular staff members in the Department of Safeguards were women. According to the gender scorecard analysis for the Department of Safeguards, women represented 35% of the staff in the Professional and higher categories. Women comprised 32% of the safeguards inspectors in the Divisions of Operations and the Office for Verification in Iran, and 31% of staff in positions at the Section Head level and above.

81. The Department of Safeguards, in line with other Departments in the Agency, continues to implement its Gender Action Plan to define its framework of action in the area of gender and gender mainstreaming. Inclusion workshops, networks, communications, surveys and feedback discussions form an important part of this Plan. The Department of Safeguards continues to prioritize activity to encourage diversity in recruitment exercises, enhancing outreach opportunities and ensuring improved gender balance on recruitment panels. The five-year trend of the percentage of women in the Professional and higher categories in the Department of Safeguards shows the steady progress made in this area. The Department of Safeguards will continue to focus on gender parity in recruitment as well as on implementing additional measures to support wider diversity, inclusion and career development.



Safeguards trainees visit the Safeguards Analytical Laboratory in Seibersdorf, Austria (Photo: IAEA)

C. 12. Quality Management

82. The Quality Management System (QMS) within the Department of Safeguards provides regular oversight of the key safeguards processes to ensure impartiality, effectiveness and efficiency of safeguards implementation. Seven internal quality audits (IQAs) and assessments were conducted during the reporting period. The audits were focused on the process of random selection of in-field verification activities, access to information and compliance with the ISO standards at SAL and ERML. The three assessments that were conducted were focused on data quality of the safeguards master data, the user's experience and the quality of data related to the application for reporting and evaluating in-field verification activities and safeguards equipment use, relocation and reporting. In parallel, the Department of Safeguards carried out a QMS management review and continued to implement quality management activities associated with condition reporting, knowledge management, process improvement and document control such as:

- Reviewing, updating and creating documentation that supports in-field and Agency Headquarters verification activities: maintaining standards for legal arrangements with states and relevant authorities; categorization of facilities; the roles and responsibilities of facility, site and country officers, and the coordinating inspectors, to maintain consistency in work processes;
- Conducting a webinar about safeguards knowledge management;
- Continuing to address recommendations from the IQAs and assessments.

C.13. Organizational Resilience

83. The Department of Safeguards continued its efforts to ensure business continuity and disaster recovery to maintain the continuation of critical business processes and the availability of information during a disruptive event. During the reporting period, the Agency made significant progress with the replacement of aging IT infrastructure with modern, more flexible hardware.

84. Significant progress was also made with the establishment of the foundation for disaster recovery capabilities at the Agency's premises in Seibersdorf. Fundamental restoration tests have been successfully completed, with further and more complete restoration scenarios to take place in a phased manner throughout 2024.

85. The Department of Safeguards also completed the plan and design of the IT disaster recovery capabilities for the Tokyo Regional Office. A contract was signed with the disaster recovery site owners, the United Nations University (UNU), and preparatory work at the UNU site is scheduled for completion before the end of 2024.

86. The Agency faced new unexpected challenges to its operations as a consequence of the armed conflict in Ukraine. The Agency's emergency preparedness played an important role in supporting continuous operations in Ukraine. Staff were equipped with the appropriate technological support to ensure the necessary care and protection for the health and well-being of Agency staff in the field.

C.13.1 Information Security and Protection¹⁹

87. Safeguards information security continued to be a priority for the Agency during the reporting period. The Department protects all safeguards information through the information security management policies and procedures established and administered by the Department of Safeguards.

¹⁹ GC(67)/RES/11, OP 41.

The Agency's regime for the protection of safeguards confidential information was approved by the Board of Governors in 1997²⁰, when the introduction of the AP widened the range of safeguards information to be provided by States that brought into force the AP. The main elements of the regime include the appropriate classification of information; utilizing authorization processes and technologies to ensure that access is provided on a need-to-know basis; and a layered, defence-in-depth approach to security controls. The Department's commitment to operating its security effectively is underpinned by a security awareness training programme for Agency staff, and regular testing of its effectiveness.

88. The Department's security model for information systems relies on increasing layers of protection from cyber-attacks. The general-purpose computing network of the Department is protected by effective security controls to mitigate the risk of targeted cyber intrusion. For the higher classification levels of information, the Department operates an environment that is protected by the same controls, but is isolated from the internet to further prevent the unauthorized disclosure, destruction, or alteration of data.

89. During the reporting period, the Department of Safeguards continued to execute its defence-in-depth, risk-focused programme of security controls to protect its information assets. By focusing on the critical strategies for reducing the risk and the impact of targeted cyber intrusions, the Department seeks to deliver highly effective information security protection in an efficient manner, while the defence-in-depth approach leverages multiple, complementary security controls to ensure that the compromise of a single control does not lead to the unauthorized destruction, disclosure, or alteration of the Department's data.

90. The Department conducted assessments in the area of information security and implemented effective measures to mitigate potential attacks by making continuous efforts to identify and remediate possible vulnerabilities in the security system. As threats to the Department's information continued to grow in sophistication, with threat actors demonstrating persistence and advanced capability, the Department continued to further improve its ability to detect and respond to incidents on the mobile and primary computing systems.

91. Physical security controls, in the form of access control and monitoring, are a crucial part of the Department's information protection standards. The Department embarked upon a multi-year project to update the system that controls access to its premises as well as the components that manage the intrusion alarms and video monitoring. The first phase of the project, which provided for upgrades to all of the IT systems and software that comprise the physical security system, was completed in 2023. In 2024, the Department continued the project by replacing electronic and mechanical components in the office areas and data processing facilities. The upgrades are expected to continue through 2025.

C. 14. Safeguards Reporting

92. The Secretariat reported the safeguards conclusions for 2023 in *The Safeguards Implementation Report for 2023* (GOV/2024/28), which also provided data on the number and type of facilities and Locations Outside Facilities (LOFs) under safeguards, and the inspection effort and related cost of safeguards implementation. At its June 2024 meeting, the Board of Governors took note of the report and authorized the release of the 'Safeguards Statement for 2023' and the 'Background to the Safeguards Statement and Summary'.²¹

²⁰ The confidentiality regime is described in GOV/2897, as supplemented by the measures set forth in the Annex to GOV/2959.

²¹ The 'Safeguards Statement for 2023' and the 'Background to the Safeguards Statement and Summary' is available at: https://www.iaea.org/sites/default/files/24/06/20240607_sir_2024_part_ab.pdf



The cover of the Safeguards Implementation Report for 2023 (Photo: IAEA)

C.15. Strategic Planning and Partnerships²²

93. The Department of Safeguards conducts internal strategic analyses and planning activities to help ensure that safeguards continue to be implemented effectively, efficiently and resiliently into the future. In 2024, the Agency prepared analyses on resource and workload trends, identifying challenges and opportunities with respect to regular and extrabudgetary funding patterns, human resources and other expenditures.

94. The Agency updated the top priorities component of its document *Enhancing Safeguards Capabilities for Nuclear Verification – Resource Mobilization Priorities* (STR-399) and prepared and published the *Development and Implementation Support Programme for Nuclear Verification* for the 2024-2025 biennium (STR-405) in support of its resource mobilization activities. The STR-399 update identifies a prioritized set of high-level safeguards activities for which the Agency is seeking external support, while the STR-405 informs Member States of the specific support needed to improve the Agency's technical capabilities. The Agency released both documents at a gathering of Member State Support Programme Coordinators in February 2024.

95. The Agency pursued new partnerships in support of Agency safeguards and worked to broaden existing partnerships. A significant expansion of the long-standing partnership with the Australian Safeguards and Non-Proliferation Office (ASNO) through the Australian Support Programme was inaugurated with the signing in May 2024 of new grant arrangements for Australian support to safeguards research and development (R&D) and other IAEA safeguards extrabudgetary funding priorities. Discussions continue with other Member States regarding the establishment of additional programmes.

²² GC(67)/RES/11, OP 33.



IAEA

International Atomic Energy Agency

Atoms for Peace and Development

www.iaea.org

International Atomic Energy Agency
PO Box 100, Vienna International Centre
1400 Vienna, Austria
Tel.: (+43-1) 2600-0
Fax: (+43-1) 2600-7
Email: Official.Mail@iaea.org