

Nuclear Verification^{1,2}

Objective

To deter the proliferation of nuclear weapons by detecting early the misuse of nuclear material or technology, and by providing credible assurances that States are honouring their safeguards obligations. To remain ready to assist with verification tasks, in accordance with the Agency's Statute, in connection with nuclear disarmament or arms control agreements, as requested by States and approved by the Board of Governors.

Implementation of Safeguards in 2017

At the end of every year, the Agency draws a safeguards conclusion for each State for which safeguards are applied. This conclusion is based on an evaluation of all safeguards relevant information available to the Agency in exercising its rights and fulfilling its safeguards obligations for that year.

With regard to States with comprehensive safeguards agreements (CSAs), the Agency seeks to conclude that all nuclear material has remained in peaceful activities. To draw such a conclusion, the Agency must ascertain, first, that there are no indications of diversion of declared nuclear material from peaceful activities (including no misuse of declared facilities or other declared locations to produce undeclared nuclear material) and, second, that there are no indications of undeclared nuclear material or activities in the State as a whole.

To ascertain that there are no indications of undeclared nuclear material or activities in a State, and ultimately to be able to draw the broader conclusion that *all* nuclear material has remained in peaceful activities in that State, the Agency assesses the results of its verification and evaluation activities under the State's CSA and additional protocol (AP). Thus, for the Agency to draw such a broader conclusion, both a CSA and an AP must be in force for the State, and the Agency must have completed all necessary verification and evaluation activities and found no indication that, in its judgement, would give rise to a proliferation concern.

For a State that has a CSA but not an AP in force, the Agency draws a conclusion only with respect to whether *declared* nuclear material remained in peaceful activities, as the Agency does not have sufficient tools to provide credible assurances regarding the absence of undeclared nuclear material and activities in the State.

¹ 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.

² The referenced number of States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons is based on the number of instruments of ratification, accession or succession that have been deposited.

In 2017, safeguards were applied for 181 States^{3,4} with safeguards agreements in force with the Agency. Of the 127 States that had both a CSA and an AP in force⁵ the Agency drew the broader conclusion that *all* nuclear material remained in peaceful activities for 70 States⁶; for the remaining 57 States, as the necessary evaluation regarding the absence of undeclared nuclear material and activities for each of these States remained ongoing, the Agency concluded only that *declared* nuclear material remained in peaceful activities. For 46 States with a CSA but with no AP in force, the Agency concluded only that *declared* nuclear material remained in peaceful activities.

For those States for which the broader conclusion has been drawn, the Agency is able to implement integrated safeguards: an optimized combination of measures available under CSAs and APs to maximize effectiveness and efficiency in fulfilling the Agency's safeguards obligations. During 2017, integrated safeguards were implemented for 65 States^{7,8}.

Safeguards were also implemented with regard to nuclear material in selected facilities in the five nuclear-weapon States party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) under their respective voluntary offer agreements. For these five States, the Agency concluded that nuclear material in selected facilities to which safeguards had been applied remained in peaceful activities or had been withdrawn from safeguards as provided for in the agreements.

For the three States for which the Agency implemented safeguards pursuant to item-specific safeguards agreements based on INFCIRC/66/Rev.2, the Agency concluded that nuclear material, facilities or other items to which safeguards had been applied remained in peaceful activities.

As of 31 December 2017, 12 States Parties to the NPT had yet to bring CSAs into force pursuant to Article III of the Treaty. For these States Parties, the Agency could not draw any safeguards conclusions.

Conclusion of safeguards agreements and APs, and amendment and rescission of small quantities protocols

The Agency continued to facilitate the conclusion of safeguards agreements and APs (Fig. 1), and the amendment or rescission of small quantities protocols (SQPs)⁹. The status of safeguards agreements and APs as of 31 December 2017 is shown in Table A6 in the

³ These States do not include the Democratic People's Republic of Korea (DPRK), where the Agency did not implement safeguards and, therefore, could not draw any conclusion.

⁴ And Taiwan, China.

⁵ Or an additional protocol being provisionally applied, pending its entry into force.

⁶ And Taiwan, China.

⁷ Albania, Andorra, Armenia, Australia, Austria, Bangladesh, Belgium, Botswana, Bulgaria, Burkina Faso, Canada, Chile, Croatia, Cuba, Czech Republic, Denmark, Ecuador, Estonia, Finland, Germany, Ghana, Greece, Holy See, Hungary, Iceland, Indonesia, Ireland, Italy, Jamaica, Japan, Kazakhstan, Republic of Korea, Latvia, Libya, Lithuania, Luxembourg, Madagascar, Mali, Malta, Mauritius, Monaco, Montenegro, Netherlands, New Zealand, Norway, Palau, Peru, Philippines, Poland, Portugal, Romania, Seychelles, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Tajikistan, the former Yugoslav Republic of Macedonia, Ukraine, United Republic of Tanzania, Uruguay, Uzbekistan and Viet Nam.

⁸ And Taiwan, China.

⁹ Many States with minimal or no nuclear activities have concluded an SQP to their CSA. Under an SQP, the implementation of most of the safeguards procedures in Part II of a CSA is held in abeyance as long as certain criteria are met. In 2005, the Board of Governors took the decision to revise the standardized text of the SQP and change the eligibility criteria for an SQP, making it unavailable to a State with an existing or planned facility and reducing the number of measures held in abeyance (GOV/INF/276/Mod.1 and Corr.1). The Agency initiated exchanges of letters with all States concerned in order to give effect to the revised SQP text and the change in the criteria for an SQP.

Annex to this report. During 2017, a CSA with an SQP and an AP were signed for one State¹⁰. In addition, three States¹¹ brought an AP into force. One State¹² acceded to the safeguards agreement between the non-nuclear-weapon States of 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 State¹³. By the end of 2017, safeguards agreements were in force with 182 States and APs were in force with 132 States. An AP continued to be provisionally applied pending its entry into force for one State¹⁴.

The Agency continued to implement the *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*¹⁵, which was updated in September 2017. The Agency organized a regional event for Sub-Saharan African States, held in Lusaka, Zambia, in August and national events for the Sudan, held in Khartoum in April, and for Ethiopia, held in Addis Ababa in April, at which the Agency encouraged the participating States to conclude CSAs and APs, and to amend their SQPs. In addition, the Agency held consultations with representatives of a number of Member and non-Member States in Dakar, Geneva, Lusaka and Vienna at various times throughout the year.

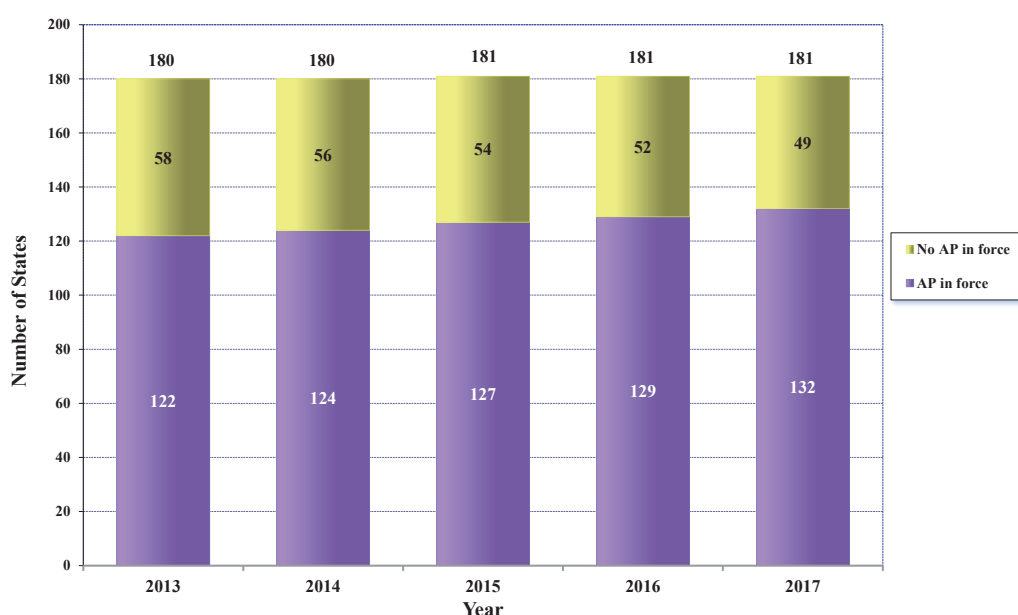


FIG. 1. Number of APs for States with safeguards agreements in force, 2013–2017 (the Democratic People's Republic of Korea is not included).

The Agency continued to communicate with States in order to implement the Board of Governors' 2005 decision regarding SQPs, with a view to rescinding such protocols or amending them to reflect the revised standard text. During 2017, an SQP became non-operative for one State¹⁶. By the end of 2017, 62 States had accepted the revised SQP text (which was in force for 55 of these States) and 7 States had rescinded their SQPs.

¹⁰ Liberia.

¹¹ Honduras, Senegal and Thailand.

¹² Croatia.

¹³ Pakistan.

¹⁴ Islamic Republic of Iran.

¹⁵ Available at: <https://www.iaea.org/sites/default/files/sg-plan-of-action-2016-2017.pdf>.

¹⁶ United Arab Emirates.

Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015)

Throughout 2017, the Agency continued to verify and monitor the nuclear-related commitments of the Islamic Republic of Iran (Iran) under the Joint Comprehensive Plan of Action (JCPOA). During the year, the Director General submitted four reports to the Board of Governors and in parallel to the United Nations Security Council entitled *Verification and monitoring in the Islamic Republic of Iran in light of United Nations Security Council resolution 2231 (2015)* (GOV/2017/10, GOV/2017/24, GOV/2017/35 and GOV/2017/48).

Syrian Arab Republic (Syria)

In August 2017, the Director General submitted a report to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic* (GOV/2017/37) covering relevant developments since the previous report in August 2016 (GOV/2016/44). The Director General informed the Board of Governors that no new information had come to the knowledge of the Agency that would have an impact on the Agency's assessment that it was very likely that a building destroyed at the Dair Alzour site was a nuclear reactor that should have been declared to the Agency by Syria.¹⁷ In 2017, the Director General renewed his call on Syria to cooperate fully with the Agency in connection with unresolved issues related to the Dair Alzour site and other locations. Syria has yet to respond to these calls.

On the basis of the evaluation of information provided by Syria and all other safeguards relevant information available to it, the Agency found no indication of the diversion of declared nuclear material from peaceful activities. For 2017, the Agency concluded for Syria that declared nuclear material remained in peaceful activities.

Democratic People's Republic of Korea (DPRK)

In August 2017, the Director General submitted a report to the Board of Governors and General Conference entitled *Application of Safeguards in the Democratic People's Republic of Korea* (GOV/2017/36–GC(61)/21), which provided an update of developments since the Director General's report of August 2016 (GOV/2016/45–GC(60)/16).

Since 1994, the Agency has not been able to conduct all necessary safeguards activities provided for in the DPRK's NPT Safeguards Agreement. From the end of 2002 until July 2007, the Agency was not able — and, since April 2009, has not been able — to implement any verification measures in the DPRK, and, therefore, the Agency could not draw any safeguards conclusion regarding the DPRK.

On 3 September 2017, the DPRK announced that it had conducted a nuclear test.

In 2017, no verification activities were implemented in the field but the Agency continued to monitor the DPRK's nuclear activities by using open source information, including satellite imagery and trade information. In June 2017, the Director General indicated his intention to enhance the Agency's readiness to play an essential role in verifying the DPRK's nuclear programme. To this end, in August 2017, a DPRK Team was formed within the

¹⁷ The Board of Governors, in its resolution GOV/2011/41 of June 2011 (adopted by a vote), had, inter alia, called on Syria to urgently remedy its non-compliance with its NPT Safeguards Agreement and, in particular, to provide the Agency with updated reporting under its Safeguards Agreement and access to all information, sites, material and persons necessary for the Agency to verify such reporting and resolve all outstanding questions so that the Agency could provide the necessary assurance as to the exclusively peaceful nature of Syria's nuclear programme.

Department of Safeguards to enhance the monitoring of the DPRK's nuclear programme; maintain updated verification approaches and procedures for the nuclear facilities known to exist within the DPRK; prepare for the Agency's return to the DPRK; and ensure the availability of appropriate verification technologies and equipment. An Executive Group was also formed within the Secretariat to consider procedural, managerial and legal matters.

During 2017, the Agency continued to observe indications that were consistent with the operation of the Yongbyon Experimental Nuclear Power Plant (5 MW(e)) which commenced the current operational cycle in early December 2015. The Agency did not observe indications of reprocessing operations at the Radiochemical Laboratory during 2017. At the Yongbyon Nuclear Fuel Rod Fabrication Plant there were indications consistent with the use of the reported centrifuge enrichment facility located within the plant. Construction work was undertaken on a building that adjoins the reported centrifuge enrichment facility. There were indications in the light water reactor construction yard of an increase in activities consistent with the fabrication of certain reactor components. The Agency has not observed indications of the delivery or introduction of major reactor components into the reactor containment building.

The Agency has not had access to the Yongbyon site. Without access to the site, the Agency cannot confirm the operational status of the facilities on the site, or the nature and purpose of the activities observed.

The continuation and further development of the DPRK's nuclear programme are a cause for grave concern. The DPRK's nuclear activities are deeply regrettable and clear violations of relevant United Nations Security Council resolutions, including resolutions 2371 (2017), 2375 (2017) and 2397 (2017). The DPRK's sixth nuclear test, announced on 3 September 2017, was also in clear violation of United Nations Security Council resolutions and is extremely regrettable.

Enhancing Safeguards

Evolving safeguards implementation

During 2017, the Agency developed new State-level safeguards approaches as described in the Director General's reports GOV/2013/38 and GOV/2014/41 and Corr.1. It developed State-level safeguards approaches for five States with a comprehensive safeguards agreement and an additional protocol in force and a broader conclusion; 29 States with a comprehensive safeguards agreement and an additional protocol in force for which the broader conclusion has yet to be drawn; and 28 States with a comprehensive safeguards agreement but no additional protocol in force¹⁸. This resulted in new State-level safeguards approaches for 62 States, bringing the total number of States for which State-level safeguards approaches were developed to 126. Of these 62 State-level safeguards approaches, 49 were for States with a small quantities protocol (SQP). In developing and implementing a State-level safeguards approach, consultations were held with the relevant State and/or regional authority, particularly on the implementation of in-field safeguards measures. The State-level safeguards approaches were developed and implemented for the above States within the scope of their respective safeguards agreements.

A State-level safeguards approach is developed in accordance with a State's safeguards agreement, through the conduct of acquisition or diversion path analysis, identification and prioritization of technical objectives, and selection of safeguards measures to address them. For those States where State-level safeguards approaches are not implemented,

¹⁸ The State-level safeguards approaches developed for these States do not include the measures available under additional protocols which are only implemented in those States that have an additional protocol in force.

in-field safeguards activities are conducted at declared facilities and locations outside facilities where nuclear material is customarily used (LOFs) based on Safeguards Criteria. New techniques and technologies are implemented, as applicable and in accordance with the States' safeguards agreements, to strengthen effectiveness and improve efficiency.

To continue to ensure consistency and non-discrimination in the implementation of safeguards for States with the same type of safeguards agreements, the Agency continued in 2017 to improve internal work practices, including the better integration of the results of safeguards activities conducted in the field with those carried out at Headquarters, and introduced further advances in the handling of safeguards-relevant information to facilitate its evaluation. The Agency also continued to revise and update its guidance documentation for safeguards implementation, including guidance on consultations with States and/or regional authorities during development or updating and implementation of State-level safeguards approaches.

Cooperation with State and regional authorities

To assist States in building capacity for implementing their safeguards obligations, the Agency conducted seven 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, and participated in nine other training activities organized by Member States on a bilateral basis. In total, more than 180 participants from some 40 countries were trained on safeguards related topics. The majority of these activities were supported financially or in-kind through Member State Support Programmes.

In 2017, the Agency published Arabic versions of the *Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols* (IAEA Services Series 21) and the *Safeguards Implementation Guide for States with Small Quantities Protocols* (IAEA Services Series 22). The Agency conducted, upon request, an IAEA State System of Accounting for and Control of Nuclear Material Advisory Service (ISSAS) mission to Jordan and participated in an Integrated Nuclear Infrastructure Review (INIR) mission to Ghana. Both missions included, inter alia, the provision of advice to the host countries on how to systematically enhance the capabilities necessary for the application of safeguards while embarking on a nuclear power programme.

Safeguards equipment and tools

Throughout 2017, the Agency ensured that the instrumentation and monitoring equipment installed in nuclear facilities around the world, which is vital to effective safeguards implementation, continued to function as required. During the year, 1150 portable and resident non-destructive assay systems comprising 2359 separate pieces of equipment were prepared and assembled for inspection use. The Agency installed seven new unattended monitoring systems, implemented major upgrades to 15 others and dismantled four, bringing the total number of such systems installed by the end of the year to 167 in 24 States. The Agency also had 1541 cameras operating at 277 facilities in 37 States¹⁹. The Agency is also responsible for maintaining approximately 120 cameras used jointly with regional or State authorities. By the end of 2017, remote data transmission infrastructure ensured the collection of 932 unattended safeguards data streams from 130 facilities in 29 States²⁰. Of these, 311 data streams were produced by surveillance systems, 111 by unattended monitoring systems and 510 by electronic seals (Fig. 2).

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¹⁹ And Taiwan, China.

²⁰ And Taiwan, China.



FIG. 2. An Agency engineer designs a glass seal for use by safeguards inspectors as part of IAEA verification measures.

The Agency continued to implement the next generation surveillance system, replacing outdated surveillance units (DCM-14 based technology). By the end of 2017, 750 next generation surveillance system cameras had been installed in 29 States²¹. The Passive Gamma Emission Tomography (PGET) system was successfully tested at three nuclear power plants during 2017 and subsequently officially authorized for use in inspections. PGET is able to detect missing or replaced rods in spent fuel assemblies, thus providing the Agency with an unprecedented verification capability of irradiated items.

In 2017, the Agency continued cooperative efforts with Member States, the Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) and the European Commission. These focused on procurement, acceptance testing, installation and maintenance of safeguards equipment designated for joint use, and staff training.

The Agency continued to undertake activities aimed at identifying and evaluating emerging instrumentation technologies that could lead to the deployment of new instruments in support of safeguards implementation. These activities were performed in close cooperation with Member State Support Programmes.

Safeguards analytical services

The Agency's Network of Analytical Laboratories consists of the Agency's Safeguards Analytical Laboratory and 22 other qualified laboratories in Australia, Brazil, China, France, Hungary, Japan, the Republic of Korea, the Russian Federation, the United Kingdom, the United States of America and the European Commission. Additional laboratories in the areas of environmental and/or nuclear material sample analysis were in the process of qualification in Argentina, Belgium, Canada, Germany, Hungary and the Netherlands.

²¹ And Taiwan, China.



FIG. 3. An analytical chemist at the Nuclear Material Laboratory analyses material collected by safeguards inspectors.

In 2017, the Agency collected 599 nuclear material samples that were analysed by the Agency's Nuclear Material Laboratory. The Agency also collected 483 environmental samples, which resulted in analysis of 1050 subsamples. Two hundred and three of these subsamples were analysed at the Agency's Environmental Sample Laboratory and the Nuclear Material Laboratory (Fig. 3), with the remainder analysed by other laboratories in the Network of Analytical Laboratories.

Support

Developing the safeguards workforce

In 2017, the Agency conducted 173 safeguards training courses to provide safeguards inspectors and analysts with the necessary technical and behavioural competencies. These included two sessions of the Introductory Course on Agency Safeguards held at the Agency for 24 newly recruited inspectors. To enhance their practical competencies for safeguards implementation in the field, several of the courses were held at nuclear facilities (Fig. 4). Holding the courses on-site serves to train safeguards staff in a realistic, effective, consistent and integrated manner in how to prepare, conduct and report on inspections, design information verification activities and 'complementary' access. Other courses were held at Headquarters, with the aim of developing skills for processing safeguards relevant data, for example, by developing analytical skills relevant to the effective use of collaborative analysis tools. During the year, the Agency developed a new training course on planning, performing and analysing efficient and effective verification measurements and activities at facilities handling unirradiated direct use material. The Agency continued to engage with Member State Support Programmes in the development of tools for training and in the conduct of courses at nuclear facilities.



FIG. 4. Agency safeguards inspectors undergo on-site training in hot cell and glovebox sampling in reprocessing facilities.

Significant Safeguards Projects

Information technology: MOSAIC

By the end of 2017, the Modernization of Safeguards Information Technology (MOSAIC) project had delivered 17 newly developed or refurbished software applications or systems, while continuing to strengthen the protection of safeguards data. The new Safeguards Authorization Management System, introduced in 2017, streamlines the process for requesting and granting access to safeguards information, while ensuring that such requests comply with Agency policies and procedures. The new State Declarations Portal, also released during the year, provides a new, more efficient way for State and regional authorities to submit declarations and exchange related communications with the Secretariat. The portal keeps track of such communications, aiding institutional memory and knowledge management, and reduces paper-based processes and manual data entry, thereby saving time and effort. Overall, MOSAIC has continued to make steady progress towards its planned completion by May 2018.

Preparing for the Future

As part of its strategic planning, the Agency held a workshop on emerging technologies in February, which fostered the update of the *Research and Development Plan (R&D)* and the biennial *Development and Implementation Support Programme for Nuclear Verification 2018–2019*. These two documents inform Member States on required support to improve the Agency's technical capabilities. The Development and Implementation Support Programme for Nuclear Verification comprises 314 support programme tasks in 24 projects. At the end of 2017, 20 States²² and the European Commission had formal support programmes with the Agency.

²² Argentina, Australia, Belgium, Brazil, Canada, China, Czech Republic, Finland, France, Germany, Hungary, Japan, Republic of Korea, Netherlands, Russian Federation, South Africa, Spain, Sweden, United Kingdom and United States of America.