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# Nuclear Verification<sup>1,2</sup>

## 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 2016

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, firstly, 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, secondly, 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

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<sup>1</sup> 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.

<sup>2</sup> 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.

Agency does not have sufficient tools to provide credible assurances regarding the absence of undeclared nuclear material and activities in the State.

In 2016, safeguards were applied for 181 States<sup>3,4</sup> with safeguards agreements in force with the Agency. Of the 124 States that had both a CSA and an AP in force<sup>5</sup> the Agency concluded that *all* nuclear material remained in peaceful activities for 69 States<sup>6</sup>; for the remaining 55 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 49 States with a CSA but with no AP in force, the Agency concluded 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 2016, integrated safeguards were implemented for 57 States<sup>7,8</sup>.

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 2016, 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 SQPs*

The Agency continued to facilitate the conclusion of safeguards agreements and APs (Fig. 1), and the amendment or rescission of small quantities protocols (SQPs)<sup>9</sup>. The status

<sup>3</sup> 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.

<sup>4</sup> And Taiwan, China.

<sup>5</sup> Or an additional protocol being provisionally applied, pending its entry into force.

<sup>6</sup> And Taiwan, China.

<sup>7</sup> Albania, Andorra, Armenia, Australia, Austria, Bangladesh, Belgium, 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, Republic of Korea, Latvia, Libya, Lithuania, Luxembourg, Madagascar, Mali, Malta, Monaco, Netherlands, Norway, Palau, Peru, Poland, Portugal, Romania, Seychelles, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, the former Yugoslav Republic of Macedonia, Ukraine, United Republic of Tanzania, Uruguay and Uzbekistan.

<sup>8</sup> And Taiwan, China.

<sup>9</sup> 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.

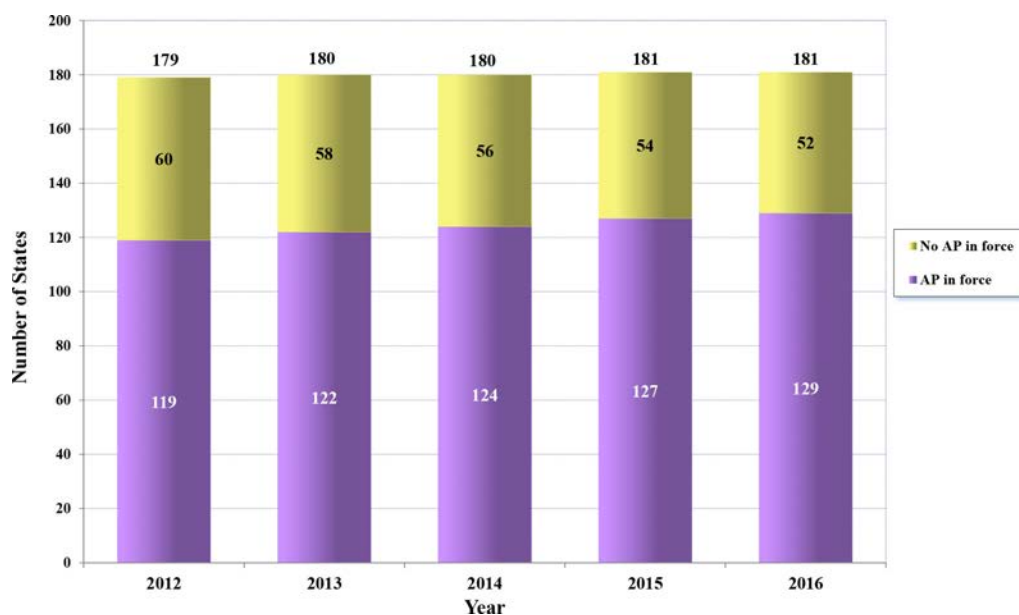


FIG. 1. Number of APs for States with safeguards agreements in force, 2012–2016 (the Democratic People’s Republic of Korea is not included).

of safeguards agreements and APs as of 31 December 2016 is shown in Table A6 in the Annex to this report. During 2016, the Board of Governors approved a CSA with an SQP and an AP for one State<sup>10</sup>. In addition, two States<sup>11</sup> brought an AP into force. An AP has been provisionally applied pending its entry into force for one State<sup>12</sup>. By the end of 2016, safeguards agreements were in force with 182 States and APs were in force with 129 States.

The Agency continued to implement the *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*<sup>13</sup>, which was updated in September 2016. The Agency organized a subregional event for States in West Africa, held in Niamey, Niger, in May, 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 New York and Vienna at various times throughout the year.

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 2016, two States<sup>14</sup> amended their operative SQP to reflect the revised standard text. This means that, by the end of 2016, 62 States had accepted the revised SQP text (which was in force for 56 of these States).

## Verification and Monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015)

In 2016, the Agency continued monitoring and verification in the Islamic Republic of Iran (Iran) in relation to the nuclear-related measures set out in the Joint Plan of Action (JPA) until being informed, on 19 January 2016, by China, France, Germany, the Russian

<sup>10</sup> Liberia.

<sup>11</sup> Cameroon and Côte d’Ivoire.

<sup>12</sup> Islamic Republic of Iran.

<sup>13</sup> Available at: <https://www.iaea.org/sites/default/files/16/09/plan-of-action-2015-2016.pdf>.

<sup>14</sup> Afghanistan and Saint Kitts and Nevis.



FIG. 2. The Director General reports that Iran has taken the actions specified in Annex V of the JCPOA, thereby paving the way for implementation of the JCPOA to begin.

Federation, the United Kingdom, the United States of America (E3+3) and Iran, on behalf of the E3/EU+3 and Iran, that — with the start of the implementation of the Joint Comprehensive Plan of Action (JCPOA) — the JPA was no longer in effect.<sup>15</sup>

On 16 January 2016, the Director General reported to the Board of Governors and in parallel to the United Nations Security Council that the Agency had verified that Iran had taken the actions specified in paragraphs 15.1–15.11 of Annex V of the JCPOA (Fig. 2). Implementation Day occurred on the same day.

Also on 16 January 2016, Iran began to provisionally apply the Additional Protocol to its Safeguards Agreement in accordance with Article 17(b) of the Additional Protocol, pending its entry into force, and to fully implement the modified Code 3.1 of the Subsidiary Arrangements to its Safeguards Agreement.

Since Implementation Day, the Agency has been verifying and monitoring Iran's nuclear related commitments under the JCPOA. During 2016, the Director General submitted six 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/INF/2016/1, GOV/2016/8, GOV/2016/23, GOV/2016/46, GOV/2016/55 and GOV/INF/2016/13).

### Syrian Arab Republic (Syria)

In August 2016, the Director General submitted a report to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic* (GOV/2016/44) covering relevant developments since the previous report in August 2015 (GOV/2015/51). 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

<sup>15</sup> In January 2016, the Director General submitted to the Board of Governors a report entitled *Status of Iran's Nuclear Programme in relation to the Joint Plan of Action* (GOV/INF/2016/3).

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.<sup>16</sup> In 2016, 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 2016, the Agency concluded for Syria that declared nuclear material remained in peaceful activities.

## Democratic People's Republic of Korea (DPRK)

In August 2016, 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/2016/45-GC(60)/16), which provided an update of developments since the Director General's report of August 2015 (GOV/2015/49-GC(59)/22).

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 6 January 2016, the DPRK announced that it had conducted a nuclear test and on 9 September 2016 the DPRK announced that it had conducted another nuclear test.

In 2016, 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. The Agency maintained operational readiness to resume safeguards implementation in the DPRK, and continued to further consolidate its knowledge of the DPRK's nuclear programme.

During 2016, the Agency continued to observe indications which were consistent with the operation of the Yongbyon Experimental Nuclear Power Plant (5 MW(e)) at Yongbyon. This followed a period between mid-October and early December 2015 when there were no such indications. This period was sufficient for the reactor to have been de-fuelled and subsequently re-fuelled. Based on past operational cycles, a new cycle commencing in early December 2015 can be expected to last about two years.

From the first quarter of 2016, there were multiple indications consistent with the Radiochemical Laboratory's operation, including deliveries of chemical tanks and the operation of the associated steam plant. Such indications ceased in early July 2016. In previous reprocessing campaigns, the Radiochemical Laboratory's operation involved the use of the spent fuel discharged from the Yongbyon Experimental Nuclear Power Plant (5 MW(e)).

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. Additional construction work around the building that houses this reported facility has been ongoing.

<sup>16</sup> 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.

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 and related statements by the DPRK, including those about continuing to "boost" its "nuclear force", are a major cause for concern. The DPRK's nuclear activities, including those in relation to the Yongbyon Experimental Nuclear Power Plant (5 MW(e)) and the Radiochemical Laboratory, and the use of the building which houses the reported enrichment facility are deeply regrettable. Such actions are clear violations of relevant United Nations Security Council resolutions, including resolutions 2270 (2016) and 2321 (2016). The DPRK's fourth and fifth nuclear tests, announced on 6 January and 9 September 2016, respectively, are also in clear violation of United Nations Security Council resolutions and deeply regrettable.

## Enhancing Safeguards

### *Evolving safeguards implementation*

During 2016, the Agency completed updating State-level safeguards approaches for the remaining States in the original group of 53 States that were already under integrated safeguards at the start of 2015. In addition, it developed State-level safeguards approaches for: eight States with a CSA and an AP in force and a broader conclusion; two States with a CSA and AP in force but without a broader conclusion; and one State with a voluntary offer agreement and an AP in force. As described in *Supplementary Document to the Report on the Conceptualization and Development of Safeguards Implementation at the State Level (GOV/2013/38) (GOV/2014/41 and Corr.1)*, in developing and implementing a State-level safeguards approach consultations are held with the relevant State and/or regional authority, particularly on the implementation of in-field safeguards measures.

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. In those States where State-level safeguards approaches are not implemented, safeguards activities are conducted at declared facilities and locations outside facilities where nuclear material is customarily used (LOFs) as specified in the Safeguards Criteria, and new techniques and technologies are implemented, as applicable and in accordance with the States' safeguards agreements, to strengthen effectiveness and improve efficiency.

In 2016, 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 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 prepared new guidance documentation and improved its internal review mechanisms for safeguards implementation.

### *Cooperation with State and regional authorities*

To assist States in building capacity for implementing their safeguards obligations, the Agency conducted nine 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 several other training activities organized by Member States on a bilateral basis. In total, more than 225 participants from some 70 countries were trained on safeguards related topics. The Agency also provided targeted assistance to facility operators to improve the performance of their measurement

system for nuclear material accounting and control at bulk facilities, and piloted a regional training course on safeguards and nuclear security for States with little or no nuclear material. The Agency also conducted two Safeguards Implementation Practices Workshops in Vienna, in which safeguards practitioners from State authorities and facilities discussed challenges and shared lessons learned and good practices in relation to establishing safeguards infrastructure and facilitating Agency verification activities.

In June, the Agency published the *Safeguards Implementation Practices Guide on Provision of Information to the IAEA* (IAEA Services Series 33). A preparatory IAEA State System of Accounting for and Control of Nuclear Material Advisory Service (ISSAS) mission was conducted to Jordan, in advance of implementation of the ISSAS mission in 2017. In 2016, the Agency conducted Integrated Nuclear Infrastructure Review (INIR) missions to Kazakhstan and Malaysia providing, inter alia, 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 2016, the Agency ensured that the instrumentation and monitoring equipment vital to effective safeguards implementation around the world continued to function as required. During the year, 1057 portable and resident non-destructive assay systems comprising 2168 separate pieces of equipment were prepared and assembled for inspection use. By the end of 2016, a total of 164 unattended monitoring systems were in operation in 24 States and the Agency had 872 video surveillance systems with 1436 individual cameras operating at 266 facilities in 35 States<sup>17</sup>. In addition, the Agency is responsible for maintaining approximately 120 cameras used jointly with regional or State authorities. By the end of 2016, remote data transmission infrastructure ensured the collection of 887 unattended safeguards data streams from 122 facilities in 25 States<sup>18</sup>. Of these, 299 data streams were produced by surveillance systems, 111 by unattended monitoring systems and 477 by electronic seals.

The Agency continued with implementation of the next generation surveillance system (NGSS), replacing outdated surveillance units (DCM-14 based technology). By the end of 2016, 597 NGSS cameras had been installed in 29 States.

In 2016, cooperative efforts with Member States, the European Commission and the Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) continued for procurement, acceptance testing, installation, and maintenance of safeguards equipment designated for joint use and for training of relevant staff.

In 2016, 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 (MSSPs).

### *Safeguards analytical services*

The Agency's Network of Analytical Laboratories (NWAL) consists of the Agency's Safeguards Analytical Laboratories (SAL) and 20 other qualified laboratories in Australia, Brazil, 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

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<sup>17</sup> And Taiwan, China.

<sup>18</sup> And Taiwan, China.

the process of qualification in Argentina, Belgium, Canada, China, Germany, Hungary, the Netherlands and the United States of America.

In 2016, the Agency collected 603 nuclear material samples that were analysed by the Agency's Nuclear Material Laboratory (NML). The Agency also collected 474 environmental samples, which resulted in analysis of 916 subsamples. Two hundred sixteen of these subsamples were analysed at the Agency's Environmental Sample Laboratory and the NML, with the remainder analysed by other laboratories in the NWAL.

## Support

### *Developing the safeguards workforce*

In 2016, the Agency conducted over 160 safeguards training courses to provide safeguards inspectors and analysts with the necessary technical and behavioural competencies. These included two Introductory Courses on Agency Safeguards for 23 newly recruited inspectors and courses held at nuclear facilities to enhance practical competencies for safeguards implementation in the field. New training courses were also developed in 2016, including a course on safeguards issues regarding Pyroprocessing at an Engineering Scale Demonstration Facility. The Agency continued to engage with MSSPs in the development of tools for training and in the conduct of courses at nuclear facilities.

## Significant Safeguards Projects

### *Information technology: MOSAIC*

During 2016, as part of the Modernization of Safeguards Information Technology (MOSAIC) project, the Agency introduced new IT tools and capabilities, completed the enhancement of all legacy safeguards IT applications and strengthened the information security of safeguards data. These tools and applications include the Electronic Verification Package (eVP) and Field Activity Reporting (FAR) applications for use by inspectors in the field, and the Safeguards Implementation Report Analytical Tool (SANT) for streamlining the production of the Safeguards Implementation Report. The new and refurbished IT tools have enabled the Agency to increase effectiveness, find efficiencies and enhance security, while meeting an ever increasing demand for its services.

### **Preparing for the Future**

In early 2016, the Agency published the *Development and Implementation Support Programme for Nuclear Verification 2016–2017* to address near term development objectives and to support the implementation of its verification activities. The Agency continued to rely on MSSPs in implementing work in pursuit of the objectives and key achievement targets described therein. At the end of 2016, 20 States<sup>19</sup> and the European Commission had formal support programmes with the Agency.

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<sup>19</sup> 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.