Nuclear Verification[1,2]

Objective

To deter the proliferation of nuclear weapons by the early detection of the misuse of nuclear material or technology, and by providing credible assurances that States are honouring their safeguards obligations. To contribute to nuclear arms control and disarmament by responding to States' requests for verification and other technical assistance associated with related agreements and arrangements. To continually improve and optimize operations and capabilities to effectively carry out the Agency's verification mission.

Implementation of Safeguards in 2015

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, as the Agency does not have sufficient tools to provide credible assurances regarding the absence of undeclared nuclear material

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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.

and activities in the State, it draws a conclusion only with respect to whether *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 2015 integrated safeguards were implemented for 54 States[3,4].

In 2015, safeguards were applied for 181 States[5,6] with safeguards agreements in force with the Agency. Of the 121 States that had both a CSA and an AP in force, the Agency concluded that *all* nuclear material remained in peaceful activities in 67 States[7]; for 54 States, as the necessary evaluation regarding the absence of undeclared nuclear material and activities for each of these States remained ongoing, the Agency was unable to draw the same conclusion. For these 54 States, and for the 52 States with a CSA but with no AP in force, the Agency concluded only that *declared* nuclear material remained in peaceful activities.

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 2015, 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)[8]. The status of safeguards agreements and APs as of 31 December 2015 is shown in Table A6 in the Annex

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3 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, Uruguay and Uzbekistan.

4 And Taiwan, China.

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

6 And Taiwan, China.

7 And Taiwan, China.

8 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.

to this report. During 2015, one State[9] signed and brought into force a comprehensive safeguards agreement with an SQP and an AP, and one State[10] signed a comprehensive safeguards agreement with an SQP. In addition, two States[11] brought an AP into force. By the end of 2015, safeguards agreements were in force with 182 States and APs were in force with 127 States.

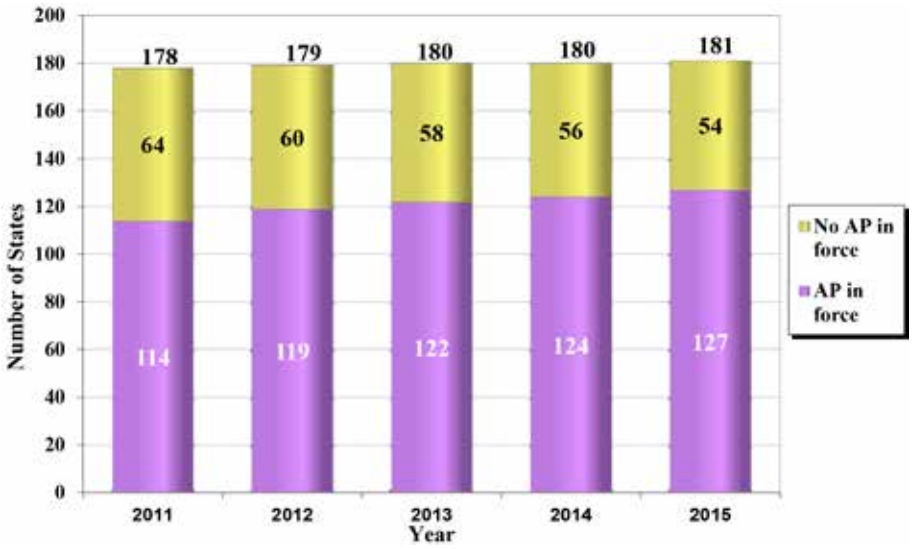

FIG. 1. Number of APs for States with safeguards agreements in force, 2011–2015 (the Democratic People's Republic of Korea is not included).

The Agency continued to implement the *Plan of Action to Promote the Conclusion of Safeguards Agreements and Additional Protocols*[12], which was updated in September 2015. The Agency organized regional and sub-regional events for States in Africa (held in Vienna), in Southeast Asia (in Singapore) and in the Caribbean (in Panama City), and a briefing for a number of Permanent Missions, at which the Agency encouraged the participating States to conclude comprehensive safeguards agreements and additional protocols, and to amend their SQPs. Also, a national workshop on safeguards was organized for Mongolia. In addition, the Agency held consultations with representatives from a number of Member and non-Member States in Geneva, New York and Vienna at various times throughout the year.

The Agency continued to communicate with States in order to implement the Board's 2005 decisions regarding SQPs, with a view to rescinding such protocols or amending them to reflect the revised standard text. During 2015, one State[13] amended its operative SQP to reflect the revised standard text and three States[14] rescinded their SQPs. This means that, by the end of 2015, 60 States of some 100 States had accepted the revised SQP text (which was in force for 54 of these States).

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9 Djibouti.

10 Federated States of Micronesia.

11 Cambodia and Liechtenstein.

12 Available at: *https://www.iaea.org/sites/default/files/final_action_plan_1_july_2014_to_30_june_2015.doc.pdf.*

13 Togo.

14 Azerbaijan, Jordan and Tajikistan.

Islamic Republic of Iran (Iran)

During 2015, the Director General submitted four reports to the Board of Governors entitled *Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran* (GOV/2015/15, GOV/2015/34, GOV/2015/50 and GOV/2015/65).

In 2015, Iran continued to conduct enrichment related activities, although it did not produce uranium hexafluoride enriched above 5% uranium-235. Iran also continued work on heavy water related projects. However, it neither installed any major components at the IR-40 Reactor nor produced nuclear fuel assemblies for the IR-40 Reactor at the Fuel Manufacturing Plant[15].

On 14 July 2015, the Director General and the Vice-President of Iran and President of the Atomic Energy Organization of Iran, HE Ali Akbar Salehi, signed in Vienna a Road-map for the clarification of past and present outstanding issues regarding Iran's nuclear programme (GOV/INF/2015/14) (Fig. 2). The Road-map identified the necessary activities to be undertaken under the Framework for Cooperation in order to accelerate and strengthen cooperation and dialogue between the Agency and Iran aimed at the resolution, by the end of 2015, of all past and present outstanding issues — as set out in the annex to the Director General's report of November 2011 (GOV/2011/65) — that had not already been resolved by the Agency and Iran.

FIG. 2. IAEA Director General Yukiya Amano and Vice-President of the Islamic Republic of Iran Ali Akbar Salehi signed the Road-map for the clarification of past and present issues regarding Iran's nuclear programme, in Vienna on 14 July 2015.

The activities set out in the Road-map, including technical-expert meetings and the conduct of safeguards activities by the Agency at particular locations in Iran, were

[15] In 2015, Iran was required by relevant binding resolutions of the Board of Governors and the United Nations Security Council to implement the modified Code 3.1 of the Subsidiary Arrangements General Part to its Safeguards Agreement; suspend all enrichment-related and reprocessing activities; and suspend all heavy water-related activities. Security Council resolution 2231 (2015), adopted in July 2015, included terms providing for the termination of the provisions of six Security Council resolutions adopted between 2006 and 2010.

completed on schedule. The implementation of the Road-map facilitated a more substantive engagement between the Agency and Iran.

On 2 December 2015, the Director General provided a report to the Board of Governors on the *Final Assessment on Past and Present Outstanding Issues regarding Iran's Nuclear Programme* (GOV/2015/68). The Agency assessed that a range of activities relevant to the development of a nuclear explosive device had been conducted in Iran prior to the end of 2003 as a coordinated effort, and some activities took place after 2003. The Agency also assessed that these activities had not advanced beyond feasibility and scientific studies, and the acquisition of certain relevant technical competences and capabilities. The Agency had no credible indications of activities in Iran relevant to the development of a nuclear explosive device after 2009 and found no credible indications of the diversion of nuclear material in connection with the possible military dimensions to Iran's nuclear programme.

On 15 December 2015, the Board of Governors adopted resolution GOV/2015/72, in which, inter alia, it noted that all activities in the Road-map had been completed in accordance with the agreed schedule and that this closed its consideration of this item.

Throughout 2015, the Agency continued to undertake monitoring and verification in relation to the nuclear-related measures set out in the Joint Plan of Action agreed between China, France, Germany, the Russian Federation, the United Kingdom, the United States of America (E3+3) and Iran, the aim of which was to reach a "mutually-agreed, long-term comprehensive solution that would ensure Iran's nuclear programme will be exclusively peaceful". The Joint Plan of Action was extended three times, most recently on 30 June 2015, when the E3+3 and Iran requested the Agency, on behalf of the E3/EU+3 and Iran, to continue to undertake the necessary nuclear-related monitoring and verification activities in Iran under the Joint Plan of Action until further notice.

On 14 July 2015, the E3/EU+3 and Iran agreed on a Joint Comprehensive Plan of Action (JCPOA), stating that "the full implementation of this JCPOA will ensure the exclusively peaceful nature of Iran's nuclear programme". In August 2015, the Board of Governors, inter alia, authorized the Director General to implement the necessary verification and monitoring of Iran's nuclear-related commitments as set out in the JCPOA, and report accordingly, for the full duration of those commitments in light of United Nations Security Council resolution 2231 (2015), subject to the availability of funds and consistent with the Agency's standard safeguards practices; and authorized the Agency to consult and exchange information with the Joint Commission, as set out in the Director General's report on *Verification and Monitoring in the Islamic Republic of Iran in light of United Nations Security Council Resolution 2231 (2015)* (GOV/2015/53 and Corr.1 thereto). After Adoption Day, the Agency began conducting preparatory activities related to the verification and monitoring of Iran's nuclear-related commitments under the JCPOA.

In October 2015, Iran informed the Agency pursuant to paragraph 8 of Annex V of the JCPOA that, effective on JCPOA Implementation Day, Iran would provisionally apply the Additional Protocol to its Safeguards Agreement pending its entry into force, and would fully implement the modified Code 3.1 of the Subsidiary Arrangements to its Safeguards Agreement.

While the Agency continued throughout 2015 to verify the non-diversion of declared nuclear material at the nuclear facilities and locations outside facilities declared by Iran under its Safeguards Agreement, the Agency was not in a position to provide credible assurance about the absence of undeclared nuclear material and activities in Iran and, therefore, was unable to conclude that all nuclear material in Iran was in peaceful activities.

Syrian Arab Republic (Syria)

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

September 2014 (GOV/2014/44). 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.[16] In 2015, 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.

In 2015, Syria indicated its readiness to receive Agency inspectors, and to provide support for the purpose of performing a physical inventory verification (PIV) at the Miniature Neutron Source Reactor in Damascus. On 29 September 2015, the Agency — after considering the United Nations Department of Safety and Security's assessment of the prevailing security level in Syria and making additional arrangements to ensure the safe transit of the inspectors — successfully carried out the PIV at the reactor.

On the basis of the evaluation of information provided by Syria, the results of the safeguards verification activities and all relevant information available to it, the Agency found no indication of the diversion of declared nuclear material from peaceful activities. For 2015, the Agency concluded for Syria that declared nuclear material remained in peaceful activities.

Democratic People's Republic of Korea (DPRK)

In August 2015, 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/2015/49–GC(59)/22), which provided an update of developments since the Director General's report of September 2014.

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, could not draw any safeguards conclusion regarding the DPRK.

Since April 2009, the Agency has not implemented any measures under the ad hoc monitoring and verification arrangement agreed between the Agency and the DPRK and foreseen in the Initial Actions agreed at the Six-Party Talks. No verification activities were implemented in the field in 2015, but the Agency continued to monitor the DPRK's nuclear activities by using open source information, including satellite imagery and trade information. Using satellite imagery, the Agency continued to observe signatures during 2015 which were consistent with the operation of the 5 MW(e) reactor at Yongbyon. Renovation or expansion of other buildings was also seen within the Yongbyon site. However, without access to the site, the Agency cannot confirm the operational status of the reactor or the purpose of the other observed activities. The Agency also continued to further consolidate its knowledge of the DPRK's nuclear programme with the objective of maintaining operational readiness to resume safeguards implementation in the DPRK.

The nuclear programme of the DPRK and its ongoing efforts to further develop its nuclear capabilities remain a matter of serious concern. The DPRK's operation of the 5 MW(e) reactor, the ongoing construction at the Yongbyon site, the extension and use of the building housing the reported enrichment facility, and statements about bolstering

[16] 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.

its nuclear deterrent capability are deeply regrettable. Such actions are clear violations of relevant United Nations Security Council resolutions.

Enhancing Safeguards

Evolving safeguards implementation

During 2015, the Agency implemented State-level safeguards approaches for 54 States[17] under integrated safeguards. Six of these approaches were updated during the year and the Secretariat is currently in the process of updating the remainder. The Secretariat is planning to develop such approaches for other States in the future. As described in several documents submitted to the Board of Governors, 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 the selection of safeguards measures to address them. In those States where State-level safeguards approaches under integrated safeguards are not implemented, the safeguards activities to be performed in the field are based on the Agency's Safeguards Criteria.

In 2015, 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 advances in the handling of safeguards-relevant information to facilitate evaluation. The Agency also prepared new guidance documentation and improved review mechanisms for safeguards implementation.

Cooperation with State and regional authorities

To assist States in building capacity for implementing their safeguards obligations, the Agency published, in February, *Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure* (IAEA Services Series No. 31), the second of four planned Safeguards Implementation Practices Guides. The Agency conducted seven international, regional and national training courses for personnel responsible for overseeing and implementing the State systems of accounting for and control of nuclear material (SSAC), and participated in several other training activities organized by Member States on a bilateral basis. In total, more than 170 participants from more than 50 countries were trained on safeguards related topics. In 2015, the Agency also provided targeted assistance to facility operators to improve their measurement system performance.

"In total, more than 170 participants from more than 50 countries were trained on safeguards related topics."

Safeguards equipment and tools

Throughout 2015, the Agency ensured that the instrumentation and monitoring equipment vital to effective safeguards implementation around the world continued to function as required. Significant financial and human resources were dedicated to maintaining installed equipment to guarantee its high reliability. During the year, 1106 portable and resident non-destructive assay systems comprising 2237 separate pieces of equipment were prepared and assembled for inspection use. By the end of 2015, a total of 162 unattended monitoring systems were in operation worldwide and the Agency had 863 video surveillance systems

[17] And Taiwan, China.

with 1416 individual cameras operating at 266 facilities in 35 States. In addition, the Agency is responsible for maintaining approximately 210 cameras used jointly with regional/State authorities. By the end of 2015, remote data transmission infrastructure ensured collection of 820 unattended safeguards datastreams from 136 facilities in 24 States. Of these, 255 datastreams were produced by surveillance systems, 109 by unattended monitoring systems and 456 by electronic seals.

The Agency continued with the next generation surveillance system (NGSS) implementation campaign, replacing a large number of outdated surveillance units (DCM-14 based technology). In 2015, 532 old video surveillance cameras were replaced with NGSS technology. This replacement campaign is currently partially funded through a dedicated item in the Agency's Major Capital Investment Fund.

"In 2015, 532 old video surveillance cameras were replaced with NGSS technology."

In 2015, 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 2015, the instrumentation technology foresight activities to identify and evaluate emerging instrumentation technologies that could support Agency safeguards implementation continued. These activities were performed in close cooperation with Member State Support Programmes (MSSPs).

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 are in the process of qualification in Argentina, Belgium, Canada, China, the Czech Republic, Germany, Hungary, the Netherlands and the United States of America. In 2015, the Agency collected 644 nuclear material samples, all of which were analysed by the Agency's Nuclear Material Laboratory. In 2015, the Agency also collected 323 environmental samples. This resulted in the analysis of 787 sub-samples by the NWAL (including at SAL). Proficiency tests and quality procedures were applied to ensure the correctness and accuracy of all results.

Support

Developing the safeguards workforce

In 2015, the Agency continued updating the Introductory Course on Agency Safeguards, with an emphasis on enhancing teaching methods by delivering training in a more interactive manner. During the year, the Agency conducted over 180 safeguards training courses to provide safeguards inspectors and analysts with the necessary technical and behavioural competencies (Fig. 3). Some of these courses were held at nuclear facilities to enhance practical knowledge of collecting and processing safeguards relevant information, in the field and at Headquarters, in a consistent and integrated manner. New training courses were also developed in 2015, for example, on conducting acquisition path analysis and on developing State-level safeguards approaches. The Agency continued to engage with MSSPs in the development of tools for training and in the conduct of courses at nuclear facilities.

Standing Advisory Group on Safeguards Implementation

The Standing Advisory Group on Safeguards Implementation (SAGSI) held two series of meetings in 2015, at which, inter alia, it considered: internal guidance related to implementation of safeguards at the State level; the MOSAIC project for modernizing

FIG. 3. Agency inspectors use non-destructive assay devices to verify spent fuel assemblies during a training exercise at Dukovany nuclear power plant in the Czech Republic in June.

safeguards information technology infrastructure; and enhancement of performance management.

Significant Safeguards Projects

Enhancing Capabilities of the Safeguards Analytical Services (ECAS)

All remaining transition activities needed to move into the new Nuclear Material Laboratory (NML) were finished during 2015. Additional training and administrative space in the NML office was constructed and the planned security upgrades to the main gate facility, the access road and the site perimeter were completed. Procurement, receipt and installation of remaining equipment for the chemical and instrumentation laboratories was completed during the first two quarters. Active testing in the new facility was completed during the period from May to November, and provisional operation commenced in December, following approval by the Agency's internal regulator and acknowledgement by the Austrian Government. With the completion of the ECAS project in December, the Agency is able to conduct safeguards sample analysis in safe, secure and modern facilities for decades to come.

Information technology: MOSAIC

The Agency's safeguards information technology modernization needs are being addressed through the Modernization of Safeguards Information Technology (MOSAIC) project. In 2015, the Agency completed the first phase of the MOSAIC project by transferring data from the mainframe computer to a new platform, re-engineering the associated software applications and decommissioning the mainframe computer. The new safeguards IT working environment provides the Agency with improved information security, enhanced applications and quicker access to data. During the year, the Agency continued to focus on aligning IT tools with safeguards implementation processes, enhancing existing tools and applications, and further strengthening information security.

Preparing for the Future

Research and development are essential to meeting the safeguards needs of the future. During 2015, the Agency continued implementing the *Department of Safeguards Long-Term Research and Development Plan, 2012–2023* with the assistance of Member State Support Programmes. To address near-term development objectives and to support the implementation of its verification activities, the Agency continued to rely on Member State Support Programmes in implementing its *Development and Implementation Support Programme for Nuclear Verification 2014–2015*. At the end of 2015, 20 States[18] and the European Commission had formal support programmes with the Agency.

[18] 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.