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Safeguards and Non-Proliferation experience from an IAEA perspective:

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Abstract

The International Atomic Energy Agency (IAEA) has been implementing nuclear safeguards (verification and assessments) for more than half a century covering peaceful nuclear activities. IAEA safeguards are implemented in States pursuant to legal authority from the IAEA Statute and bilateral, regional and international nuclear non-proliferation treaties and agreements; and are set of technical measures that allow the IAEA to independently verify a State's legal commitment not to divert nuclear material from peaceful nuclear activities to nuclear weapons or other nuclear explosive devices. In 1991, the IAEA safeguards system suffered a massive shock when it was discovered that Iraq was running an heretofore undetected parallel undeclared nuclear (weapon acquisition) programme. As a result, the IAEA safeguards system was strengthened based on a combination of expanded information and technical measures through the Additional Protocol (to safeguards agreements) that was approved for implementation in 1997. Further challenges to the IAEA safeguards system came during 1992 through 2015, from the DPRK, Iran, Libya, South Korea and Syria. This presentation describes the structure and technical elements of safeguards.

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IAEA Safeguards

Non-nuclear-weapon States party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) are required to renounce nuclear weapons and to use nuclear energy exclusively for peaceful purposes, verification of this obligation would be fulfilled by bringing into force a comprehensive safeguards agreement (CSA) with the Agency. The basic undertaking of the State would be to accept safeguards on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.[2]

For its part, the IAEA has the corresponding right and obligation to ensure that safeguards are applied. For States with comprehensive safeguards agreements in force but with little or no nuclear material or

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[2] Paragraph 1, INFCIRC/153/Corr.

nuclear activities, a Small Quantities Protocol (SQP) may be concluded which holds in abeyance certain measures of the agreement, until the State acquires more than specified quantities of nuclear material and/or a nuclear facility. While the reporting requirements and the conduct of inspections in States with SQPs are far less intense than in States without SQPs, all States must establish a functioning system for accounting and control of nuclear material and maintain on-going communications with the Agency.[3]

In February 1992, the Board of Governors affirmed that the scope of comprehensive safeguards agreements was not limited to nuclear material actually declared by a State, but included any material that is required to be declared. In other words, the Board confirmed that the organization has the right and obligation, under such agreements, to verify not only that State declarations of nuclear material subject to safeguards are 'correct' (i.e. they accurately describe the types and quantities of the State's declared nuclear material holdings), but that they are also 'complete' (i.e. that they include all material that should have been declared).

Objectives of safeguards

The objective of safeguards is the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection. The 'timely detection' of the diversion of 'significant quantities' is based on the premise that, in case a certain quantity of nuclear material cannot be accounted for, the possibility of the State manufacturing a nuclear explosive device cannot be excluded. Furthermore, a certain amount of time is required for the State to convert nuclear material into a weapon-usable form. Goal quantities and timeliness requirements are established for detecting diversion of different categories and forms of nuclear material (e.g. low-enriched uranium and high-enriched uranium; bulk form or fresh reactor fuel assemblies). If the overall objective of a comprehensive safeguards agreement is to be achieved, a second objective must be pursued, that is the detection of undeclared nuclear material and activities in a State. This requires different tools from those needed for the timely detection of the diversion of declared nuclear material, such as a broader range of information, more emphasis on the evaluation of information, more access for inspectors to locations, and a more analytical approach in implementing safeguards. It also requires the evaluation of the State's entire nuclear fuel cycle capabilities (i.e. the State 'as a whole') in addition to individual facilities.

The IAEA has defined three safeguards objectives[4] that are common to all States with CSAs, as follows:

- to detect undeclared nuclear material and activities anywhere in the State;
- to detect undeclared production or processing of nuclear material at facilities and Locations Outside Facilities (LOFs); and,

[3] IAEA: Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols, (IAEA Services Series 21), pp. 1-2.
[4] See, "The Safeguards System of the International Atomic Energy Agency", http://www.iaea.org/safeguards/documents/safeg_system.pdf

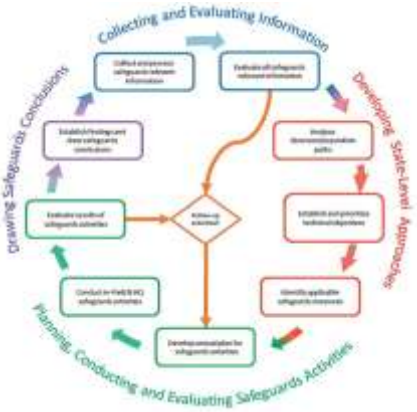
- to detect diversion of declared nuclear material at facilities and LOFs.

In order to meet the overall objective the Agency determines an optimized combination of safeguards measures needed to achieve State-specific technical objectives, based on the evaluation of all available information on the State. The concept of considering the State as a whole provides the opportunity to focus verification efforts and resources where needed to meet the State-specific objectives. The methodology and approach are based on a comprehensive State evaluation that takes State-specific factors into consideration in all stages of safeguards implementation.

In order to apply effective safeguards under comprehensive safeguards agreements, the Agency identifies and conducts safeguards activities to address generic State-level safeguards objectives that are common to all States with comprehensive safeguards agreements. In determining how these generic safeguards objectives are to be addressed for a particular State, the Agency conducts an analysis of all technically plausible paths by which that State could pursue the acquisition of nuclear material for the development of a nuclear weapon or other nuclear explosive device. Such an acquisition path could involve the diversion of declared nuclear material, unreported imports of nuclear material, unreported production or processing of nuclear material at declared nuclear facilities or LOFs, undeclared nuclear material and activities, or any combination of these. The Agency then establishes technical objectives for each path.

State-level approach

The generic and technical objectives and applicable safeguards measures to address them form the basis of a State-level safeguards approach for a State. In developing and implementing a State level safeguards approach for a State, the Agency takes into account State-specific factors, such as the nuclear fuel cycle and related technical capabilities of the State. In evaluating safeguards implementation for a State, the Agency assesses the extent to which the planned activities have been carried out and the objectives of the State-level safeguards approach achieved. In addition, the Agency monitors the status of follow-up actions, including the actions necessary in order to conclude whether or not any identified anomalies, discrepancies and inconsistencies constitute an indication of diversion of nuclear material or of the presence of undeclared nuclear material or activities.



State-level approach: Source: Tariq Rauf, “IAEA Nuclear Verification”, 2015.

Access to locations and information is essential for meeting the objectives of safeguards agreements. The State's Safeguards Regulatory Authority (SRA) is responsible for facilitating the access and providing support to IAEA inspectors. Agency activities in the State fall into three major categories: design information verification, inspections, and complementary access. Each category of activity involves various tasks needed to achieve the technical objectives, and may involve access to a variety of locations within a facility, site, or other locations in a State.

Safeguards Inspections

The IAEA may carry out three kinds of inspections: ad hoc, routine, and special inspections, as well as complementary accesses. States must ensure the inspectors are able to carry out their activities, by providing access to locations and to information necessary to meet independently the objectives of the inspection. States, and NWFZ regional control mechanisms, have the right to have IAEA personnel accompanied during inspections, provided that in doing so, inspectors are not delayed or otherwise impeded in carrying out their functions.

Ad hoc inspections are normally conducted to verify the information contained in the initial report by a State to the IAEA, before Subsidiary Arrangements have been concluded and Facility Attachments have been prepared, or to verify nuclear material before it is exported or upon receipt in the importing State.

OBJECTIVE A To detect undeclared nuclear material and activities	State as a whole	This objective is achieved through evaluating State declarations and all safeguards relevant information available to the Agency and performing activities in the field.
OBJECTIVE B To detect undeclared production or processing of nuclear material	Declared facilities and LOFs	This objective is achieved through evaluating State declarations and performing activities at declared facilities and LOFs.
OBJECTIVE C To detect diversion of declared nuclear material	Declared facilities and LOFs	This objective is achieved through evaluating State accounting reports and performing activities at declared nuclear facilities and LOFs to verify inventories and flows of declared nuclear material.
ACTIVITY COMMON TO THE THREE OBJECTIVES Follow-up questions, discrepancies, anomalies and inconsistencies identified when performing activities necessary to meet the above objectives.		Follow-up activities are defined and carried out in order to ascertain whether the identified discrepancies, anomalies and inconsistencies indicate the possible presence of undeclared nuclear material or activities or the diversion of nuclear material from peaceful activities.

Routine inspections[5] are conducted after the Subsidiary Arrangements Attachments have been concluded and specific information has been incorporated in the Attachments, including information on 'strategic points' in each facility. Once the broader conclusions are drawn in a State with an AP in force, the IAEA has the right under certain conditions to conduct inspections on a random basis, with a minimum advance notification to the State and operator or to select part of the routine inspection activities randomly. This supplementary measure can achieve increases in both effectiveness and efficiency, and is an important component of the State level concept for safeguards planning and implementation. States, and nuclear-weapon-free zone (NWFZ) regional control mechanisms, have the right to have inspectors accompanied[6] during unannounced inspections; such accompaniment must not delay or otherwise impede the inspectors in the exercise of their functions. States may find the logistics challenging, but the Agency may nonetheless exercise its right to conduct unannounced inspections. The IAEA periodically communicates to the State its general programme of inspections to help minimize impacts on the facilities. Inspectors conducting a routine inspection must be granted access and support to carry out their activities to meet the verification objectives.

The IAEA may require special inspections which may be either additional to the routine inspection effort, or involve access to information or locations which are additional to those involved in routine and ad hoc inspections, or both. While special inspections have rarely been carried out, they are an important element of the Agency's legal authority to implement safeguards, and may be necessary for the IAEA to achieve the objectives of NPT and NWFZ safeguards.

Complementary access refers to access provided to IAEA inspectors by a State under an Additional Protocol, to enable the inspectors to carry out specific verification and assessment activities to meet the Agency's safeguards objectives. The Agency may request complementary access to a variety of locations in a State with an Additional Protocol in force. The IAEA may request access to any location on a site; complementary access at sites is often conducted in conjunction with DIVs or inspections at facilities on or at the site. Complementary access is also used to confirm the continued decommissioned status of a facility or LOF. The Agency may also request complementary access to locations at which activities take place as declared by a State to the IAEA.[7] Furthermore, the State shall provide access to the Agency to any location specified by the Agency, other than the above, to carry out location-specific environmental sampling, provided that if the State is unable to provide such access, the State shall make every reasonable effort to satisfy Agency requirements, without delay, at adjacent locations or through other means.[8] Each type of access requested has specific advance notice requirements; in some cases this may be less than two hours. In addition to locations associated with State declarations under an AP, the IAEA may also request complementary access to any location in the State. Such conditions require effective coordination within the country, and as with inspections, the State has the right to accompany IAEA

[5] The purposes of routine inspections are listed in paragraph 72 of INFCIRC/153.
[6] Paragraph 89 of INFCIRC/153.
[7] Activities declared pursuant to Article 2 of INFCIRC/540.
[8] INFCIRC/540, Article 5.

inspectors on complementary access, provided that such accompaniment does not impede or delay the access.[9]

Managed access refers to steps taken by the State to prevent the dissemination of proliferation-sensitive information,[10] to meet safety or physical security requirements, or to protect proprietary or commercially sensitive information, in such a manner as to not impede the IAEA's activities to fulfil the purpose of the access. The State when providing its initial declaration pursuant to its Additional Protocol, should inform the Agency of the places at a site or location at which managed access may be applicable. Arrangements for managed access shall not preclude the Agency from conducting activities necessary to provide credible assurance of the absence of undeclared nuclear material and activities at the location in question, including the resolution of a question relating to the correctness and completeness of the information provided by the State in its initial declaration under the Additional Protocol or of an inconsistency relating to that information. An example of managed access is the designation of routes through buildings that avoid areas where inspectors' safety is a concern but which allow inspectors to gain a thorough understanding of the function and purpose of the building. Ultimately, the State must provide sufficient access to information and locations during managed access to allow the IAEA inspectors to fulfil the purpose of the access.

Conclusion

The single most significant obstacle to nuclear weapon development remains acquisition of special nuclear material (SNM) – highly enriched uranium and weapon-usable plutonium. Development of a production capability for SNM cannot be achieved without a number of observable indicators and requires time as well as overcoming considerable obstacles. With advances in safeguards methodologies and practices, ubiquitous availability of unrestricted satellite imagery, national technical means and related capabilities, clandestine production of SNM runs an unacceptably high risk of detection through the implementation of IAEA safeguards – DPRK and Iran are cases in point. For IAEA nuclear verification pursuant to safeguards agreements, the legal and technical basis remains unchanged, i.e. nuclear material accountancy and verification as the core of the safeguards system. Furthermore, safeguards procedures such as the "State Level Approach" or "State Level Concept" need to retain the centrality of nuclear material accounting and verification; third-party or open source and intelligence information when used should be in an open and transparent manner with full disclosure its origin and available for review at the IAEA Board of Governors. Moreover, as in the case of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and the Comprehensive Nuclear-Test-Ban Treaty Organization CTBTO, information on allegations or suspicions of non-compliant activities should be considered only if provided through official channels and subject to consideration and review at the IAEA Board of Governors.

Thus, with a strengthened IAEA safeguards system free of external and internal manipulation and supplemented by credible actionable additional information and data sources, the probability of detection of clandestine production of SNM could be significantly improved. In addition, removing existing SNM production facilities from national control and placing them under multilateral auspices

[9] INFCIRC/540, Article 4.
[10] Such as uranium enrichment or plutonium separation.

with IAEA involvement, and the negotiation of a Fissile Material Treaty including existing stocks and production facilities, would go far in further strengthening the nuclear non-proliferation system and provide additional confidence of assurance of non-proliferation. Finally, if a State is determined to develop or has achieved a break-out capability or nuclear latency – as have several advanced non-nuclear-weapon States – there is no absolute guarantee or system to prevent break-out; this is the enduring dilemma of nuclear technology short of a global prohibition on nuclear weapons and nuclear weapon-usable materials supported by robust verification authority and supplemented by multilateralizing the sensitive parts of the nuclear fuel cycle[11].

Given the several decades' long experience of the IAEA in nuclear verification, the credibility of the Agency's safeguards conclusions, and the recognized independence and impartiality of the IAEA, the Agency is recognized as the sole competent authority to verify States' compliance with their NPT and NWFZ nuclear-non-proliferation obligations. Only the IAEA has the legal authority, under its Additional Protocol, to confirm the absence of undeclared nuclear material and activities. The NPT and all five existing nuclear-weapon-zones rely upon comprehensive safeguards to meet respective treaty requirements. No verification system in the world anywhere can provide an absolute guarantee of detecting violations if a State is taking active concealment measures, on the other hand, the suite of safeguards technologies and methodologies being implemented by the IAEA currently make it very difficult for a State to have the assurance of the non-detection of clandestine nuclear activities by the Agency.

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[11] See, Open-Ended working Group (United Nations General Assembly (UNGA) RES 67/56), *Taking Forward Multilateral Nuclear Disarmament Negotiations*, Geneva, 23 May 2013, "The Roles and responsibilities of Nuclear-weapon Possessing and Nuclear-Weapon States," Presentation by Tariq Rauf: http://www.reachingcriticalwill.org/images/documents/Disarmament-fora/OEWG/statements/23May_Rauf.pdf.