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International Atomic Energy Agency Traditional Safeguards Implementation Process in the United States of America for U.S. Nuclear Regulatory Commission Licensees

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ABSTRACT

The United States Nuclear Regulatory Commission (NRC) is responsible for ensuring obligations required by the United States (US) and International Atomic Energy Agency (IAEA) Safeguards Agreement are met at NRC licensed facilities. Under this US-IAEA Safeguards Agreement, the U.S. allows the IAEA to apply safeguards on all nuclear material within the U.S., excluding only facilities associated with activities with direct national security significance. Additionally, the U.S. periodically provides the IAEA with a list of facilities eligible for the application of safeguards within the U.S. adding or removing facilities from that list as necessary. In 1967, President Johnson committed to this principle to allay concerns that the application of IAEA safeguards could lead to commercial disadvantages for the nuclear industries of non-nuclear-weapon States. Facilities selected by the IAEA for the application of safeguards undergo a challenging transition from being subjected to domestic safeguards alone, to implementing the required additional safeguards measures of the IAEA. International safeguarding activities evolve throughout all life-cycle phases of a selected facility, utilizing updated design information and agreed Facility Attachment arrangements. Managing these transitions requires clear regulatory guidance, frequent IAEA involvement/negotiations, and facility operator cooperation. This paper will describe the implementation process of traditional IAEA safeguards at a NRC licensed facility located in the U.S. and selected from the voluntarily offered eligible facilities list.

Key Words: Safeguards, NRC, Licensees

1. INTRODUCTION

Responsibilities for the control and regulation of by-product, source and special fissionable material in the United States of America (U.S.) were originally described in the U.S. Atomic Energy Act of 1954 (amended) for all nuclear installations built in the U.S..[i] Licensing of these installations, inspections, international activities and enforcement of requirements were assigned to the Atomic Energy Commission until 1974. The Energy Reorganization Act of 1974 created the Nuclear Regulatory Commission (NRC) to license and regulate civilian uses of nuclear materials and facilities, along with the Energy Research and Development Administration (Department of Energy precursor) to direct development and production of nuclear weapons, promotion of nuclear power and other energy-related work, and regulation of defense nuclear facilities. Several changes occurred since the creation of the NRC, including greater intensity in oversight of licensed facilities after the Three Mile Island incident in 1979, and the coming into force of the *Agreement Between the United States of America and the International Atomic Energy Agency for the Application of Safeguards in the United States of America* (US-IAEA Safeguards Agreement) and its accompanying Reporting Protocol (December 9, 1980).

Guidance concerning U.S. policy issues and appropriate steps in resolving disputes associated with the US-IAEA Safeguards Agreement are provided through the IAEA Steering Committee (ISC). Chaired by the U.S. Representative to the IAEA, the ISC heads a structured organization of subcommittees and subgroups of interagency participants including the Department of State (DOS), the NRC, the Department of Energy (DOE), and the Department of Defense (DOD), and others. Decisions on common government issues associated with implementation of IAEA safeguards in the U.S. is vetted through this organizational structure. A representative of the NRC chairs the Subgroup on IAEA Safeguards in the U.S. (SISUS) and participates in all other subgroups and committees of the interagency organization[ii]. The NRC's Office of International Programs (OIP) represents the NRC in U.S. intergovernmental agency discussions concerning the negotiation of international treaties and conventions at the policy level, and works with technical staff during the implementation of those Agreements.

The U.S. NRC provides direct support of U.S. efforts to meet its nuclear non-proliferation obligations under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Acting as the U.S. Safeguards Regulatory Authority for its commercial nuclear industry, the NRC is charged with providing oversight for implementation of procedures and practices necessary to facilitate information gathering, timely reporting, and in-field verification. In addition to facilitating IAEA international nuclear safeguards at licensed facilities in the U.S., the NRC oversees the use of nuclear material and nuclear related activities. Other NRC responsibilities include: participation in negotiations of multilateral international safeguards agreements, reviewing import and export licenses, support implementation of an effective State System of Accounting and Control (SSAC), and responsibility for accounting for source and special nuclear materials at licensed facilities through the Nuclear Material Management and Safeguards System (NMMSS).

2. TRANSPARENCY and REGULATORY GUIDANCE

Under the US-IAEA Safeguards Agreement (INFCIRC/288), "Voluntary Offer," the U.S. allows the IAEA to apply international safeguards on all special nuclear material (SNM) within the U.S., *only* excluding facilities associated with direct national security significance activities. Periodically, the U.S. provides the IAEA with a list of facilities eligible for the application of safeguards; adding or removing facilities from that list as necessary (Art. 2(b)). Revisions to this eligible facilities list (EFL) by the NRC and DOE are submitted for a 60-day Congressional review before they are submitted to the IAEA. As a result, the U.S. submits a completed IAEA Design Information Questionnaire (Art. 42) and negotiates a Subsidiary Arrangement (Art. 39) for those facilities formally selected by the IAEA from this list under the US-IAEA Safeguards Agreement or its Reporting Protocol.

The US-IAEA Safeguards Agreement and its associated EFL stems from discussions held between Nuclear Weapon States (NWS)[1] and major industrial Non-Nuclear Weapon States

[1] Article IX.3 of the NPT defines a nuclear-weapon State as one which manufactured and exploded a nuclear weapon or other nuclear explosive device prior to January 1, 1967. Those States are: China, France, the Russian Federation, the United Kingdom, and the United States of America.

(NNWS), who were concerned that acceptance of safeguards under the NPT would place them at a commercial and industrial disadvantage in developing nuclear energy for peaceful uses. Interferences of IAEA safeguards would affect the efficient operation of their commercial activities and possibly compromise their industrial secrets through IAEA personnel's access to their facilities and records. In recognition of this concern, President Lyndon B. Johnson stated on December 2, 1967 that the United States would not ask any country to accept safeguards that the U.S. was unwilling to accept for its own nuclear activities—excluding those with direct national security significance[iii]. In order to minimize cost to the IAEA, it was decided that safeguards would only be applied to a select number of facilities in the U.S., based on advanced designs or sensitivity in terms of international competition.

Most of the facilities listed on the U.S. EFL are licensed by the NRC, which regulates these facilities in accordance with regulations established and recorded in Title 10 (Energy) of the Code of Federal Regulations (CFR) in order to protect the public health and safety, promote the common defense and security, and protect the environment. Title 10 of the CFR also includes all pertinent aspects of the US-IAEA Safeguards Agreement related to the implementation of IAEA safeguards at licensed facilities. Pursuant to implementing Articles of the Agreement, several parts incorporate references to 10 CFR Part 75 (some applicable parts are summarized below):

- 10 CFR Part 40-Domestic Licensing of Source Materials—Establishes procedures and criteria for the issuance of licenses to receive title to, receive, possess, use, transfer, or deliver source and byproduct materials. References are included to provide direction to applicable US-IAEA Safeguards implementation.
- 10 CFR Part 50-Domestic Licensing of Production and Utilization Facilities—Provides for the licensing of production and utilization facilities (i.e. reactors). References are included to provide direction to applicable US-IAEA Safeguards implementation.
- 10 CFR Part 70-Domestic Licensing of Special Nuclear Material—Establishes procedures and criteria for the issuance of licenses associated with the handling of bulk SNM (i.e. Enrichment, Fuel Fabrication). References are included to provide direction to applicable US-IAEA Safeguards implementation.
- 10 CFR Part 74-Material Control and Accounting of Special Nuclear Material—Prescribed requirements for the control and accounting of SNM and its transport. References are included to provide direction to applicable US-IAEA Safeguards implementation.
- 10 CFR Part 75-Safeguards on Nuclear Material-Implementation of US-IAEA Safeguards Agreement—Prescribed implementation of requirements established by international treaties and agreements between the U.S. and IAEA.

- 10 CFR Part 110-Export and Import of Nuclear Equipment and Material—Prescribed criteria for reporting export and import of nuclear equipment and material. IAEA safeguards outlined in Article III (2); is applied under this Part.

After the entry into force of the US-IAEA Safeguards Agreement in 1980, the U.S. NRC provided oversight for the implementation of traditional IAEA safeguards at several facilities employing rules set forth in 10 CFR Parts 40, 50, 70, 74, 75, and 110.

Currently there are three NRC licensed low enrichment (LEU) fuel fabrication facilities reporting to the IAEA under the U.S. Reporting Protocol, utilizing a Transitional Facility Attachment for guidance and a completed IAEA Design Information Questionnaire (DIQ) describing essential equipment and routine operations of the plant. Historically, the IAEA implemented and subsequently withdrew traditional safeguards at several facilities under the US-IAEA Safeguards Agreement. The list of NRC licensed facilities inspected intermittently between 1980 and 2005 includes: 6 commercial power reactors, 5 LEU fuel fabrication facilities, and two HEU down-blending projects.

It should be noted, that in order for licensees to engage in international trade of nuclear related equipment or materials they must first obtain export licenses from the NRC. Prior to issuing a license, the NRC determines if a bilateral agreement for peaceful nuclear cooperation between the U.S. government and the government of the importing/exporting nation is in place. Conditions necessary to approve an agreement for cooperation are explained in Section 123 of the Atomic Energy Act. Key requirements of these 123 Agreements include the following:

- Safeguards will be maintained with respect to all nuclear materials and equipment transferred. This includes all special nuclear material used in or produced through the use of such nuclear materials and equipment.

- Assurances from the cooperating party that no nuclear materials, equipment or technology will be used for any nuclear explosive device or for any other military purpose.

- Assurance by the cooperating party that adequate physical security will be maintained with respect to any nuclear material

As a compliment to NRC's licensing and regulation role, the DOS, DOC and DOE also participates in export controls.

3. TRANSITIONING SELECTED FACILITITIES TO IAEA SAFEGUARDS

When a licensed facility is selected from the EFL for IAEA safeguards under the US-IAEA Safeguards Agreement, several key communications take place. Initially, an official letter is transmitted from the IAEA to the United States Mission to the International Organizations in Vienna, Austria (UNVIE), notifying the U.S. Government of the selection. An official cable is

then transmitted from UNVIE to the Department of State, with copies to the NRC and other relevant Federal agencies. It is important to note that Article 3.c of the US-IAEA Safeguards Agreement conveys the idea that an IAEA safeguards approach for a selected facility would be at least equivalent in amount and composition to an approach on a similar facility in a NNWS under a Comprehensive Safeguards Agreement (INFCIRC/153). The U.S. also has an Additional Protocol (INFCIRC/540) in force. Therefore, the U.S. should expect an initial safeguards approach similar to one implemented at a comparable facility in a NNWS subject to these IAEA Agreements. Changes are made to an approach through bilateral negotiations, in light of technology advances and maturing safeguarding concepts.

Licensee notification would occur by written notice from the U.S. NRC Office of Nuclear Material Safety and Safeguards (NMSS) that the facility is subject to IAEA safeguards pursuit to Article 39(b) of the US-IAEA Safeguards Agreement. In connection with the selection, the licensee is advised of their obligation to comply with the requirements of 10 CFR Part 75. Pursuant to Article 8, the U.S. is obligated to provide facility information to the IAEA within 45 days of selection by the IAEA in accordance with Code 3.1 of the U.S. Subsidiary Arrangements-General Part. As a result, facility information is provided to the NRC through completion and submission of an IAEA DIQ as soon after notification as possible in order to meet the IAEA timeliness requirement. After an NRC review of the DIQ for completeness and correctness, the design information is forwarded to the IAEA through UNVIE.

Facilities selected by the IAEA for safeguards in the U.S. are usually operating and already have SNM on-site under a material balance area (MBA) designation. Pursuant to Article 60(a), the U.S. is obligated to provide an initial physical inventory listing of all nuclear material to the IAEA within 30 days of the end of the month in which the facility is selected. The initial inventory report is submitted to the IAEA as a Physical Inventory Listing (PIL). This PIL may be based on book values and will represent the beginning inventory for a new material balance period effective as of the initial inventory reporting date. Reporting further PILs and interim inventory changes will be routinely performed using NMMSS, the U.S. national electronic system for nuclear material accounting and reporting to the IAEA (10 CFR 75).

Utilizing facility provided design information and information obtained during site visits, the U.S. Government and IAEA will negotiate a Subsidiary Arrangement (Art. 40) which formally defines the technical and administrative procedures necessary to implement measures contained in the US-IAEA Safeguards Agreement. The selected facility will be consulted during the negotiation process and have an opportunity to comment on all arrangements for its own Facility Attachment (FA) before the procedure is put into practice. A licensee FA will usually be implemented through the issuance of a license amendment or other appropriate means. NRC verifies that safeguarding measures could be effectively applied at licensee facilities with minimal impact on licensee operations, and represents U.S. Government and licensee interests in negotiating FA documents. Transitional Facility Attachments are agreed upon and exercised in the same manner as a FA, but are only used when a facility is selected under the U.S. Reporting Protocol—as in the current situation at all U.S. fuel fabrication facilities. If needed, license

amendments will be issued by the NRC from time-to-time as conditions change affecting either a FA or Transitional FA.

The IAEA will perform an initial site visit or inspection, which occurs before the FA is finalized. Implementation discussions with the licensee will be held on-site, which describe activities to be performed during the course of inspections and visits. Logistics of sampling methods, instrumentation installation, submittal of required records, and inspector access as outlined in the draft FA, are agreed upon between the IAEA and U.S. Government with input from the facility operator. Design information will usually be verified during the initial site visit utilizing the completed IAEA DIQ and will be verified at least once per year thereafter. Verification of the initial inventory will be performed during an initial ad hoc inspection, scheduled through the U.S. notification system for IAEA inspection activities. Normally, physical inventory verification criteria will be utilized during the ad hoc inspection for the initial PIL submitted.

Routine inspections by the IAEA at a selected licensed facility as specified in its FA to verify nuclear material, examine records and reports, evaluate containment and surveillance measures, and other activities are carried out while accompanied on-site by an NRC representative. Each IAEA activity is performed by an IAEA inspector in order to meet the inspection goal for that facility, which consists of a quantity component and a timeliness component. The on-site NRC representative facilitates these activities while they are being performed at the facility to ensure the inspection goal is achieved with minimal impact to plant operations. Full attainment of the inspection goal relies on satisfying criteria relevant to specific material types and categories present at the facility.

Some aspects of an IAEA safeguards approach may be remotely monitored to improve efficiency by providing better utilization of equipment, better planning of inspections and reduction in inspection efforts needed to meet verification requirements. Remote monitoring is a technique whereby safeguards relevant data is collected by unattended containment, surveillance, monitoring and measurement systems, and then transmitted off-site via communication networks to IAEA Headquarters for review and evaluation. Remote monitoring is currently being used by the IAEA across the globe and has been successfully implemented at a U.S. facility. All transmission of data is via a secure virtual private network (VPN), allowing the data to be authenticated and encrypted while being transmitted.

Information communicated to the IAEA concerning a licensed facility's design, location or reporting requirements is furnished by the NRC. However, a licensee may request that information of particular sensitivity that it customarily holds in confidence not be physically transmitted to the IAEA. The NRC will take into account the obligation of the IAEA to take every precaution to protect commercial and industrial secrets and other confidential information coming to its knowledge in the implementation of the US-IAEA Safeguards Agreement. If the request is granted, the NRC will determine a location where the information will remain readily available for examination by the IAEA and inform the licensee.

Termination of safeguards at a facility selected for IAEA safeguards occurs when eligibility of the nuclear material is withdrawn by the U.S. or the IAEA elects to cease safeguards activities by formally notifying the U.S. of de-selection. Updates in design information or Facility Attachments are no longer required to be submitted to the IAEA under the US-IAEA Safeguards Agreement. However, some facility design information may continue to be reportable as part of the U.S. Additional Protocol declaration. The US-IAEA Safeguards Agreement allows for two different forms of selection; through either the principle text of the agreement, or through the associated protocol. In the latter case, there is no opportunity for routine or ad hoc inspections however material balance information is still transmitted to the Agency and the facility is still required to maintain an up-to-date DIQ. The IAEA has chosen, in the past, to transition a facility to selection under the protocol of the US-IAEA Safeguards Agreement, from selection under the principle text, rather than completely terminate all safeguards activities.

4. GOALS AND OBJECTIVES OF SELECTION

The IAEA's primary goals of selection of a facility under Article 39(b) of the principal text of the US-IAEA Safeguards Agreement for the application of IAEA safeguards would be to: 1) test innovative safeguards methods, 2) gain experience at advanced nuclear fuel cycle facilities, 3) fulfill expectations of NNWS that some facilities in the U.S. are subject to IAEA safeguards[iv]. Lessons learned from pursuing these goals would improve the ability of the IAEA to draw a safeguards conclusion on the absence of; a diversion of declared nuclear material, undeclared nuclear materials and undeclared nuclear activities in a NNWS as well as allay concerns of possible commercial industry advantages.

Drawing a sound safeguards conclusion on a facility requires reliable safeguards methods be applied that provide assurances of non-diversion or absence of unauthorized production of SNM. As a result of advances in technology, field testing innovative ideas becomes a priority when attempting to provide confidence that equipment, instrumentation and methods are dependable. Utilizing U.S. facilities as testing grounds will diminish the likelihood of instrument infant mortality, corrupted data and other problems which may be related to the application of innovative safeguards methods at NNWS facilities. Some safeguards methods could greatly impact facility production should a false positive indication of diversion require a needless extensive re-measurement of on-site SNM.

Complicated uranium/plutonium bulk handling facilities require IAEA model safeguards approaches be adapted to the facility; based on design, throughput and physical size. Industry continuously improves its processes in order to be safer, gain efficiency and be more competitive in the marketplace. Matching advances in safeguarding methods to industry progress requires international nuclear safeguards inspectors to continuously raise their awareness of new possibilities in acquiring a nuclear device through plausible proliferation pathways. With the implementation of IAEA safeguards at advanced nuclear fuel cycle facilities in the U.S., new safeguarding concepts and approaches which require actual boots-on-the-ground experience can be evaluated.

Implementation of international safeguards at facilities in the U.S. fulfills President Johnson's edict to permit IAEA safeguards on U.S. (NWS) facilities listed on its EFL. Through the application of these safeguards measures the IAEA is allowed to independently draw a safeguards conclusion, while protecting confidential information and industrial secrets of facilities with no direct national security significance. In addition, the NRC and other U.S. Government entities ensure IAEA safeguards implementation is conducted in a manner designed to avoid hampering international commerce or restricting growth of the peaceful use of nuclear materials.

5. IAEA-NRC-OPERATOR INTERFACE

One of the key elements necessary in successfully meeting the primary goals of implementing IAEA safeguards at a U.S. facility is for operators to have a clear understanding of their role in strengthening nuclear safeguards across the globe. Albeit, developing safeguards concepts and approaches may not manifest itself well on the bottom line of a financial ledger, the broader prospective provided in President Eisenhower's Atoms for Peace speech on December 8, 1953 to the 470th Plenary Meeting of the United Nations General Assembly brings to light a social responsibility to recognize that "…a completely acceptable system of world-wide inspection and control," will foster peaceful use of atomic energy. The IAEA Statue (Art III (A.5)) fulfills that request. The challenges associated with safeguarding all SNM and other materials that might be used for military purposes around the world requires continuous support from member States and their operating nuclear facilities.

Article 31 of the US-IAEA Safeguards Agreement, states that: *pursuant to Article 7, the Agency, in carrying out its verification activities, shall make full use of the United States system of accounting for and control of all nuclear material subject to safeguards under this Agreement and shall avoid unnecessary duplication of the United States accounting and control activities.* However, provisions of the Agreement suggest that there are IAEA "reserved powers"- functions that cannot be delegated or otherwise accomplished by organizations or personnel other than the IAEA and its inspectors. These include independent verification of SSAC findings by the IAEA and the development of safeguards conclusions derived from the IAEA State evaluation process, including anomaly resolution and the detection of undeclared nuclear materials or activities.[v]

Operators of licensed facilities in the U.S. who have been given notice by the U.S. NRC in writing that their installation was selected for the application of IAEA safeguards, may experience changes in certain aspects of NRC domestic safeguards oversight. However, integrating domestic material control and accountancy (MC&A) at the licensed operating facility into activities required by an IAEA nuclear safeguarding approach will normally minimize the operational impact of matching requirements at a particular facility type. Correct, complete and up-to-date reports, records and supporting documentation will be provided to U.S. NRC representatives who will then provide the data to IAEA inspectors for examination at each inspection.

In general, U.S. NRC domestic safeguarding practices related to MC&A are normally comprised of programmatic validations of a facility's ability to meet federal regulatory requirements and safeguards license conditions. An important aspect of NRC inspections is verifying accounting values used for MC&A purposes, which are based on measurements, and that the measurement program includes the capability to perform quantitative determinations of uranium and U-235 content. The IAEA would achieve this inspection parameter by performing nondestructive analysis on the nuclear material—while utilizing a sampling plan which meets the detection criteria for a particular stratum.

Inventory control programs verified by the U.S. NRC have static and dynamic components, similar to IAEA inventory verification techniques. Unique item identification, inventory reconciliation and adequacy of inventory are all verified by the U.S. NRC during inspection activities. The impact to operations of the IAEA safeguards approach could be minimized by jointly performing item monitoring and verification, or the IAEA could take credit for U.S. NRC verification activities.

One of the most important and time consuming activities of an IAEA safeguards approach for a particular nuclear facility is the annual physical inventory verification (PIV). Licensed bulk handling facilities selected for IAEA safeguards in the U.S. usually require several days of inspection effort to complete a PIV, which typically involve many hours of operator support. Strengthening an approach through advanced safeguards concepts and instrumentation could reduce the amount of operator support required during a PIV, thereby improving efficiency of inspection resources and promoting effectiveness of a model approach used in a NNWS.

It is also important to remember that the more capable the operators the better the safeguards information provided to the SSAC and, ultimately, to the IAEA. High-quality personnel, systems, and proactive involvement of facility directors and senior managers in the corporate governance arrangements for safeguards will have a fundamental and positive influence on the implementation of IAEA safeguards. An environment of open communication regarding SSAC performance, IAEA safeguards needs, and limitations on the operators and SSACs could lead to the sharing of good practices in support of both domestic and international nuclear materials management requirements, support the implementation of a SLA, and avoid unnecessary duplication of effort.

6. CONCLUSION

In support of U.S. efforts to meet its nuclear non-proliferation obligations under the US-IAEA Safeguards Agreement, the U.S. NRC works with other U.S. Government entities within an interagency network which forms the U.S. State System of Accounting for and Control of nuclear material. Charged with providing oversight for implementation of procedures and practices necessary to facilitate design information gathering, timely reporting and in-field verification of special nuclear material at licensed facilities, the U.S. NRC provides a list of

licensed facilities eligible for the application of IAEA safeguards as outlined in 10CFR Part 75. When a licensed facility is selected from the EFL for IAEA safeguards under the US-IAEA Safeguards Agreement several key communications take place to ensure timeliness in reporting and a single point of contact within the U.S. Government for the IAEA. The primary goals of selection of a facility under Article 39(b) of the principal text of the US-IAEA Safeguards Agreement for the application of IAEA safeguards would be to assist in addressing the many challenges the IAEA faces because of the enormity of safeguarding all SNM and other materials around the globe. Strengthening an approach through proven advanced safeguards concepts and instrumentation could reduce the amount of operator support required during inspections and visits by the IAEA, thereby improving efficiency of inspection resources and promoting effectiveness of a model approach utilized in a NNWS. Open communications and increased transparency between the facility, the U.S. NRC, and the IAEA during the traditional safeguards implementation process should result in an environment of enhanced cooperation in meeting US-IAEA Safeguards Agreement obligations.

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[i] Atomic Energy Act of 1954, as Amended (P.L. 83-703)
[ii] Federal Register/Vol. 63, No. 28/Wednesday, February 11, 1998/Notices, pg 7041
[iii] http://www.State.gov/t/isn/5209.htm, 2012
[iv] IAEA, The Safeguards System of the IAEA, http://www.iaea.org/OurWork/SV/Safeguards/documents, 2012
[v] James A. Casterton, Chair Standing Advisory Group on Safeguard Implementation, The Further Evolution of SSAC/IAEA Cooperation: SAGSI's Considerations A presentation to the IAEA Safeguards Symposium, Nov. 01-05, 2010