Safeguarding the IAEA Communications Process[1]

Abstract

The United States has been engaged in nuclear materials commerce since 1954. Information regarding these activities is recorded and tracked in the Nuclear Materials Management and Safeguard System (NMMSS). NMMSS data include export, import, and retransfer of U.S. nuclear materials located in foreign countries. In order to transmit these data to the IAEA (International Atomic Energy Commission), NMMSS has been using the IAEA-developed Safeguards Declaration Portal (SDP). Since the decision to implement the SDP (June 2022), NMMSS has been able to capitalize on substantial benefits offered by this new software including: near real time transmission of reports and associated IAEA feedback; edits to alert users that data entry fields may contain errors or omissions; an archival reference library of previous submittals; infrastructure protocols that allow for real-time notification of incoming IAEA communications; and a customizable U.S. stakeholders' environment that formalizes the internal U.S. coordination, review, and approval process. Most importantly, the SDP has resulted in significantly reducing the number of false-error transit matching issues, thereby reducing NMMSS operating costs associated with investigating and resolving avoidable reporting concerns. This paper discusses the NMMSS experience in using the SDP to strengthen its IAEA reporting processes, provides suggestions for further program enhancements, and outlines NMMSS plans to utilize the SDP concept for other international NMMSS reporting and communications projects.

Introduction

The Department of Energy's National Nuclear Security Administration's (DOE/NNSA) NMMSS is the United States' primary method of tracking possession, use, and shipment of source and special nuclear material within the U.S. as well as exports and imports of these materials. NMMSS also maintains historical records dating back to the 1940s that serve as the authoritative source in preparing reports (referred to as "declarations") of U.S. balances and inventories of plutonium and highly enriched uranium. NMMSS is sponsored by DOE and the Nuclear Regulatory Commission (NRC) and collects data from over 420 governmental and commercial nuclear entities.

NMMSS is a dynamic system which has evolved over decades in response to changing sources, uses, and risks associated with nuclear materials. A diverse group of key domestic stakeholders within both the legislative and executive branches of the U.S. government relies on NMMSS information to enact policy and make programmatic decisions. NMMSS's analytical services and information products fulfill transparency obligations and commitments to the IAEA and other countries under safeguards, nonproliferation treaties, and peaceful use agreements.

To demonstrate compliance under peaceful-use provisions with its foreign partners, the U.S. relies on facility operators to maintain and supply the NMMSS material and accounting data in accordance with DOE/NRC reporting requirements. NMMSS processes the facility data and

[1] Peter Dessaules and Loida Begley, Department of Energy, National Nuclear Security Administration (DOE/NNSA), Eduardo Sastre, U.S. Nuclear Regulatory Commission (NRC), and Ali Tabatabai, Link Technologies, Inc.

periodically provides reports to both DOE and NRC policy makers for review and submittal to IAEA and foreign partners.

NMMSS Information Types/Frequency Provided to IAEA

The IAEA annually collects and processes over one million nuclear material accounting report entries submitted by more than 70 member states; of all records processed yearly by the IAEA, approximately 60,000 are submitted by NMMSS. The analysis of these data supports the IAEA in drawing its yearly safeguards conclusions for each member state and in preparing its annual safeguards implementation report. NMMSS submittals to the IAEA are based on three different Information Circulars (INFCIRC) used to communicate IAEA requirements to member states as shown in Figure 1.

In addition to monthly Inventory Change Reports (ICR), annual Material Balance Reports (MBR), and annual Physical Inventory Listings (PIL), NMMSS also responds to IAEA questions and feedback associated with import communications, semi-annual statements, and transit matching. All data, including questions from the IAEA and NMMSS responses, are transmitted bidirectionally using the SDP.

Figure 1. NMMSS Reporting to the IAEA

INFCIRC	Description	Report Types	Frequency
207	Imports and exports	ICR	Monthly
288	Domestic and international movements of materials to and from the U.S. facilities selected by the IAEA	ICR PIL MBR	Monthly Annually Annually
366	Modified small-quantity protocol (SQP) reporting movements of nuclear material to and from the U.S. territories to the Caribbean	ICR PIL	Annually Annually

Notification of Exports and Imports of Peaceful Use Nuclear Material

The U.S. reports all exports and imports of peaceful use nuclear material to the IAEA; its reporting commitments fulfill requirements of *Notification to the Agency of Exports and Imports*

of Nuclear Material (INFCIRC/207) as well as *U.S.-IAEA Safeguards Agreement* (INFCIRC/288).

The INFCIRC/207 commitment is to report imports/exports consisting of one effective kilogram or more of material (i.e., 10,000 kilograms of natural uranium or 1,000 grams of plutonium) involving a non-nuclear weapon state. The U.S. also voluntarily reports imports/exports involving one gram or more of special nuclear material and one kilogram or more of source material from a non-weapon state or from the other four declared nuclear weapon states (China, Russia, France, and United Kingdom).

The IAEA uses these data to match transfers of nuclear material between shippers and receivers. The agency evaluates international transfers to ensure all reported exports can be verified and matched to imports; this work is called 'transit matching.'

U.S.-IAEA Safeguards Agreement

The U.S.-IAEA Safeguards Agreement (also called the Additional Protocol or Voluntary Offer Agreement) is a treaty between the U.S. and the IAEA for the application of international safeguards on nuclear material at facilities in the U.S. Although not required to do so under the Treaty on the Non-Proliferation of Nuclear Weapons, the U.S. voluntarily signed (in 1977) and executed this safeguards agreement in permitting the IAEA to apply safeguards on all source or special nuclear material. The agreement involves all facilities within the U.S., excluding only facilities with direct national security significance.

In order to comply with U.S.-specific provisions of the safeguards agreement, the U.S. maintains a list of facilities eligible for IAEA safeguards. This list, called the Eligible Facilities List (EFL), is periodically updated to contain NRC and DOE facilities or locations that have been reviewed and approved by the U.S. government as not being associated with activities of direct national security significance. Since the safeguards agreement entered into force, more than 250 facilities licensed by the NRC have been placed on the EFL. Four NRC-licensed and one DOE facility are currently specifically selected by the IAEA for submitting nuclear material accounting data to the IAEA.

Under the U.S.-IAEA Safeguards Agreement, the U.S. provides nuclear material accounting data as well as potential access to any nuclear facility selected by the IAEA. The fundamental safeguards measure used by the IAEA to verify declarations is detailed nuclear material accountancy. The IAEA performs its verification activities using several methods including observation, verification of design information, review of nuclear material accountancy records and reports, independent measurements, containment and surveillance, and unattended monitoring. The IAEA also confirms that any facility selected for verification is being used only for the declared peaceful purpose. Since 1980, 21 U.S. facilities have been selected by the IAEA for verification.

NMMSS submits to the IAEA four different types of accounting data for U.S. selected facilities:

1. Material Balance Report (MBR): comparison accounting based on calculated ending inventory and the measured physical inventory of nuclear material present.

2. Physical Inventory Listings (PIL): identification of inventory items.
3. Inventory Change Reports (ICR): documentation of changes to the facility inventory which include shipments, receipts, nuclear transformations (e.g., production of plutonium and consumption of uranium), transfers to waste, process losses, and accidental gains or losses of material that occur within the facility boundaries.
4. Concise Notes: exposition narrative from the facility informing the IAEA of qualifying statements or exceptions regarding the data contained in reporting forms required under the U.S.-IAEA Safeguards Agreements.

The U.S.-IAEA Safeguards Agreement is a key component of U.S. international nuclear non-proliferation policy. Its objective is to verify and document that nuclear material subject to safeguards is not used for nuclear weapons or other explosive devices.

Nuclear Weapons Free Zones Reporting

The *Treaty for the Prohibition of Nuclear Weapons in Latin America* (The Treaty of Tlatelolco) has 33 signatories and was entered into force in 2002. The treaty was ratified by the five nuclear-weapon states and it requires that parties with international responsibility for territories within Latin America must respect specific denuclearization provisions of the Treaty and conclude an IAEA safeguards agreement for their territories.

Reporting is per INFCIRC/366, *Safeguards Implementation Guide for States with Small Quantities Protocol* (SQP*)*. U.S. Caribbean territories include Puerto Rico, the U.S. Virgin Islands, Navassa Island, Serranilla Bank, Baja Nuevo (Petrel Island), and the Guantanamo Bay Naval Base. U.S. Caribbean facilities have minimal quantities of nuclear material used primarily in medical, industrial, and research applications.

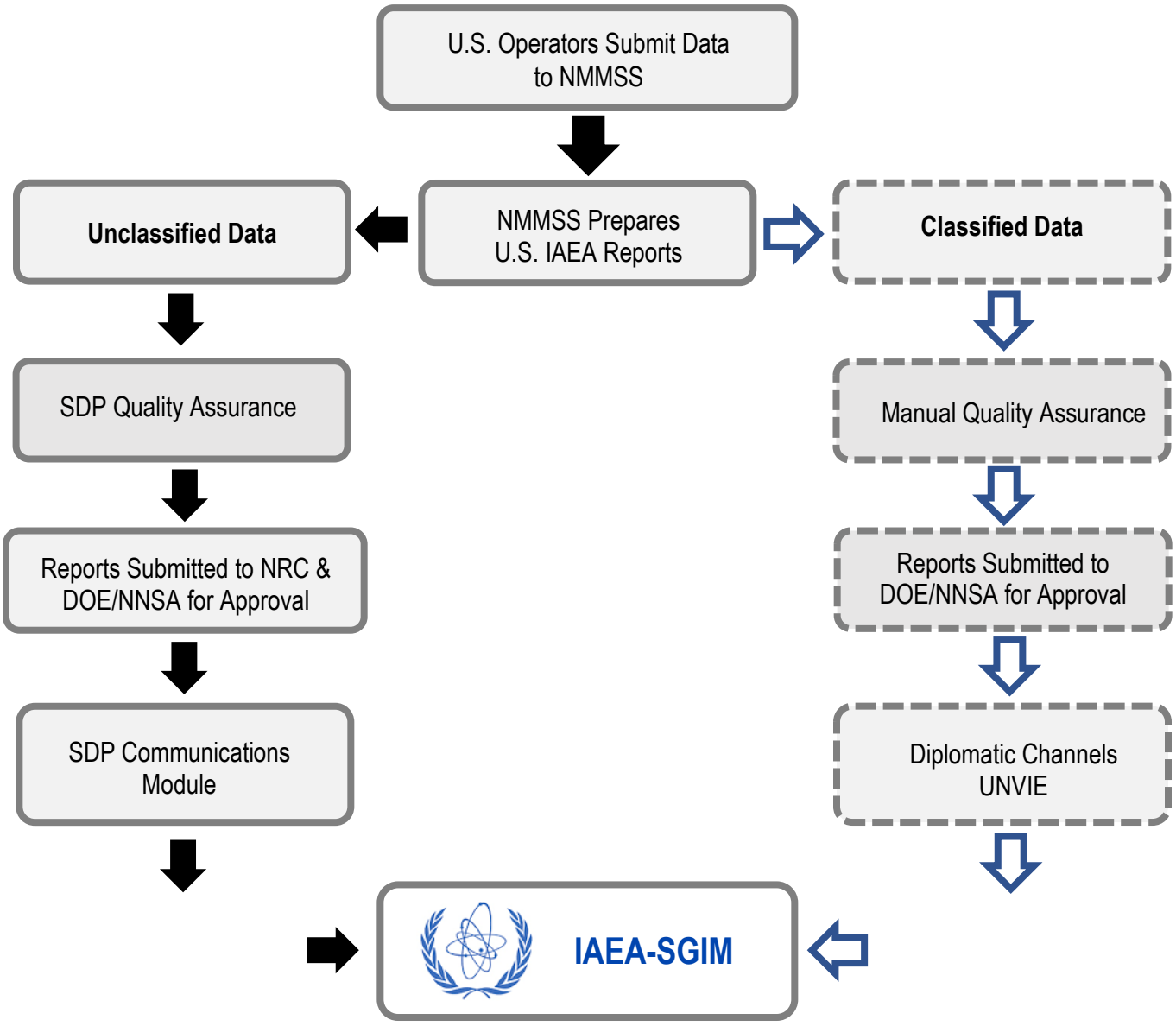
NMMSS submitted the initial SQP nuclear material inventory report to the IAEA in 2018 and has subsequently updated this information annually. Updated information consists of current inventories and changes such as nuclear material imports exports and exports.

IAEA Declarations Portal

In 2017, the IAEA launched a new web-based system streamlining the submission of safeguards information called the State Declarations Portal (SDP) which supports information exchange between State and Regional Authorities (SRAs) and the IAEA. The new SDP operates on a secure online network and is designed to save both time and effort in information exchanges with member states. Information protection is enhanced by two-factor authentication and end-to-end encryption. As of March 2019, more than 30 nation-states had adopted the SDP approach for information sharing with the agency.

In September 2018, NMMSS received authorization from the U.S. government to test and evaluate SDP functionalities as the primary mechanism for submission of U.S. nuclear material and safeguards reports to the IAEA. The NMMSS process for submitting unclassified data to the IAEA is shown in Figure 2. Classified data is handled separately through diplomatic channels by the U.S. Mission to the IAEA in Vienna, Austria (UNVIE) and is not discussed in this paper.

Figure 2. Process for Submitting U.S. Reports to the IAEA Using the SDP



Advantages of Using the IAEA Declarations Portal

The SDP has proven to be an excellent tool for submitting U.S. nuclear material accountancy reports to the IAEA. The SDP is intuitive and effective; implementation costs involved staff training which was minimal. Integration of SDP into the current NMMSS reporting process protocol, hierarchy, and framework has proven to be seamless and extremely practical. Advantages of the IAEA system include: end-to-end encryption, dynamic quality control

algorithms, linked historical datasets, robust collaborative working environment, bidirectional communication, and enhanced embedded messaging. Collectively, these features have:

- Reduced the number of false-error transit matching issues, thereby lowering NMMSS operating costs associated with investigating and resolving avoidable reporting concerns.

- Diminished human data-entry errors by using auto-edits alerting users that data fields may contain errors or omissions.

- Decreased analyst research time for previously submitted data by providing an online archival reference library of earlier U.S. reports.

- Improved communication speed with near real-time IAEA feedback which allows the U.S. to immediately begin the data resolution process. For example, acknowledgement letters confirming that U.S. nuclear material accounting declarations have been received are extremely useful for managing workflow.

- Improved internal U.S. communications processes using SDP's customizable document management feature to formalize the U.S. approval process.

- Fostered a collaborative work environment encouraging teamwork and addressing continuity of operations issues.

- Formalized the NMMSS-IAEA training process by providing analysts with a documented knowledge capture environment.

- Enabled customized reporting for U.S. government stakeholders to maximize control of the internal review and approval process by providing real-time shared access to view reports and data associated with submittals.

Suggested SDP Enhancements

NMMSS has identified several enhancements that could increase SDP capabilities and increase the overall user value/satisfaction of future releases. These enhancements include:

- Expanded user guide with additional information on product configuration instructions.

- Enhanced quality assurance to validate conformity with current reporting guideline.

- New functionalities including complex data queries/searches and automated online editing of to-be-submitted data.

Integrate SDP Functionality to Other International Activities

The growth of the NMMSS nonproliferation mission was recognition of the interdependencies between IAEA reporting and reporting requirements specified under U.S. Bilateral Peaceful Nuclear Cooperation Agreements (NCA). Many of the IAEA reporting issues are very similar to NCA reporting. For example, in both cases, the U.S. relies on its facility operators to maintain and supply the NMMSS with often analogous data in accordance with DOE/NRC and IAEA/NCA reporting commitments. The aim of both IAEA and NCA reporting is also to demonstrate compliance with peaceful-use provisions of provided nuclear materials. To meet these conditions, NMMSS uses the same facility data and repackages/reformats it to meet specific country/report requirements.

As with IAEA data, the NCA information needs to be protected using approved encryption methods for reports prepared weekly, monthly, quarterly, and annually. Besides data protection schemes, there are also report management concerns and data quality issues. Because of the inherent complexity of the overall NCA process, NMMSS has been exploring the IAEA SDP concept for potential transportability in building a new NMMSS Declarations Portal.

Acknowledgement

The NMMSS team acknowledges the many contributions made by IAEA Department of Safeguards, Division of Information Management (SGIM) to strengthen U.S. nonproliferation information management endeavors. The development and implementation of the SDP has been enhanced by SGIM's flexibility and responsiveness in providing technical assistance during the entire execution and operational phases.