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International Atomic Energy Agency

# Safeguards Implementation Practices Guide on Provision of Information to the IAEA

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**IAEA Services Series 33**

SAFEGUARDS IMPLEMENTATION  
PRACTICES GUIDE ON PROVISION  
OF INFORMATION TO THE IAEA

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PRACTICES GUIDE ON PROVISION  
OF INFORMATION TO THE IAEA

INTERNATIONAL ATOMIC ENERGY AGENCY  
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## FOREWORD

The IAEA implements safeguards pursuant to agreements concluded with States. It is in the interests of both States and the IAEA to cooperate to facilitate the practical implementation of safeguards. Such cooperation is explicitly required under all types of safeguards agreement and is furthered through a common understanding of the respective rights and obligations of States and the IAEA. To address this, in 2012 the IAEA published IAEA Services Series No. 21, *Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols*, which aimed at enhancing understanding and improving cooperation in safeguards implementation.

To meet their safeguards obligations, States may establish different processes and procedures at the national level, and set up their infrastructure to meet their specific needs. Indeed, a variety of approaches are to be expected, owing to differences in the size and complexity of States' nuclear programmes, their regulatory framework and other factors.

The purpose of this Safeguards Implementation Practices (SIP) Guide is to share the experiences and good practices as well as the lessons learned by both States and the IAEA, acquired over the many decades of safeguards implementation. This SIP Guide addresses the important topic of the provision of information by States to the IAEA. Declarations by States form the basis for IAEA verification activities, and the quality and timeliness of such declarations impact significantly the efficiency of safeguards implementation.

The information contained in the SIP Guides is provided for explanatory purposes and their use is voluntary. The descriptions in the SIP Guides have no legal status and are not intended to add to, subtract from, amend or derogate from, in any way, the rights and obligations of the IAEA and the States set forth in *The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons* (issued as INFCIRC/153 (Corrected)) and *Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards* (issued as INFCIRC/540 (Corrected)). This SIP Guide provides information which States may find useful in implementing their safeguards agreements with the IAEA.

The IAEA wishes to acknowledge the many safeguards experts and practitioners from Member States who have contributed to the creation of this SIP Guide. The IAEA appreciates the Member State Support Programmes that participated in Task JNT C01959: Member State Contributions to IAEA Topical Guidance on Safeguards Implementation, which facilitated the participation of external experts in providing input to these SIP Guides. The IAEA officer responsible for that task and for this publication was C. Mathews of the Division of Concepts and Planning.

#### *EDITORIAL NOTE*

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# 1. INTRODUCTION

## 1.1. PURPOSE, SCOPE AND STRUCTURE

The purpose of Safeguards Implementation Practices (SIP) Guides is to share information about effective safeguards implementation practices for the benefit of all States, particularly with the aim of enhancing their capacity and capabilities in the area of safeguards implementation. States with Small Quantities Protocols are advised to also refer to the *Safeguards Implementation Guide for States with Small Quantities Protocols* (IAEA Services Series 22)<sup>1</sup>.

This SIP Guide addresses the activities undertaken by a State to **collect, review and provide to the IAEA complete, correct and timely information**, including, for example, nuclear material accounting reports, facility design information, import/export notifications, and additional protocol (AP) declarations.

The Guide primarily addresses the activities undertaken by the IAEA and States pursuant to a comprehensive safeguards agreement (CSA) based on INFCIRC/153 (Corr.) and an AP based on INFCIRC/540 (Corr.). However, States that have concluded a voluntary offer safeguards agreement (VOA) and States that have concluded item specific safeguards agreements based on INFCIRC/66/Rev.2 could also use this Guide to facilitate the implementation of their safeguards agreements.

SIP Guides belong to a series of guidance prepared by the IAEA with the assistance of experts from Member States. The Guides comprising this series are shown in Figure 1. The SIP Guides further elaborate on the content of the *Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols* (IAEA Services Series 21). This SIP Guide addresses the provision of information to the IAEA, primarily Sections 4 through 8 of Services Series 21, which cover:

- Provision of initial information on nuclear material;
- Provision of information on locations in the State including facilities, locations outside facilities (LOFs), and sites;
- Initial and updated State declarations on nuclear fuel cycle-related activities;
- Nuclear material inventories, inventory changes, exports and imports; and
- Special reports, amplifications and clarifications.

This SIP Guide also addresses voluntary provision of information by States about stocks, exports and separation of americium and neptunium. Several annexes offer case studies and examples of good practices.

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<sup>1</sup> This publication can be found at <http://www-pub.iaea.org/books/IAEABooks/10493/Safeguards-Implementation-Guide-for-States-with-Small-Quantities-Protocols>, and is available in English, French and Spanish.

**Key points** are provided in coloured text boxes such as this one.

*Implementation practices and examples are contained in white text boxes with italicized text.*

The diagram shown in Figure 1 indicates the subjects of each of the four SIP Guides, and their relationship with the higher level *Guidance for States Implementing CSAs and Additional Protocols* (IAEA Services Series 21). States with small quantities protocols are encouraged to review IAEA Services Series 22. Other IAEA Services Series such as 11 and 15 (on AP declarations and nuclear material accountancy, respectively) provide topical guidance in a number of areas. Guidance documents and many other resources can be found at [www.iaea.org/safeguards](http://www.iaea.org/safeguards) under the ‘Assistance for States’ tab.

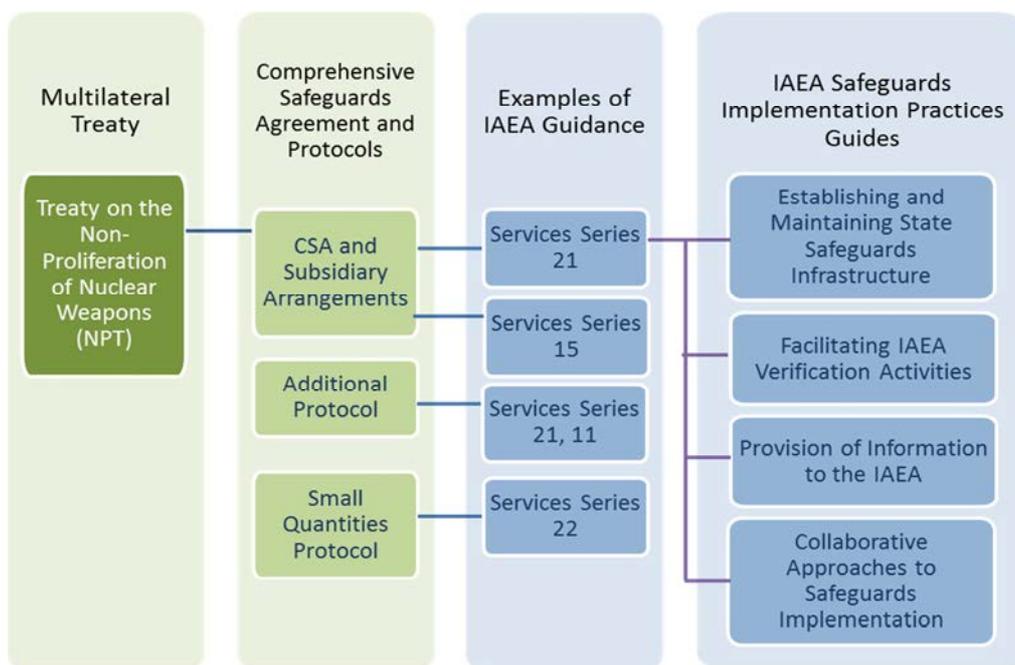


FIG. 1. IAEA safeguards guidance related to CSAs.

## 1.2. THE STATE OR REGIONAL AUTHORITY AND THE STATE SYSTEM OF ACCOUNTING FOR AND CONTROL OF NUCLEAR MATERIAL

The IAEA and the State must cooperate to implement safeguards. States with CSAs are required to establish and maintain a State system of accounting for and control of nuclear material (SSAC). The SSAC and the State<sup>2</sup> authority with responsibility for safeguards implementation (SRA) are described below.

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<sup>2</sup> In the rest of this document publication the word ‘State’ is used in relation to either a single State or, as applicable, a group of States which have agreed to establish a regional organization with nuclear material accounting and control responsibilities or other responsibilities relating to the implementation of safeguards.

The **State authority with responsibility for safeguards implementation** is the authority established at the national level to ensure and facilitate the implementation of safeguards. In addition to its safeguards functions, the SRA (if established within a broader nuclear authority) may have additional responsibilities associated with nuclear safety, security, radiation protection and export/import controls. One of the primary responsibilities of an SRA is to establish (initially) and maintain (continuously) an SSAC.

An **SSAC as a system** is comprised of all of the elements that enable the State to fulfill its nuclear material accounting, control and reporting responsibilities. These elements include information systems (computerized or paper-based); operators of facilities and other locations and their nuclear material accounting systems that produce accounting data; various processes, procedures and administrative controls (such as for import and export reporting; collection and submittal of design information); quality checks; and the SRA itself and its oversight activities to ensure all safeguards obligations are effectively met.

It is recommended that all safeguards responsibilities (pursuant to safeguards agreements as well as APs) be assigned to the same State authority. However, sometimes a State may assign some safeguards responsibilities to one State authority (such as nuclear material accounting and reporting) and some to another State authority (such as preparing and submitting AP declarations). This could be based on legal or practical reasons related to the functions or competencies of certain State authorities. In such a case, the responsibilities of an SRA are fulfilled by two or more State authorities, and those authorities should coordinate with one another as necessary to ensure effective safeguards implementation.

### 1.3. COLLECTING INFORMATION AND PROVIDING IT TO THE IAEA

States are required to provide information to the IAEA pursuant to their safeguards agreements and APs. Many States also provide information voluntarily to the IAEA. The IAEA verifies information contained in State reports and checks its consistency with facility records and with the results of its independent verification. Information provided by States pursuant to their APs enhances the IAEA's ability to evaluate the consistency of State declarations to ensure they are correct and complete.

The volume of information provided by a State to the IAEA depends mainly on, e.g. whether or not the State has concluded an AP; the number and type of facilities in the State; nuclear fuel cycle-related research and development (R&D) activities carried out or planned in the State; and the frequency of nuclear material inventory changes. A State with few or no facilities will normally submit far less information than a State with many facilities. Section 2 summarizes the main types of information collected by States and provided to the IAEA.

#### **INFCIRC/153 Paragraph 7**

The Agreement should provide that the State shall establish and maintain a system of accounting for and control of all *nuclear material* subject to safeguards under the Agreement, and such safeguards shall be applied in such a manner as to enable the Agency to verify, in ascertaining that there has been no diversion of *nuclear material* from peaceful uses to nuclear weapons or other nuclear explosive devices, findings of the State's system. ...

**INFCIRC/153 Paragraph 8**

The Agreement should provide that, to ensure the effective implementation of safeguards thereunder the Agency shall be provided, in accordance with the provisions set out in Part II below, with information concerning *nuclear material* subject to safeguards under the Agreement and the features of *facilities* relevant to safeguarding such material. ...

**INFCIRC/540 (Corr.) Article 2**

a. [The State] shall provide the Agency with a declaration...

In order to implement its safeguards obligations, each State needs to establish three fundamental elements of its safeguards infrastructure:

- 1) Laws, regulations and a system of accounting for and control of nuclear material at the national/regional level, and designation of an SRA, which ensure that the requirements of the safeguards agreement, subsidiary arrangements and AP (if applicable) are fully met;
- 2) Infrastructure to facilitate the collection, validation and provision of timely, correct and complete reports, declarations and other information to the IAEA; and
- 3) Infrastructure to facilitate the provision of support and timely access, to the IAEA, to locations and information necessary to carry out safeguards activities.

This SIP Guide focuses primarily on the second of these three elements. Please refer to the *SIP Guide on Facilitating IAEA Verification Activities (IAEA Services Series 30)* and the *SIP Guide on Establishing and Maintaining State Safeguards Infrastructure (IAEA Services Series 31)* for more information on the other two elements.

## **2. OVERVIEW OF INFORMATION PROVIDED BY STATES**

States provide a variety of information to the IAEA pursuant to their safeguards agreements and APs. This section provides an overview of such information and the mechanism and timing for its submission to the IAEA. Information provided pursuant to a CSA is submitted in accordance with requirements of the agreement and as specified in more detail in the associated Subsidiary Arrangements. This includes information about State laws and regulations pertaining to implementation of the safeguards agreement, and the organizational units (at the national and facility levels) responsible for safeguards activities.

Details regarding the format of nuclear material accounting reports are specified in Code 10 of the General Part of the Subsidiary Arrangements. The contents and timing for submission of AP declarations are specified in Articles 2 and 3 of INFCIRC/540 (Corr.). The IAEA provides detailed guidelines on preparing and submitting AP declarations in IAEA Services Series 11. Nuclear material accounting and reporting are discussed in IAEA Services Series 15.

This SIP Guide provides **examples, good practices and explanations** regarding the various types of safeguards related information submitted by States to the IAEA.

## 2.1. TYPES OF INFORMATION

Information provided by States to the IAEA can be grouped into seven main areas:

- 1) Information on facilities and on locations outside facilities where nuclear material is customarily used (LOFs);
- 2) Nuclear material accounting information;
- 3) Advance notification of imports and exports of nuclear material;
- 4) Reports on the import and export of any material containing uranium or thorium, which is not 34(c) material (i.e. reporting under INFCIRC/153 (Corr.) paragraphs 34(a) and (b));
- 5) Special reports, amplifications and clarifications;
- 6) Information required by an AP; and
- 7) Voluntarily provided information.

Information is also provided by States to the IAEA for the purpose of aiding the planning of verification activities. Each of these is described briefly below.

## 2.2. FACILITIES AND LOFS

Design information is submitted and updated as necessary for each facility using a ‘design information questionnaire’ (DIQ), including a description of the form, location and flow of nuclear material; a general layout; description of features relating to nuclear material accountancy, containment and surveillance; and a description of existing and proposed procedures for nuclear material accountancy and control and the procedures for physical inventory taking. An example of a DIQ for a research reactor can be found in Annex I.

Information concerning LOFs is submitted using a ‘LOF information template’. This includes a general description of the use of the nuclear material and its geographic location; contact information; and a general description of the existing and proposed procedures for nuclear material accountancy and control.

Basic information about a facility’s annual operational programme, including its plans for taking a physical inventory, working schedule, holidays and processing schedule (such as outages, refuelling, etc.) must be submitted as specified in the Facility Attachment (FA). Facility safety requirements (training, certifications) and radiological protection are also described. In addition, as agreed between the IAEA and the SRA, supplemental information might be provided to enable the IAEA to implement its safeguards approach.

### 2.3. NUCLEAR MATERIAL ACCOUNTING REPORTS

When a State brings into force its CSA with the IAEA, it submits an ‘initial report’ on its nuclear material inventory. This information and other information is used by the IAEA to work with the State in establishing material balance areas (MBAs) that will be used to account for nuclear material in the State and for concluding Subsidiary Arrangements. Thereafter, the State submits nuclear material accounting reports for each MBA as described below.

Inventory change reports (ICRs) provide information about changes in the inventory of nuclear material (including transfers within a State from one MBA to another) and are submitted as specified in the Subsidiary Arrangements (typically within 30 days after the end of the month in which the changes occurred or were established).

Material balance reports (MBRs) provide a summary of the material balance in the MBA reflecting all inventory changes in a material balance period (MBP). MBRs are submitted as specified in the Subsidiary Arrangements (typically, within 30 days of a physical inventory taking (PIT)).

Physical inventory listings (PIL) include all batches of nuclear material separately and specify material identification and batch data for each batch at each key measurement point (KMP). PILs are submitted with the corresponding MBR (except for an initial PIL, which is a standalone report).

All nuclear material accounting reports are prepared based on information contained in facility records (general ledgers, shipping documentation, measurement data, calibration data, material movement logs, etc.). Complete and well-organized records and documentation are a critical component of an effective nuclear material accounting system at each MBA.

As needed, States submit corrections to nuclear material accounting reports. States also provide important information in the form of Concise Notes or Textual Reports, which are explanations related to, e.g. nuclear material reporting or facility operations.

### 2.4. IMPORTS AND EXPORTS OF NUCLEAR MATERIAL

Information is submitted by States on international transfers of nuclear material. Such transfers are reported in advance, through ‘advance notifications’ of export/import. Once the imports or exports have occurred, they are reported to the IAEA as an inventory change.

The IAEA uses this information to match transfers of nuclear material between shippers and receivers. The IAEA evaluates the transfers to ensure all reported exports can be accounted for and matched with reported imports; this work is called ‘transit matching’. Annex II describes good practices for aiding the IAEA’s transit matching efforts.

### 2.5. IMPORTS AND EXPORTS OF PRE-34(C) MATERIAL

States also submit information on imports and exports of material containing uranium or thorium, which does not meet the conditions specified in paragraph 34(c) of INFCIRC/153

(Corr.). In IAEA Services Series 21, this material is referred to as pre-34(c) material. Whether the imports or exports are specifically for non-nuclear purpose or not determines how they are reported (under a CSA or in an AP declaration).

## 2.6. INFORMATION REQUIRED BY AN AP (INFCIRC/540 (CORR.))

Initial and updated information is provided by a State with an AP in force<sup>3</sup> as specified in Articles 2 (content of the declarations) and 3 (timing and submission) of INFCIRC/540 (Corr.). Initial declarations are provided within 180 days after a State's AP comes into force. Thereafter, updates are submitted annually.

In addition to the initial declarations and annual updates, information is provided quarterly on specified equipment and non-nuclear material listed in Annex II of INFCIRC/540 (Corr.), including, for each export of such equipment and material: the identity, quantity and location of intended use in the receiving State. Full guidance is provided in IAEA Services Series 11, and implementation practices are further described in Section 11 of this SIP Guide.

## 2.7. SPECIAL REPORTS, AMPLIFICATIONS AND CLARIFICATIONS

A 'special report' is submitted by States to the IAEA, to report unusual occurrences of relevance to safeguards, such as the possible loss of nuclear material. These are to be submitted within 72 hours of the event. 'Amplifications' (requesting additional information) or 'clarifications' (requesting the resolution of questions regarding information that was already provided) are submitted in response to a request by the IAEA.

## 2.8. VOLUNTARY INFORMATION

States also voluntarily provide information, e.g. on separated americium and neptunium, related separation activities and on certain exports. All of this information is provided annually. Once a State joins a voluntary reporting scheme, it commits to provide relevant information to the IAEA. States are also encouraged to participate in the IAEA's 'Incident and Trafficking Database' (ITDB) which maintains a record of seized nuclear and radioactive material reported by States.

## 2.9. PROVISION OF INFORMATION TO ASSIST THE IAEA IN PLANNING ITS ACTIVITIES

States and the IAEA may agree upon the provision of other information to support specific safeguards activities (such as unannounced inspections and use of remote monitoring). Some SRAs prepare an annual safeguards national audit/inspection programme that specifies when the SRA will conduct audits of facility design documentation, nuclear material accountancy, non-destructive assay (NDA) measurement campaigns and national inspections. When an SRA provides this information voluntarily to the IAEA, it can help the IAEA to schedule its in-field verification activities to take advantage of circumstances that are beneficial to the

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<sup>3</sup> Or when an Additional Protocol is provisionally applied.

IAEA's objectives, including minimizing disruption to facility operations. Information is also submitted regarding facility operational programmes and calendars showing national public holidays.

In all cases, discussions between the SRA and IAEA are helpful in determining the kind of information that would be useful to the IAEA.

### **3. ESTABLISHING A STATE SAFEGUARDS INFORMATION MANAGEMENT SYSTEM**

In order to manage all of the information described above, each SRA will need to establish a system with which to collect, process, check, format and submit information to the IAEA. Such a system is referred to in this SIP Guide as a State's safeguards information management system (SIMS). Depending on how a State sets up such an information system, it can serve multiple purposes, including:

- Nuclear material management (accounting, import/export, transportation, storage, bilateral supply agreements, etc.);
- Safeguards reporting and declaration requirements;
- Acquisition, use and disposition of nuclear material;
- Safety;
- Security;
- Efficiency of operations; and
- Organization of resources.

#### **3.1. DESIGNING A SAFEGUARDS INFORMATION MANAGEMENT SYSTEM**

States are not required to set up a SIMS, but it is recommended and in practical terms, it is necessary. States with a CSA are required to establish and maintain an SSAC; an information management system is very helpful in fulfilling this obligation.

A SIMS may be very simple, involving a set of procedures and policies and some spreadsheets, or may be complex, including nuclear material accounting systems at facilities and software applications used by the SRA and by safeguards officers at facilities to transmit and check the quality of data, with features to enable the automated production of nuclear material accounting reports. Annex III provides case studies of States' experiences in designing and establishing SIMS and related software applications to support the collection and management of information.

Each SRA should determine its functional requirements and establish a system to meet its needs. This is discussed in general terms in IAEA Services Series 31. This SIP Guide provides additional detailed information regarding **system functionality**.

In general terms, information management is the collection and management of information from one or more sources (from within or outside the State) with distribution to one or more users or recipients. The primary related functions are acquiring, organizing, formatting, securing, validating, maintaining and retrieving information. The information system is managed through careful planning, organization, procurement, quality assurance, evaluation, reporting, archiving, securing and auditing.

A State's SIMS can be designed to produce a number of useful outputs, such as:

- Describing the flow of information from facilities and LOFs (and other entities) to the SRA (including design information, operational programme, and answers to any IAEA requests for amplifications or clarifications, for example) and who is responsible to provide the information (See Figures 2 and 3);
- Describing the processes and information flows in the State for the provision of nuclear material accounting reports to the IAEA;
- Describing the reporting entities, processes and information flows for preparing and submitting AP declarations, including the identification of new entities (i.e. organizations with AP reporting obligations) each year;
- Evaluating consistency between facility records/reports and State reports;
- Describing how nuclear material accounting reports are produced for each material balance area (MBA), including how any necessary corrections are made;
- Establishing and supporting quality control and quality assurance procedures;
- Supporting correspondence with facilities/LOFs operators and other reporting entities, and with the IAEA; and
- Implementing a plan for information archiving and disaster recovery.

Figures 2 and 3 depict the flow of information in a State and the various actors involved.

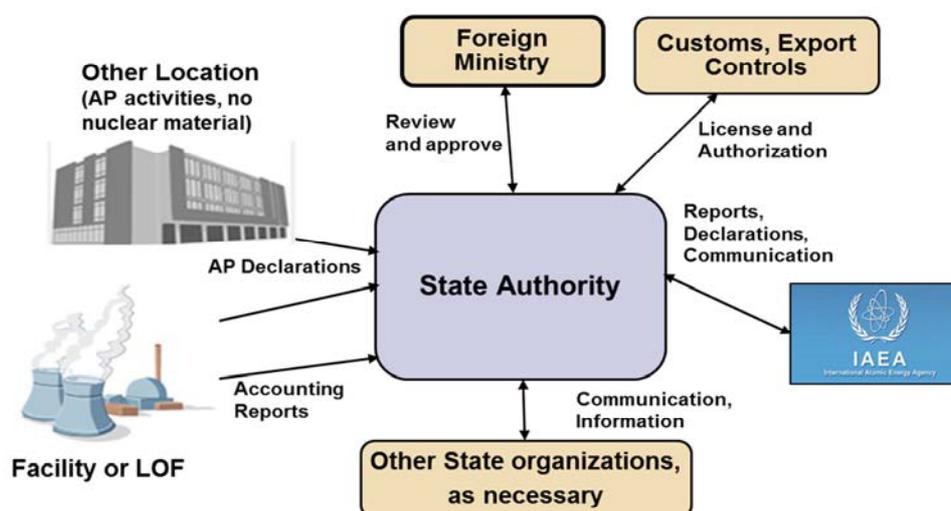


FIG 2. Example of information flow in a State.

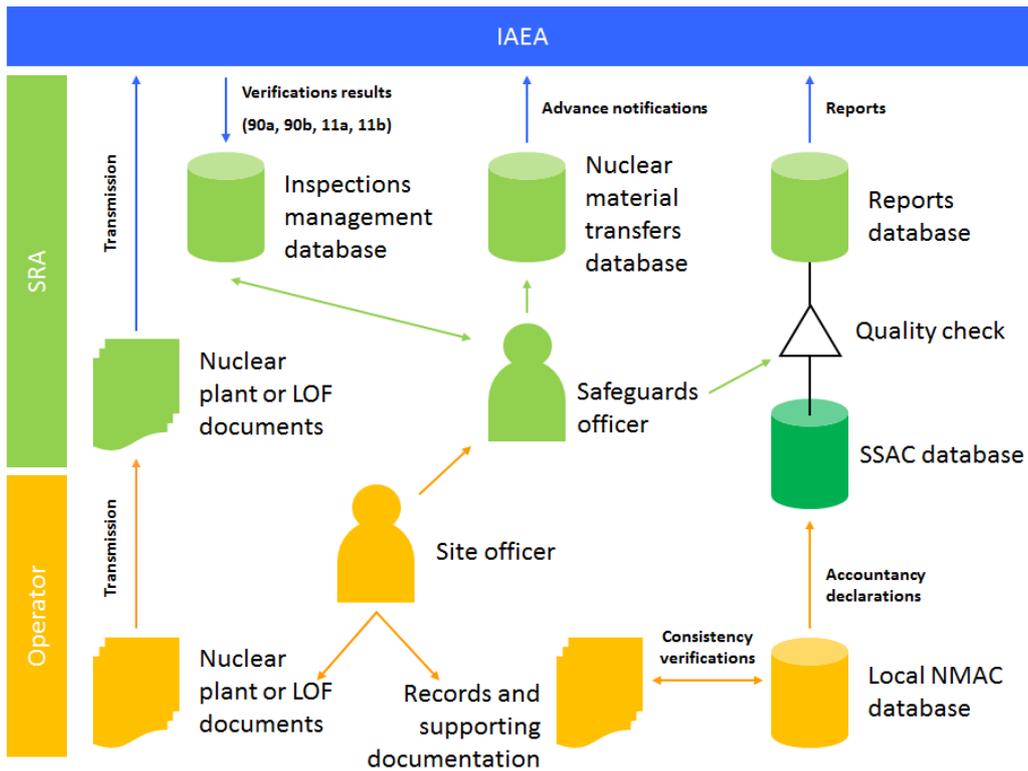


FIG. 3. Example of information flows within a State system and submissions to IAEA.

### 3.2. FUNCTIONS AND FEATURES OF A STATE SIMS

A State's SIMS will serve as a national nuclear material accounting system/database, and should have the necessary functionality and capabilities to support the State's accounting and reporting requirements. The accounting component of the system should be designed to meet generally accepted accounting practices and the forms/formats set out in Code 10 of Subsidiary Arrangements (General Part). The following functions and features may be useful for a State to consider in developing its SIMS:

- Maintain a complete single storage (database) of every current and active MBA, its name, nuclear material, batch types, material types and descriptions, inventory changes (i.e. Code 10 reporting codes and formats for nuclear material in the MBA), for relevant operating parameters that pertain to the DIQ for the facility;
- Maintain every nuclear material element/isotope, quantities and locations (MBAs and KMPs) in the State for physical inventories and transactions;
- Maintain information on decommissioned facilities/LOFs and keep an MBA history;
- Maintain a tracking time-logged history of every nuclear material transaction;
- Use double entry accounting with transaction recording;
- Maintain ledgers of material transactions at every MBA;
- Provide for necessary reporting in advance of certain inventory changes, such as exemption and termination;
- Facilitate proper making of corrections and ensure nuclear material accounting reports reflect facility records;

- Retain documents and information for at least as long as required by the CSA (5 years);
- Assist with audits and quality control;
- Match international and domestic transfers of nuclear material;
- Support the evaluation of the material balance at the end of each period;
- Track exemptions and de-exemptions including locations, use and domestic transfers of exempted material;
- Track material for which safeguards have been terminated, but where further declarations may be applicable;
- Produce the NMA reports (ICRs, PILs and MBRs) and other reports and declarations (e.g. export/import reports, advance notifications, AP declarations);
- Produce reports for the SRA for national regulatory purposes;
- Facilitate review and approval (e.g. of reports and declarations) by the SRA and other government stakeholders prior to submission to the IAEA;
- Support other functional requirements, such as compliance with licenses, domestic tracking of materials by country of origin<sup>4</sup>, tracking other non-nuclear materials (controlled materials such as graphite, heavy water, zirconium, etc. and dual-use equipment);
- Ensure robust access control, security and protection from internal and external threats; and;
- Facilitate the receipt of data/reports electronically from operators in the State.

It is very useful for the State's SIMS to be able to track corrections back to the MBA documentation. A traceable 'chain' of the correction history should be maintained and accessible in the system, identifying and linking to historical and/or related transactions or inventory listings and to source records at the facility/MBA itself.

IAEA inspectors conducting physical inventory verification (PIV) appreciate receiving a summary of all inventory changes in the MBA organized by material element, to aid their verification tasks. The inventory change listing may also be used by an SRA or operator to trace records back to the general ledger and other facility records.

*Example: A significant unexpected material unaccounted for (MUF) was found during the PIT at a facility. The inventory change report helped to reveal that the root cause was recording a shipment of natural uranium fuel bundles as containing low enriched uranium.*

A more sophisticated SIMS may be designed to import the operators' reports and convert the data into Code 10 format. Such a system could also perform a data quality check, including allowable Code 10 formats, data validity and completeness of required data. The IAEA's 'quality control validation software' (QCVS) can be used for this purpose.

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<sup>4</sup> Although not required by a CSA or AP, it may be required by bilateral agreements concluded by a State.

The SIMS should facilitate reconciliation of the State's nuclear material inventory with the IAEA's records, as reported to the State in the IAEA semi-annual statement of the inventory. The SRA can then work with the IAEA to resolve any differences. The IAEA statement is provided for each MBA in the State, allowing for the State's system to compare its MBA values. The IAEA's statement indicates the State reports (by number) that have been incorporated into the figures reflected in the statement. Differences can occur if the State uses a different accounting correction mechanism than the IAEA (which can cause a correction to be reflected in a different time period at the IAEA than in the State). Corrections are discussed in Section 8.12.

*Example: Anticipating the introduction of nuclear power into a State, an SRA began to develop a software system to support SSAC nuclear material reporting obligations. In addition to addressing the reporting requirements under its CSA, the SRA intends to expand the system to also address AP declarations, national safeguards inspections and nuclear security needs. In developing the information system, the SRA collaborated with another State who had more experience in this area. A joint workshop was organized to discuss and analyse various aspects, e.g. the flow of information, sources of data, recipients of information, etc. Software was then developed by the SRA using the Code 10 of the Subsidiary Arrangements as the basis. The aim of this software is for facility operators to report accounting data online and then the SRA will consolidate the data into national reports with the format and accuracy checked using QCVS. Hence, it was important to understand not only Code 10, but also the different fields of the report formats and the restrictions of each field (for example the number of characters that one column could have). Quality control features can then be factored into the software to auto-validate the data as much as possible.*

### 3.3. CONSISTENCY BETWEEN FACILITY RECORDS AND THE STATE'S NUCLEAR MATERIAL ACCOUNTING REPORTS

A well-designed nuclear material accounting and reporting system at a facility provides the ability to relate a nuclear material **accounting entry** reported to the SRA with the corresponding **facility record**.

Maintaining the linkage between accounting entries and corresponding facility records is advantageous because the accounting reports sent by the SRA to the IAEA are identified by three data fields: MBA code, report number and line entry number. It is common that the line number identity is not included in the facility records. Therefore, it is necessary for the State system to be capable of relating an IAEA-numbered accounting entry to the relevant record(s) in the State and facility information system. A numbering system is also needed at the facility to identify the related facility records.

Figure 4 shows the three basic types of facility records, along with IAEA nuclear material accounting reports. In the facility records, the supporting documents (inventory change documents, internal material transfers, etc.) are those that relate to material movements within an MBA which are not reported to the IAEA, but are important supporting documents for the reports that are submitted (ICRs, PILs, etc.). Likewise, the physical inventory item list in an MBA may not correlate directly to the PIL because items may be combined into one batch in a PIL. These issues are addressed in more detail in Sections 8 and 9.

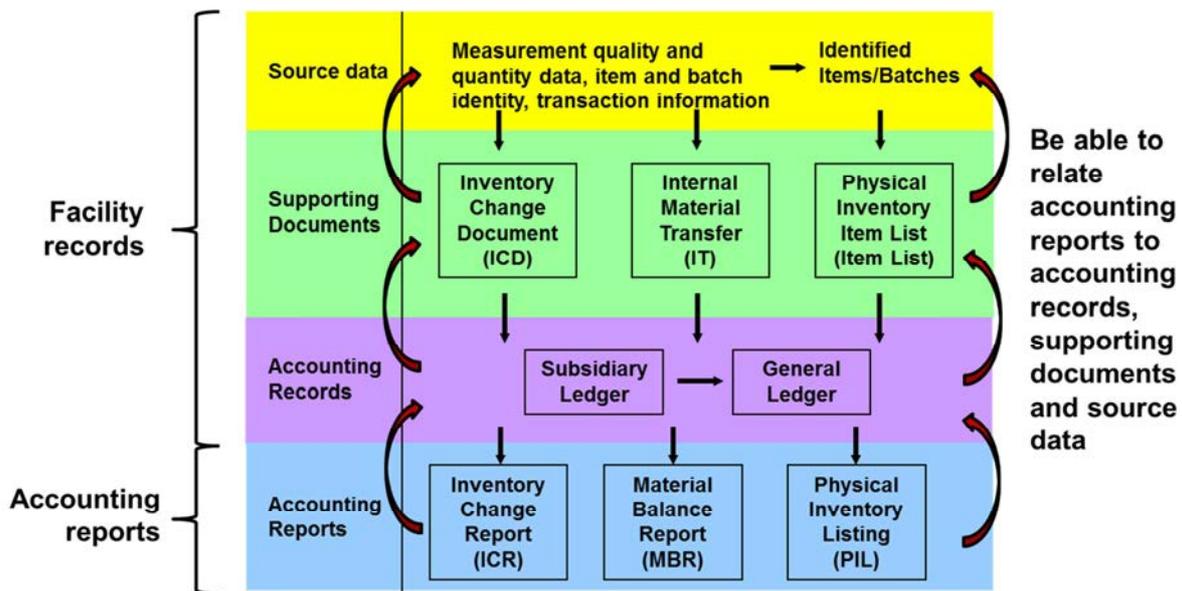


FIG. 4. Relationship of facility records and documents to State accounting reports.

As mentioned above, the IAEA developed a software package to assist States in performing quality control of their reports prior to dispatch to the IAEA. QCVS validates information in accounting reports by accepting inputs in pre-defined formats and producing the correct format for dispatch to the IAEA.

A State may also assign this quality check function to the facility operators, so any errors can be detected and resolved before submission to the State, which is a good practice. The software accepts accounting records in Excel format (commonly used by facility operators) and the records can be converted into the IAEA report format automatically. QCVS also helps facility operators to produce high quality reporting data by validating syntax and identifying logical errors. The syntax verification checks whether data format and codes are correct and the logical verification checks for accounting data that are obviously incorrect.

### 3.4. BATCH REPORTING

Nuclear material accounting and reporting for States with CSAs is done on a batch reporting basis. A batch is defined in INFCIRC/153 (Corr.) as ‘... a portion of nuclear material handled as a unit for accounting purposes’. Facility accounting systems need to be able to identify and list all batches of nuclear material in an MBA and the associated location.

### 3.5. SETTING UP A NEW STATE SAFEGUARDS INFORMATION MANAGEMENT SYSTEM

The SIP Guide on Establishing and Maintaining State Safeguards Infrastructure (IAEA Services Series 31) offers general guidance with regard to considerations and good practices in setting up a SIMS.

## 4. COMMUNICATION CHANNELS

There are several key entities (organizations) involved in safeguards communication: the SRA; the IAEA; the State's Permanent Mission to the IAEA and/or Ministry of Foreign Affairs; the facility and LOF operators; and the other AP reporting entities in the State. Each type of communication may involve two or more of these entities. Points of contact, roles and responsibilities should be defined and communicated. When assignments change, the points of contact need to be updated and shared with all interested parties.

### 4.1. FORMAL AND INFORMAL COMMUNICATION BETWEEN THE IAEA AND STATE

Formal communication channels are specified in Subsidiary Arrangements (General Part) to safeguards agreements and are used by both the IAEA and the State when conveying such information. Formal communication usually involves the Permanent Mission to the IAEA, or the Embassy/Mission in Vienna, and it is important that the staff of the Mission have up-to-date contact information for the SRA, so communications can be transmitted in a timely manner as needed. Likewise, the Mission needs to be informed how and when to transmit information received from the SRA that needs to be conveyed to the IAEA.

Many day to day matters are addressed through working level communication. Proactive working level communication helps the SRA and IAEA to work efficiently together.

*Example: Administrative arrangements are often established between the SRA and each facility operator (and LOF) which specify the agreed communication channels and provide contact information (phone number, email address) for the key personnel. These arrangements can be kept up to date through informal communications.*

The date that a report is transmitted by the SRA to the IAEA is the date with which the timeliness of submission of reports and declarations is evaluated by the IAEA. Reporting delays are recorded by the IAEA and significant delays are reported in the annual Safeguards Implementation Report (SIR) and in the IAEA statements that are sent to the State. Such delays are often caused by a lack of awareness somewhere along the review/approval chain with regard to the process or requirements for timely submission.

It is a good practice for an SRA to **follow up with the entities** along the review/approval chain as necessary to ensure reports are transmitted to the IAEA on time.

### 4.2. MECHANISMS FOR SUBMISSION OF REPORTS, DECLARATIONS AND OTHER STATE INFORMATION

The content, form and formats for submitting information to the IAEA are specified in Subsidiary Arrangements, but some specifics may evolve over time. Changes may be documented through an exchange of correspondence as agreed between the IAEA and the State.

For example, there are several options for the actual submittal of the information:

- Encrypted files submitted as attachments to email (to a specified email address);
- Magnetic media such as compact discs or USB sticks;
- Hard copy paper forms (pdf files as attachments to emails or sent via fax or diplomatic pouch); and
- Any other means as may be agreed upon.

The IAEA strongly recommends that all nuclear material accounting reports be provided in **electronic format** for fixed format Code 10. For States with a labelled format Code 10, the reports **must be provided in electronic format**. The IAEA also prefers to receive **AP declarations** in electronic format, using the current version of the IAEA ‘Protocol Reporter’ software.

Even if a State does not allow for electronic *transmission* of data (e.g. by email), the IAEA strongly prefers to receive data in electronic *format* (e.g. saved to a compact disc or flash drive/USB stick and sent via registered mail or diplomatic pouch). The IAEA does not require that nuclear material accounting reports be encrypted, but many States choose to encrypt them for their own security requirements. The IAEA does require that secure channels be used to transmit AP declarations electronically (e.g. encrypted).

When there is a change in the format, medium or transmission mechanism, it is a good practice to have a period of parallel reporting to ensure that all aspects of submission are functioning before the change is implemented officially.

Submission of **electronic data** has the following advantages as compared with hard copy:

- SRA and IAEA can share the electronic data, reducing the transcription error and facilitating quality control;
- SRA and IAEA are able to search text in the electronic data;
- The data can be easily copied, transferred to a database and archived;
- Notification is immediate that the data has been received; and
- Programs such as QCVS and Protocol Reporter software can be used.

Electronic data must be stored and accessed securely and protected from cyber threats, and mechanisms may be needed for secure transmission, such as encryption.

*Example: An SRA receives accounting reports from nuclear facilities in electronic format via email, then imports the data into the State’s SIMS and resolves any syntax, logical and transaction errors. After error checks, the accounting report file is exported from the SIMS in the format required by the IAEA. Finally, accounting reports are submitted as an encrypted attachment to a plain-text email message to the IAEA at the agreed email address (e.g. FileServer@iaea.org). All attachments containing confidential information are encrypted using the encryption program mutually agreed to by the State and the IAEA. AP declarations are submitted by the reporting entities in the State to the SRA in electronic format using MS Excel, then analysed and verified by the SRA for correctness, completeness and internal consistency. Declarations are submitted as an encrypted attachment to a plain-text email message sent to the agreed email address at the IAEA (e.g. SGOA\_APSubmissions@iaea.org, SGOB\_APSubmissions@iaea.org, etc.).*

A computer-based system helps to manage nuclear material accounting, reporting, declarations and nuclear activities efficiently.

*Example: An SRA's information system prepares and processes reports required by the IAEA and maintains records of national inspections. It consists of three main parts: 1) a safeguards information database, 2) a national inspection management system, and 3) a report processing system. The safeguards database maintains information of all facilities and LOFs. The inspection management system facilitates national inspection activities by scheduling inspection activities, auditing and verifying the accounting and operating records from facilities and maintaining the records of national and IAEA inspections. The report processing system collects and maintains nuclear material accounting data for all facilities and LOFs and prepares and processes the accounting reports and other reports required under the SG agreement.*

*Example: In a State, the facility operators submit DIQs, ICRs, MBRs and PILs to the regional authority/inspectorate who then forwards the information to the IAEA. The operators send copies of the reports to the State authority that monitors that the facility operators are complying with the requirements in the safeguards agreement as well as the regional authority's regulations. The State authority maintains a national database with all accountancy data and AP declaration data for all facilities and activities in the State. The State authority receives and responds to regional and IAEA inspection notifications 24/7, 365 days a year.*

Typical methods of secure communication between the State and the IAEA are encryption using PGP, PKI or S/MIME and transmission via a VPN internet line. Secure communication channels are essential to submit States' official information electronically to the IAEA.

A highly-protected computing environment to host sensitive data and web-based services is under development at the IAEA, offering new possibilities for submission of State declared information while securely hosting and processing data in a timely manner. These solutions are envisioned to utilize a secure web-based portal that supports the transmission of State declared information and related bi-directional communication between the SRA and IAEA. As the system is deployed, States will be encouraged to use it as a secure and efficient method of data transmission.

#### 4.3. ELECTRONIC MAILBOX

An electronic mailbox refers to the use of a secure information repository into which the operator submits various reports, as agreed in advance with the IAEA. The near real time submittal of information into a secure electronic mailbox is an important measure taken by the State to enable the IAEA to implement randomized routine inspections with shorter notice.

**Electronic mailboxes** are not used for submitting State reports to the IAEA, but are used for collecting and transmitting **operator data**, typically to facilitate the use of **short notice randomized inspections (SNRIs)**.

The mailbox declaration data is either transferred via secure communication channel to the IAEA (via email, digitally signed and using S/MIME encryption) or it remains at the facility

for retrieval by an inspector upon arrival. Once deposited in the mailbox, the operator can no longer change or remove the information.

The contents of the information submitted to the mailbox are agreed between the IAEA and the SRA/facility operator on a case-by-case basis. For example, a fuel fabrication facility operator might submit mailbox declarations with information on receipts, material in process, product and shipments of nuclear material on a daily basis. When IAEA inspectors arrive on short-notice to verify inventory flows, the mailbox data will reflect the inventory situation at that point in time.

States may also arrange with the IAEA to email reports directly to an IAEA email address. This email address, which is different from a facility electronic mailbox to support short notice randomized inspections, may be used by an SRA to submit accounting reports (ICR, PIL and MBR) and other information (e.g. notifications of imports and exports of nuclear material) directly to the IAEA.

*Example: A State agreed with the IAEA that all reports are submitted by email with the letter and/or report as an attachment to the email. The email address differed for each type of submission (e.g. ICRs, PILs and MBRs per Code 10; requests for exemptions and de-exemptions per Code 6; advance notifications of exports per Code 7). The State and the IAEA determined in advance what information was to be submitted to each email address. For example, non-sensitive information was submitted to SG-ARMS, while sensitive reports such as ICRs, PILs and MBRs, reports of imports and exports of pre-34(c) material, voluntary reports of imports/exports to nuclear-weapon States (NWSs), and responses to transit matching requests were sent to an email address set up just for this purpose. The data content in attachments determined whether the emails were encrypted and digitally signed or not (this was determined by the State). If the content of the documents was deemed to require protection, then the email with the attachments was encrypted prior to sending, thus requiring that the recipient email address at the IAEA was capable to receive and decrypt the attachments.*

*Example: In a State, security requirements prohibited the transmission of sensitive data in electronic form. The State then decided to provide data on a compact disc to inspectors during each inspection. The CD was attached to a letter confirming that the data is provided officially by the State. Hard copies of reports are also submitted using official channels.*

## **5. INFORMATION ON LOCATIONS OUTSIDE FACILITIES**

### **5.1. DEFINITION OF A ‘LOCATION OUTSIDE FACILITY’ (LOF)**

LOFs are locations that are not facilities and that customarily use nuclear material in quantities less than one effective kilogram<sup>5</sup>. Such locations include, e.g. companies that possess equipment containing nuclear material (often depleted uranium (DU) that is used as

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<sup>5</sup> An effective kilogram is a special unit used in safeguards, and is defined in INFCIRC/153 (Corr.). See ‘Definitions’ in IAEA Services Series 21.

shielding for a high activity radiation source), or that use nuclear material in an industrial process (such as uranyl nitrate as a catalyst). The radiotherapy laboratory in a hospital could be a LOF if it contained a teletherapy instrument with DU shielding. LOF operators often have limited experience with IAEA safeguards requirements, so SRA communication is important to ensure information is received in a timely manner and of high quality.

If a State has a location carrying out small-scale (bench top or pilot scale) conversion (e.g. UF<sub>6</sub> to UO<sub>2</sub>) or fuel fabrication activities (or any other stage of the nuclear fuel cycle, as specified in the definition of a facility), and these locations are using nuclear material in any amount (even less than an effective kilogram), these are not LOFs; they are facilities because of their nuclear fuel cycle function.

There may be situations where it is not clear whether a location should be classified and reported as a LOF or a facility; in such cases, the SRA should discuss the situation with the IAEA, so that a determination can be made.

## 5.2. INFORMATION PROVISION RELATED TO LOFS

Information on each LOF needs to be submitted to the IAEA using a ‘LOF Information Template’ (found on the ‘Assistance for States’ webpage at [www.iaea.org/safeguards](http://www.iaea.org/safeguards)).

### **INFCIRC/153 Paragraph 49**

The Agreement should provide that the following information concerning nuclear material customarily used outside facilities shall be provided as applicable to the Agency:

- (a) A general description of the use of the nuclear material, its geographic location, and the user’s name and address for routine business purposes; and
- (b) A general description of the existing and proposed procedures for nuclear material accountancy and control, including organizational responsibility for material accountancy and control.

The Agreement should further provide that the Agency shall be informed on a timely basis of any change in the information provided to it under this paragraph.

## 5.3. COLLECTION OF INFORMATION FROM LOFS OPERATORS BY AN SRA

To be able to cooperate with LOFs efficiently, the SRA needs to have the legal authority to impose **reporting and access obligations on the LOF**, which is usually done through a license or authorization process.

The SRA will need to establish effective oversight of LOFs (discussed in more detail in IAEA Services Series 31). The SRA should maintain updated contact information for the individual responsible for accounting for the nuclear material at the LOF (often referred to as a safeguards officer or chief accountant, for example) and the license should require designation of such an individual). This SIP Guide will use the term ‘safeguards officer’ to refer to the individual(s) with safeguards responsibility at a LOF or facility.

The SRA should ensure that nuclear material is not permitted to be shipped to, or received by, any entity that **does not possess the proper license**. Such an act should be prohibited.

If the safeguards officer at a LOF will change, the LOF should notify the SRA of the new contact information (this could be specified in the license). The LOF operators need to report inventory changes to the SRA in a timely manner regarding their nuclear material inventories.

*Example: In the initial stages of implementing its CSA, an SRA held outreach seminars for LOF operators and produced a brochure explaining IAEA safeguards and the reporting and access obligations of LOF operators. The brochure was sent to LOF operators and posted on the SRA's website. An example of an outreach brochure is provided in Annex X.*

The safeguards officer at a LOF should have clearly defined responsibilities and sufficient authority to carry them out. The license should require each LOF to establish clear procedures for controlling and reporting nuclear material inventory, flow, storage, use and for keeping good accounting records.

Annex V provides examples of situations likely to occur at LOFs and the associated reporting for each situation, and offers suggestions for SRA quality checks. Depleted uranium is commonly used as shielding at hospitals/radiotherapy labs; Annex VI provides some examples of uses of depleted uranium and where to look for it in a State.

The SRA should audit/inspect each LOF periodically. The frequency of such visits will depend on the number of LOFs in the State, the capacity of the SRA, and the logistical complexities involved. Such contacts are useful not only to evaluate compliance with national regulatory requirements (license conditions) but also to stay in contact with the operator and safeguards officer, inform them of any updated requirements, and ensure they are prepared for an IAEA inspection.

An SRA may **verify multiple license conditions during a national inspection** or audit at a LOF. This can save resources and reduce impact on the operators, but requires some cross-training of SRA staff.

For example, one inspection could address the LOF's compliance with nuclear material accounting and reporting, nuclear security (control of radioactive sources, for example), and radiation protection (safety of personnel, public, environment).

*Example: LOF operators often have limited experience with safeguards and benefit from support and training on preparing accounting reports. A State authority provided training to LOF operators on how to prepare accounting reports based on Code 10 and helped each LOF to create a general ledger. The SRA agreed with each LOF operator that they would submit a report of the nuclear material inventory to the SRA every month, even when no change to the inventory had occurred. This fixed communication channel created interaction between the SRA and the LOF operators and provides the SRA with full and updated knowledge of the nuclear material inventory in the State.*

*Example: A survey was issued to all LOF operators by the SRA. SRA staff then visited each LOF operator, informing them about their safeguards responsibilities (national and international). The SRA agreed with each LOF that any questions on safeguards related matters should be directed to the SRA and such communications would always be welcomed. The operators described their nuclear material and how they used it. In several cases, the nuclear material had only been in storage and*

*there were no plans for its use. Whenever possible, the LOF shipped the material to a storage location in the State. In some cases the State also provided funding support for clean-up activities. This was an important aspect, as it can be costly to dispose of nuclear material that no longer has any use.*

#### 5.4. SRA GUIDANCE AND ASSISTANCE TO LOF OPERATORS

LOF operators will appreciate guidance on how to meet their safeguards related obligations. Guidance can describe good accounting practices and the reporting requirements that are relevant to LOFs. This guidance helps LOFs to prepare procedures and to train new staff. One area of potential confusion is exempted material. It may be useful for the SRA to prepare a ‘Request for Exemption’ on behalf of a LOF and submit the request to the IAEA for approval. (See Section 8.26 for more information on exemption). Once the exemption has been approved, the SRA can notify the LOF operator using a form such as an ‘Exemption Notification Form’ advising them about their ongoing responsibilities for storage and labelling, the need to report any transfers, and to notify the SRA prior to shipment, etc.

It is not recommended to **exempt only a portion** of the nuclear material inventory at a LOF or facility. Paragraph 38 of INFCIRC/153 (Corr.) clearly provides that **exempted material to be processed or stored together with safeguarded material shall be de-exempted.**

The SRA may establish its own reporting requirements with regard to exempted material, such as reports of movements of exempted material within the State, which can help to ensure that those locations that possess exempted material maintain proper records, submit reports to the SRA and remain prepared to grant access to the SRA as needed.

It is very important for every SRA to ensure that all exempted material continues to remain under regulatory control in the State. SRAs must **continue to oversee exempted material** and ensure de-exemption is requested when necessary.

To build awareness of safeguards at LOFs, it may be useful to organize training for their safeguards officers. Such training could be conducted as workshops or through issuing guidance. Workshops may focus on the aspects of nuclear material accountancy frequently encountered by the LOF operators and could be organized for similar types of LOFs (e.g. radiotherapy labs, users of sources, ceramics manufacturers, etc.) or organized regionally.

It is good practice to encourage LOF operators to **minimize the inventory** of nuclear material at their LOFs and to transfer any material which is not used to a licensed storage or recycle facility.

In many States, the State’s national license allows for possession of small quantities of nuclear material in solution or powder forms by, for example, industrial waste collectors, universities, laboratories, small fabrication shops, hospitals and medical clinics. Such licensees may not be certain of the material composition and may not be aware of reporting obligations. IAEA Services Series 22 provides more detail about locating and reporting nuclear material in LOFs.

## 5.5. CHARACTERIZING NUCLEAR MATERIAL AT LOFS

The SRA should have the ability to characterize and quantify nuclear material at LOFs in the State. Usually the LOF operator does not possess such equipment so the quantity of nuclear material on inventory is based on shipping documentation or labels. This is usually adequate, but in cases where the quantity and/or type of nuclear material at the location are uncertain or new material is unexpectedly discovered, then the SRA needs to characterize the material. It is also convenient to have measurement equipment available to be able to verify nuclear material during national audits or inspections. Such equipment is usually based on gamma spectroscopy.

## 5.6. METHODS OF NUCLEAR MATERIAL ACCOUNTING FOR LOFS

Each LOF is a physical location. But for accounting purposes, the State and the IAEA may agree to account for all nuclear material at LOFs under one MBA. It is often called a ‘catch-all MBA’ or ‘LOF MBA’. Even when a ‘catch-all MBA’ or ‘LOF MBA’ is used, each physical LOF will need to:

- Keep track of its inventory of nuclear material and record all changes to it;
- Meet requirements for identifying, storing and transferring safeguarded and exempted material;
- Submit nuclear material accounting reports to the SRA (transfers, exemptions, accidental gains, list of inventories, etc.);
- Carry out an annual physical inventory of the nuclear material on hand; and
- Grant access to the SRA and IAEA to carry out inspections and review records.

The optimal method of accounting for nuclear material at LOFs in a State depends on a **number of factors**, such as the number and type of LOFs, geographical distribution, size of the State, the reporting format under Code 10 (i.e. labelled or fixed), the structure/organization of the SRA, and the IAEA safeguards implementation measures used in the State (e.g. the proximity of facilities to LOFs). It is a good practice for the SRA to discuss with the IAEA options for accounting for nuclear material at LOFs.

The SRA must maintain regulatory oversight and control on exempted nuclear material. To assist the State in tracking this inventory of exempted material, the SRA may wish to establish an MBA for this purpose. Of course, the State authority must ensure that exempted material is not transferred outside of this MBA before being de-exempted, and ensure that safeguarded nuclear material is not stored together with exempted material.

*Example: A catch-all MBA is established to account for all nuclear material at LOFs, with a unique inventory KMP code assigned to each physical LOF. If fixed format Code 10 is used and more than 26 LOFs exist in the State, then a second MBA would need to be established. With labelled Code 10, a combination of letters can be used for the KMP codes. The LOFs can be grouped e.g. by region or type of location or usage of nuclear material and assigned a letter with a unique number for each.*

The SRA may wish to prepare a simple form to be used by LOFs in reporting inventory changes and other accounting information to the SRA. The LOF can send information using this form to the SRA, who creates the ICRs in the proper format and submits them to the IAEA.

#### 5.7. DECLARATIONS OF THE SITES OF LOFS UNDER AN AP

For States with an AP in force, a 2.a.(iii) declaration is required for the site of each geographically distinct LOF (unless it possesses only exempted nuclear material). Please refer to Section 11.6 for detailed guidance on AP site declarations.

## 6. INFORMATION ON FACILITIES (DESIGN INFORMATION)

### 6.1. INTRODUCTION

As discussed in Section 5 of IAEA Services Series 21, States are required to provide information to the IAEA on facilities (see paragraphs 8, 42 to 45 of INFCIRC/153 (Corr.)).

#### **INFCIRC/153 Paragraph 42**

Pursuant to paragraph 8 above, the Agreement should stipulate that design information in respect of existing *facilities* shall be provided to the Agency during the discussion of the Subsidiary Arrangements, and that the time limits for the provision of such information in respect of new *facilities* shall be specified in the Subsidiary Arrangements. It should further be stipulated that such information shall be provided as early as possible before *nuclear material* is introduced into a new *facility*.

The IAEA uses this design information and the results of its verification, *inter alia*, to develop a safeguards approach for the facility. The timeliness for the provision of design information in respect of existing and new facilities is provided in Code 3.1 of the Subsidiary Arrangements (General Part). Regarding the early provision of design information for a new facility, the modified Code 3.1 of Subsidiary Arrangements stipulates that preliminary design information must be submitted by the State to the IAEA as soon as the decision has been taken to construct, or to authorize construction, of such facility.

A State with an AP in force declares its ten-year approved nuclear development plan as approved by State authorities, which includes any plans for new facilities. Annex XI provides an example of a State's declarations submitted each year regarding such plans as described in the AP Art. 2.a.(x). Once the State takes a decision to construct, or to authorize construction of the new facility, the State provides early design information and discontinues declarations regarding this facility under the 2.a.(x) declaration. Design information continues to be updated throughout the construction, commissioning, operation and all subsequent lifecycle stages of the facility, until it has been determined by the IAEA to be decommissioned for safeguards purposes.

Design information is submitted using a ‘design information questionnaire’ or DIQ. The IAEA has templates of DIQs for each facility type. The appropriate DIQ template can be requested by emailing the IAEA (the request can be directed to the relevant country officer, or if uncertain, to [official.mail@iaea.org](mailto:official.mail@iaea.org) with ‘DIQ Template’ in the subject line).

## 6.2. SAFEGUARDS BY DESIGN DIALOGUE

The IAEA values the opportunity to engage with States and facility designers to take into account safeguards considerations early in the facility design process. This engagement enables cost savings to be realized for both the State and the IAEA by optimizing efficient safeguards measures, and avoiding the need for unplanned equipment installation. To support this dialogue, the IAEA published a series of guidance documents (e.g. IAEA Nuclear Energy Series Nos. NP-T-2.8 in 2013 and NP-T-2.9 in 2014). This series is available on the Assistance for States webpage under ‘Other Documents.’

Safeguards by design (SBD) is the process of considering international safeguards features/aspects throughout all phases of a nuclear facility project, from the initial conceptual design through facility construction and into operations, including design modifications and decommissioning. The ‘by design’ concept encompasses the idea of preparing for the implementation of safeguards at a facility through the management of the project in all of its stages. Safeguards-by-design does not introduce new requirements but does facilitate the cost effective implementation of safeguards needs. Annex VII offers two case studies describing the application of SBD at a reactor and at a geologic repository for spent fuel.

During SBD discussions, the State is usually represented by the SRA, which is often responsible for nuclear safety and security in addition to safeguards, and must harmonize these requirements. The SRA may wish to prepare written guidance that explains safeguards, safety and security requirements in a balanced way. The operator is usually responsible for construction and operation of the facility, and can incorporate safeguards features into the commercial bidding documents. The vendor will have then a commercial obligation to fulfill the terms of contract concluded with the operator. The designer’s task is to design the facility according to the specifications given by the vendor.

Meetings involving all of these entities can facilitate SBD discussions and ensure the IAEA safeguards needs are understood by the vendor and designer, who are making actual design decisions. The agenda of the meetings could address:

- Features/information to be included in the design information to be provided pursuant to the safeguards agreements (this will be a primary topic of the discussion since safeguards will probably be unfamiliar to the designers);
- Design features related to safety and security (relevant expertise from the State authority will be needed for these discussions);
- Issues around sharing facility-confidential information among the participants;
- Experience obtained from any existing facilities; and
- Review of existing guidance on safeguards by design.

SBD is a voluntary process so it is important that the designer, vendor, and operator understand the potential benefits, such as:

- avoiding costly retrofits to address safeguards needs;
- integrating safeguards equipment and systems into the plant design at an early stage;
- facilitating consideration of joint use of equipment by the operator and inspectorate;
- reducing operator burden with less inspection presence and shorter outages; and
- increasing flexibility for future safeguards equipment installation.

*Example: In a State, a requirement has been established that sixty days after the 'Decision in Principle' (the Government's decision to build a new nuclear facility), the operator has to provide the preliminary design information to the SRA. Usually the information available at that time includes the name of the operator, the type of planned reactor and the general location of the planned site (if not yet decided) and a tentative time schedule.*

### 6.3. DESIGN INFORMATION

Design information is submitted and updated as necessary for each facility using a DIQ, including a description of the form, location and flow of nuclear material; a general layout; description of features relating to nuclear material accountancy, containment and surveillance; and, a description of existing and proposed procedures for nuclear material accountancy and control and the procedures for physical inventory taking. An example of a DIQ for a reactor can be found in Annex I, including examples of the kind of information provided in each of the elements of this important document.

DIQs should include **significant detail** in the text descriptions and be accompanied by drawings, photographs, charts, process diagrams and other supporting documentation as appropriate.

The DIQ is one of the most important documents for safeguards, as the information contained in it is used to, e.g. design the safeguards approach; determine the types, locations and configuration of safeguards equipment; verify the operator's measurement systems; draft the FA; determine the material balance areas; and much more. A more complete description of the uses of design information, and activities carried out by the IAEA during design information verification (DIV) is found in Section 3 of IAEA Services Series 30.

The initial DIQ for a new facility needs to be periodically updated as new information becomes known, including equipment, points where measurements of nuclear material will be made, operating schemes and records systems. Information on measurement uncertainties, expected material held up in process and other possible contributors to MUF, will be important for facility evaluation and should be provided in the design information as soon as possible.

The results of calibrations and tests are also important to include, to enable the IAEA's analysis of measurement performance against international target values (ITVs), adherence to the 'Guidance on determination of uncertainties in measurements' (GUM) and other relevant standards, as well as to prepare for the use of verification equipment.

The SRA should inform the IAEA of the different stages of the facility licensing process to help create mutual understanding of the facility construction timing and key points in the DIV process. The DIQ requests information on the operational modes and phases of the facility. Annex II of IAEA Services Series 30 describes the facility lifecycle or operational stages and associated safeguards activities, and the kinds of information provided by the State to the IAEA at each stage. For example, a facility will have a commissioning phase, an operating phase, and periodically maintenance or modification phases. Each involves provision of certain types of information, and various safeguards activities.

The State and the IAEA could meet periodically to discuss safeguards related aspects regarding a planned facility, so that the SRA, operator/designer and IAEA develop a **shared understanding** of the plans well in advance of preparing the submission of preliminary design information.

#### 6.4. EARLY PROVISION OF DESIGN INFORMATION

Early provision of design information in respect to a new facility is required under a CSA, but it is also helpful to both the State and the IAEA. It fosters communication about what to expect, helps the IAEA plan out its resources and describe to the State the equipment and activities that will need to be incorporated into the facility plans. It gives more time to accommodate each party's needs, leading to fewer design changes and achieving overall cost savings.

Modified Code 3.1 of the Subsidiary Arrangements stipulates the timing for provision of design information: '3.1.2. Provision of preliminary design information for new facilities [shall be provided] **as soon as the decision to construct, or to authorize construction,** has been taken, whichever is earlier.'

When a State submits early design information, the IAEA will respond and discuss potential safeguards measures for the facility with the SRA. As the facility development work proceeds, the State will provide updated and more detailed design information, including the type of facility, power, capacity, etc. At this point, the construction license will probably not yet have been issued and information will not be detailed or specific, and will be updated as more information becomes available. The designer will be creating preliminary design concepts, and the bidding phase may involve multiple vendors and designers. If the operator has set specifications that the facility shall incorporate safeguards features, the designers will describe ways in which the design facilitates anticipated safeguards features.

The preliminary design information does not have to be provided in the form of a DIQ, although it is preferred by the IAEA. To ensure updated information is provided periodically during the construction process, the State may define 'hold points' or explicit points during the licensing process at which submission of updated design information will be required.

*Example: The timing for early provision of design information can be addressed in the license process, e.g. by specifying when the SRA shall be provided with preliminary information and updates on the nuclear facility (e.g. before construction starts, during construction, before commissioning, during operation, etc).*

After the preliminary design information has been provided to IAEA, the SRA should submit updates to reflect the physical condition of the facility as it progresses through design, construction, commissioning and begins operation. As there may be more than one supplier responding to a request for bid, there is often a lengthy gap between the planning of a new facility and the actual design. During this time, the preliminary information may not need to be updated. Figure 5 shows the basic steps in providing information on facilities to the IAEA (when an AP is in force).

As soon as the supplier of a new facility is chosen, the facility operator can start to prepare the initial DIQ, which is submitted to the SRA and subsequently sent to the IAEA. The initial DIQ continues to be updated as more information is known, enabling the IAEA to plan and develop the safeguards approach. In addition, when an AP is in force, this is the point when the State can prepare the initial site declaration to be provided to the IAEA in the next annual update (See Annex XI).

*Example: In a State planning for new nuclear power plants, a requirement has been established that an operator wishing to build a new plant must submit a generic design assessment to the SRA containing general information about the planned nuclear power plant. This is submitted to the SRA well in advance of applying for a siting license. The submittal of the design assessment facilitates discussion among the SRA and the operator and can support SBD discussions with the IAEA as well.*

In addition, it is important to provide updated information to the IAEA on the project schedule, including information on the programme of activities, current progress, any changes that may impact safeguards implementation, and any changes to the entities involved (such as key equipment manufacturers).

The IAEA has to **plan its resources** to support safeguards implementation at facilities under construction or modification, so early discussions are important.

For a State with a modified Small Quantities Protocol (SQP), if a decision is taken to build a facility, the SQP will become non-operational. Early discussion with the IAEA can help the State and the IAEA to **work together** on the implementation of all safeguards procedures, including preparing Subsidiary Arrangements. See section 13 of IAEA Services Series 22 for more information.

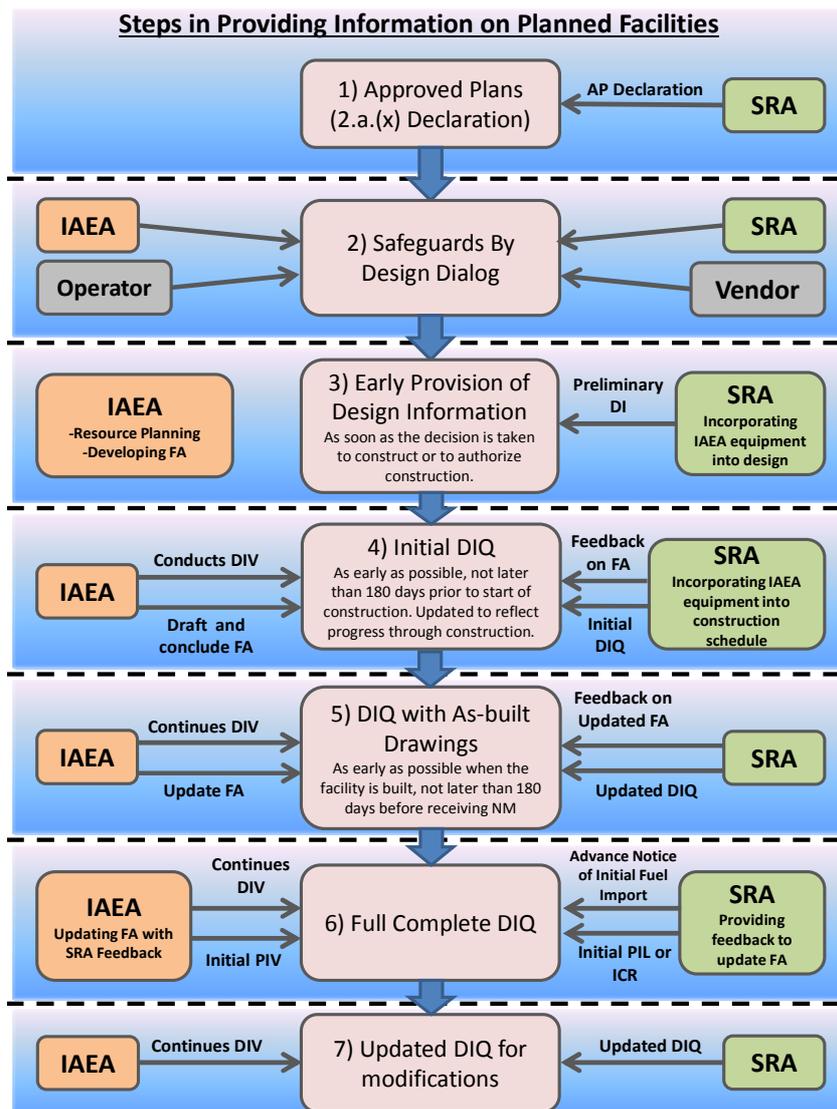


FIG. 5. Overview of steps taken in providing design information.

## 6.5. DESIGN INFORMATION QUESTIONNAIRE

Design information is submitted using a DIQ. Since DIV begins even before concrete for the foundation of a facility is poured, it is necessary to submit a DIQ at least 180 days before start of construction (and design information is provided earlier than that – when the decision is taken to construct the facility or to authorize its construction).

*Example: In a State, DIQs are prepared according to a prescribed procedure in the SRA's quality management system (QMS), which also specifies the timelines for submittal. In the QMS procedures, design information shall include at least the following information, where applicable, for each facility (following the DIQ):*

- The identification of the facility, its description, purpose, nominal capacity and geographical location, name and address to be used for routine business purposes;
- A description of the general arrangement of the facility with references to the form, location and flow of nuclear material and to the general layout of process equipment which use, produce or process nuclear material;
- A description of features relating to material accountancy, containment and surveillance; and

- *A description of the existing and proposed procedures at the facility for nuclear material accountancy and control.*

*All of the information provided in text form is supplemented by design drawings (produced using specialized software such as AutoCAD), process diagrams, photographs and other documentation. The information is submitted as a package to the IAEA in electronic form, using secure channels of communication (transmitted via official channels on CD), to facilitate its evaluation.*

## 6.6. FACILITY ATTACHMENTS AND UPDATES TO DESIGN INFORMATION

The Code 2 of a FA specifies what kinds of changes or modifications to the facility or systems at the facility should be reported in advance of the change. The FA is based on the DIQ. MBAs and KMPs are specified in the FA (See Section 8.2). If a FA is not in force, any changes to the facility or its processes which would result in inaccuracies in the DIQ should be reflected in an updated DIQ and submitted to the IAEA, to ensure that the IAEA has accurate information about the facility.

Updates to a DIQ should be submitted as soon as possible and **sufficiently in advance of the change** to allow the IAEA to modify its safeguards approach as needed.

## 7. NUCLEAR MATERIAL ACCOUNTING CONCEPTS

### 7.1. INTRODUCTION

The Nuclear Material Accounting Handbook (Services Series 15) was published by the IAEA for use by States in their application of nuclear material accounting. The Handbook explains methods used to account for nuclear material and to report nuclear material accountancy information to the IAEA. It provides a description of the processes and steps necessary for the establishment, implementation and maintenance of nuclear material accounting and control at the MBA, facility, LOF and State levels, and explains the relevant terms. It also explains quality controls and audits of facility accounting systems to support correct and complete reporting from the State to the IAEA, and to facilitate IAEA verification of the information in the reports. Many terms and aspects of nuclear material accounting are complex and are further amplified in this SIP Guide, with examples and good practices.

### 7.2. MATERIAL BALANCE AREAS AND KEY MEASUREMENT POINTS

An MBA is an area in or outside of a facility such that the quantity of nuclear material in each transfer into or out of the MBA can be determined; and the physical inventory of nuclear material in each MBA can be determined when necessary, in accordance with specified procedures, in order that the material balance for IAEA safeguards purposes can be established.

The MBA is the nuclear material accounting area for related reports submitted to the IAEA. Material crossing the boundary of an MBA must be reported to the IAEA as an inventory change and material within the boundary must be reported as part of the physical inventory. Movements of nuclear material within an MBA are not to be reported to the IAEA. However,

as noted later, certain changes to nuclear material within an MBA (e.g. nuclear transformations, changes in uranium category and changes of batch structure) are to be reported to the IAEA.

Most facilities comprise only a single MBA; thus, for accounting purposes, the MBA and facility are identical. However, large, complex facilities (e.g. fuel fabrication or reprocessing plants) frequently require additional accounting and controls that a single MBA structure cannot support. In such cases, an arrangement with a single facility comprising two or more MBAs may be agreed upon with the IAEA.

Four-character **MBA and facility codes** are defined in the FA and are required data elements in nuclear material accounting reports. The MBA and facility codes always begin with the IAEA's country code for the State.

For each possible type of nuclear material batch in an MBA, the FA describes the associated inventory changes codes, flow KMPs, inventory KMPs, material description codes (MDCs) and measurement basis codes.

As mentioned above, although internal movements of material within an MBA are not to be reported to the IAEA, there are internal changes to the inventory that must be reported, such as the production of plutonium as a result of fuel irradiation in a reactor.

### 7.2.1. Reactor MBA

For a reactor, the IAEA inspectors will need to see separate records on the amounts of material in the fresh fuel storage, core and spent fuel storage, but the inventory reports need not be separated into these areas. Therefore, a reactor would typically have one MBA with three inventory KMPs and three flow KMPs, as shown in Figure 6.

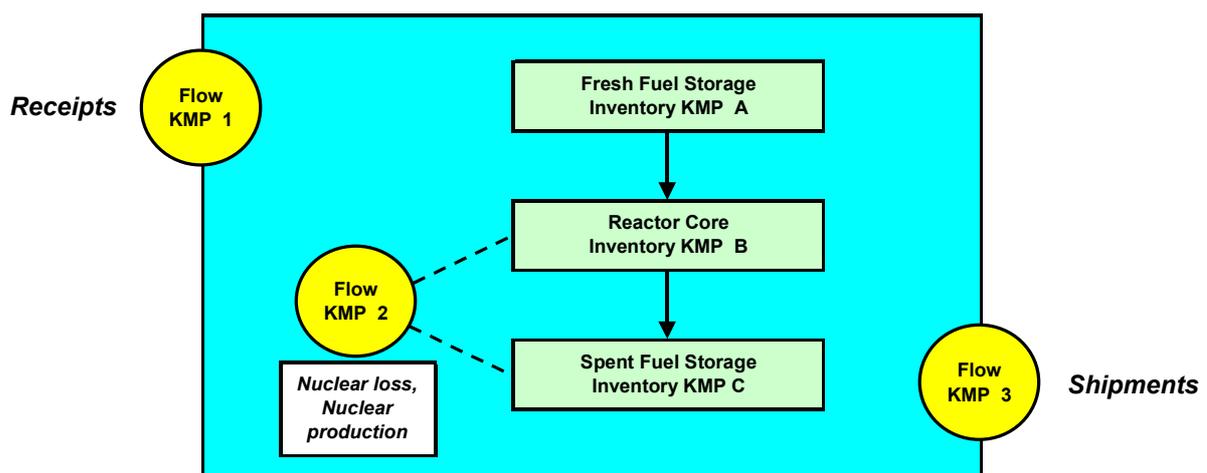


FIG. 6. Typical MBA and KMP structure for a reactor.

Upon discharge of the spent fuel assemblies/bundles from the core, the inventory changes would include category change ND (natural uranium to depleted uranium), nuclear loss LN of

U-235 and nuclear production (NP) of plutonium. The spent fuel is normally stored in the spent fuel pond for several years, after which it might be transferred to a dry storage inventory KMP within the MBA or transferred to another MBA. The decay occurring during the cooling in the spent fuel pond can be reported on a regular basis or upon shipment. Figure 7 elaborates further the inventory changes at the KMPs for a power reactor with one MBA.

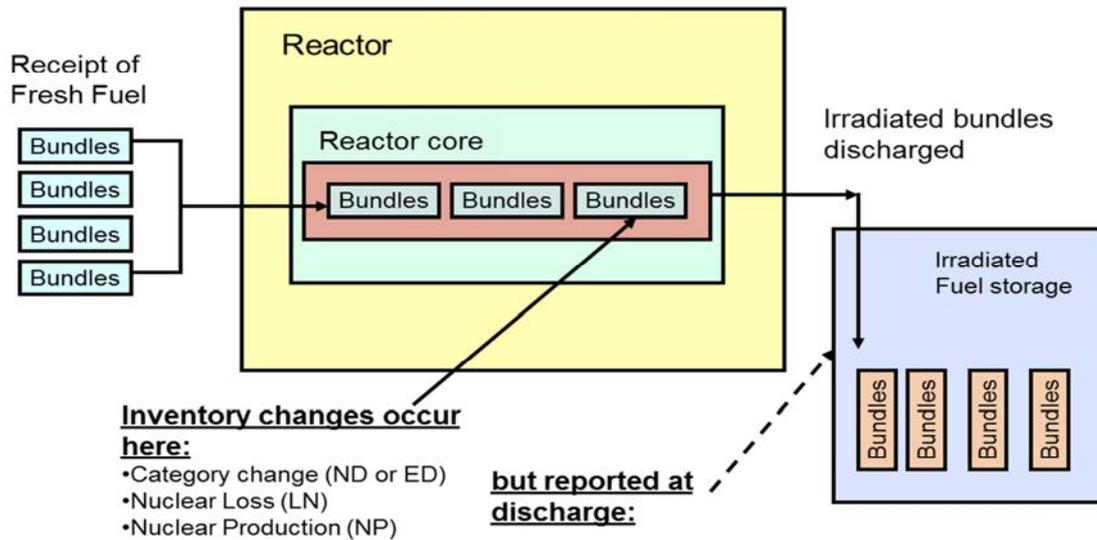


FIG. 7. Example of inventory changes reported at KMPs at a reactor.

### 7.2.2. Fuel fabrication plant with three MBAs

The following shows an example of a basic three-MBA structure, such as for a fuel fabrication plant. This structure is useful for separating material in item form (fuel assemblies) from material in bulk form (pellets), and isolating the shipper-receiver differences, MUF associated with the process, and measured discards. Figure 8 depicts such a three-MBA structure.

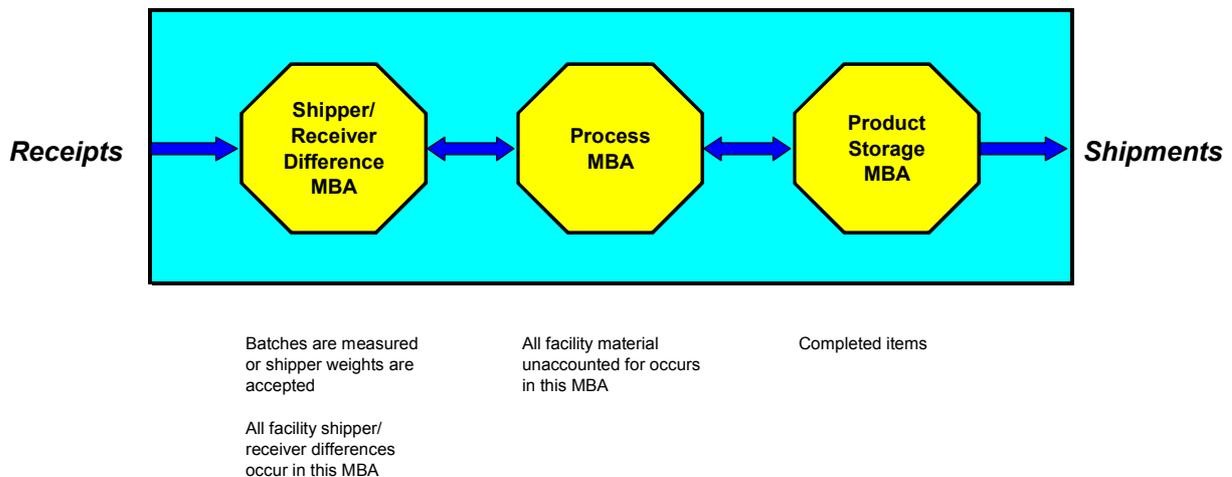


FIG 8. Example of a 3 MBA structure to separate bulk processing from items.

### 7.2.3. Uranium milling and concentration plant accounting areas

A State may wish to establish accounting areas for milling and concentration plants to keep track of transfers and inventories of pre-34(c) material (e.g. uranium and thorium concentrates). A State's SIMS can track production, holdings, imports and exports of pre-34(c) material such as uranium and thorium concentrates by its mines and mills for reporting shipments under the CSA and AP as applicable. The system can also maintain inventory balances and track domestic transfers of pre-34(c) material between the mills, refineries and other locations that are not subject to safeguards under a CSA, in addition to tracking the nuclear material in the MBAs at facilities and LOFs.

These plants can be assigned a domestic 'MBA code' with distinctly different 3-alphanumeric characters so as to remain distinguishable from the IAEA's MBA codes in the system. The SRA's SIMS can specify each location with its 3-character code and a facility description, including permissible material types and material description codes, and inventory change codes for import, export and domestic transfers, as required. The practice of tracking pre-34(c) material movements into, between and exported from locations within the State is also useful for tracking country-obligated material for reporting to partner States pursuant to bilateral nuclear cooperation agreements.

### 7.3. ESTABLISHING REPORTING CODES FOR MBAS

The State and the IAEA work together to define the MBAs for a facility, based on evaluation of the information in the DIQ and conduct of DIE/DIV. Each MBA is assigned a code which is used for reporting nuclear material inventory and other information specific to that MBA. A process for establishing applicable reporting codes in a State may resemble Figure 9.

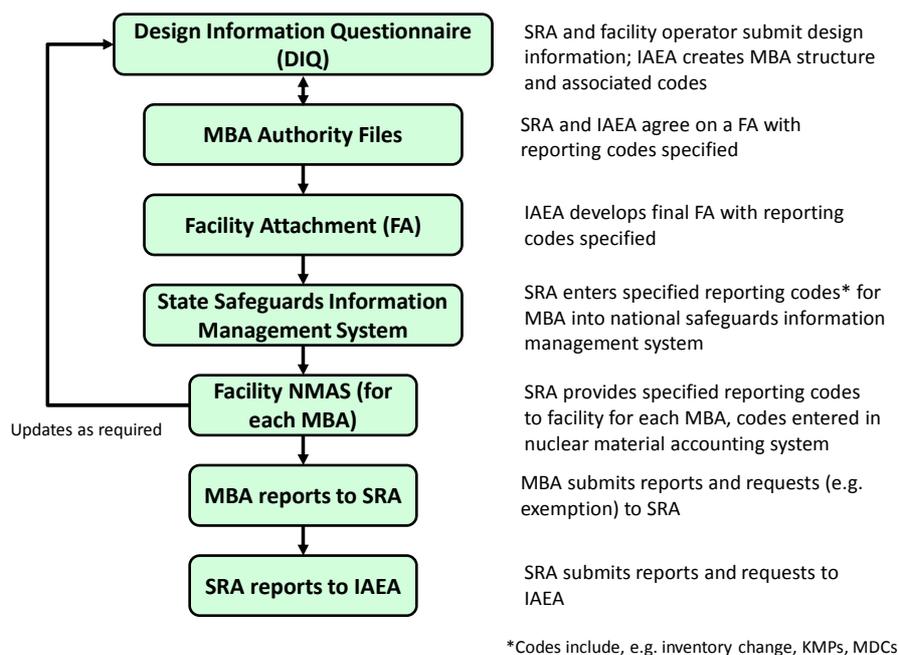


FIG. 9. Example of process to identify reporting codes for an MBA.

Once the DIQ is submitted and applicable codes are determined for the facility, the IAEA establishes its facility ‘authority files’ and the SRA notifies the facility operator of the reporting codes that must be used for submitting information to the SRA. The same approach applies once information has been provided by the SRA to the IAEA in respect to LOFs. The SRA may also enter these codes into its SIMS database, so data entries from the facility such as inventory changes and inventory lists can be accepted from the MBA.

If the facility design or operations change, then the DIQ is updated. If the changes necessitate revisions to the codes, the IAEA will communicate with the SRA and the facility/LOF operator will need to be notified. The reporting codes are thus revised and the IAEA’s authority files for the MBA are updated as well. The relevant FA may need to be revised as well; the IAEA will communicate with the State/SRA for that purpose.

#### 7.4. KEY MEASUREMENT POINTS AND KMP CODES

A KMP is a location where material appears in such a form that it can be measured for the purpose of determining inventory or flow. Flow KMPs are reported only in ICRs and inventory KMPs are reported only in PILs. Movement of nuclear material between KMPs is not reported to the IAEA.

While the IAEA does not track material balances on a KMP basis, facility operators typically maintain separate balances for accounting sub-areas such as a reactor core and spent fuel pond at a reactor. Maintaining accounting at the sub-area level enables the facility operator to **localize and investigate any possible loss** much more effectively than if accounting is only maintained at the MBA level. In addition, sub-area level accounting can be quite helpful in facilitating IAEA verification activities.

In a ‘catch-all’ LOF MBA, the KMP may be used in the PIL to reflect one physical location, and a list of inventory KMP codes with the respective locations may be included in the LOF Attachment.

**KMP codes** are used to name each KMP, and the naming convention indicates whether the KMP is a flow KMP or an inventory KMP. Normally, **numbers are used for flow KMPs and letters are used for inventory KMPs**, as specified in a facility/LOF attachment.

KMP codes are defined in fixed format Code 10: paragraph 12; or labelled format Code 10: label 407. With fixed format Code 10, there is only one character available and, therefore, it may be necessary to use letters as well for flow, if there is a need for more than nine flow KMP codes. A maximum of two characters are defined for KMP codes in labelled format Code 10, therefore a limit on numbers and letters does not pose an issue. It is the practice in some cases to use a character other than a number or letter, such as an asterisk (\*), as the KMP code for reporting category changes or re-batching, for example.

## 7.5. BOOK INVENTORIES (ADJUSTED AND ENDING)

A book inventory is the amount of nuclear material calculated to be present in an MBA on the basis of nuclear material accounting records. The formula to calculate book inventory can be found in Code 10 or IAEA Services Series 15. The calculation is based on the most recently available MBR physical inventory, plus/minus all reported inventory changes through the date for which the inventory is to be calculated. If there is no physical inventory with which to begin the calculation, a beginning inventory of zero is used.

There are two defined types of book inventories that can be reported in MBRs: ‘adjusted’ and ‘ending’ book inventories. The ‘adjusted’ book inventory includes shipper/receiver differences and the ‘ending’ book inventory does not. The current model Code 10 only requires the ‘adjusted’ inventory to be reported. Table 1 shows the difference between book ending (BE) and book adjusted (BA).

TABLE 1. DIFFERENCE BETWEEN BOOK ENDING AND BOOK ADJUSTED INVENTORIES

| MBR entry name                    | Weight (kg) |
|-----------------------------------|-------------|
| Physical beginning inventory (PB) | 100         |
| Receipts domestic (RD)            | 50          |
| Book ending inventory (BE)        | 150         |
| Shipper/receiver difference       | -2          |
| Book adjusted inventory (BA)      | 152         |
| Physical ending inventory (PE)    | 152         |

For older Code 10 documents that only require ending book inventory (BE) to be reported, it is a good practice to report **adjusted book inventory (BA)** as well.

## 7.6. MATERIAL BALANCE PERIODS

The time between two PITs is the period for which the nuclear material balances are determined for an MBA. The beginning date of the period is one day following the previous PIT and the ending date is the date of the PIT at the end of the period. For the first MBP of an MBA, the beginning date can be determined based on how the nuclear material accounts are established. If there is an initial PIL, the period beginning date is one day after the initial PIL date. For accounts established at first receipt of nuclear material, the beginning date must be at least the earliest inventory change date in the relevant ICR. The beginning date in the ICR header can be used for the period beginning date, but it should be logical, such as the first of the month in which the first inventory change occurs.

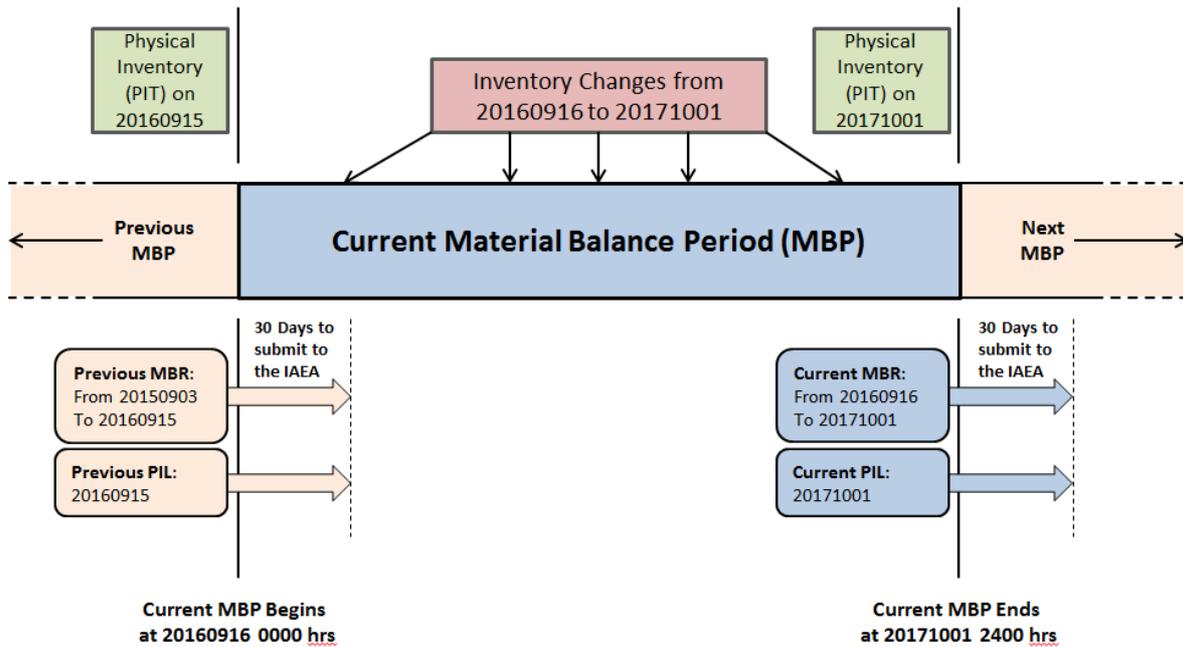


FIG. 10. Material balance periods and associated report dates.

The time between PITs for most facilities (e.g. power plants, fuel fabrication facilities) is normally about one year, but there is some flexibility in the period. (However, the IAEA typically does not allow more than 14 months between two PIVs). The scheduling is determined by the IAEA, taking into consideration the facility operational programme and planned outages. There may also be closed core PIVs for power plants in cases where an outage does not occur for more than 14 months.

### 7.7. SHIPPER – RECEIVER DIFFERENCES

A shipper-receiver difference (SRD) is determined when the receiver of a batch of nuclear material performs a measurement to establish the quantity of nuclear material received. The SRD is calculated as the shipper's value minus the receiver's value. A negative SRD reflects an increase in the nuclear material accounts, and a positive SRD reflects a decrease in the nuclear material accounts.

All receipts must be reported **based on shipper's values** (measurement basis for labelled code 10 = 'N'). Shipper-receiver differences are then reported subsequently as necessary.

When the measurement of nuclear material is made, only the difference (shipper value minus receiver value) is recorded with inventory change code 'DI'. The date of the inventory change entry is when the SRD is applied to the accounts of the MBA. It is possible that the measurement is made after the receipt has been reported (using shipper's values) perhaps months or years later. In all cases, the SRD is reported with the date the difference is accounted for and not the date of receipt of the batch.

It is good practice that **SRD be reported using the original receipt batch name**. If the receiver needs to report its own batch name for the SRD, it should also report the shipper's batch name reported on the receipt (label 447 in code 10). States reporting in fixed format can rename their batches using the inventory change codes 'RM' and 'RP'.

## 7.8. UNIFIED URANIUM

The use of 'unified uranium' reporting is discussed between the SRA and the IAEA and reflected in the relevant FA. Such reporting may be applicable in respect of nuclear material at facilities where changes in category (between depleted, natural and enriched uranium) occur often, such as enrichment or fuel fabrication plants.

'Unified uranium' reporting requires that the isotope weights are reported for each batch, regardless of its enrichment. This can present problems for some facility operators that may not know the exact isotopic content for batches of depleted uranium. If unified uranium reporting is agreed between the SRA and the IAEA, then the SRA should ensure that the facility operator determines the isotopic content of all batches of depleted and enriched uranium (the fissile content of natural uranium is easily determined). Unified uranium element and isotope weights should be reported in grams, as required by Code 10.

The material balance evaluation is then made using only the unified uranium category, and the accounting reports (ICR, PIL and MBR) must be submitted using unified uranium. It is possible that receipts and shipments will have one MBA reporting in categories (depleted, natural and enriched) whereas the partner MBA reports in terms of unified uranium. This is correct as each MBA must report in the categories required for nuclear material accounting in the relevant FA.

With a unified uranium account, category changes do not apply and cannot be reported. A batch of unified uranium bulk material may contain only items/material of the same nominal enrichment. Fuel assemblies may have different enrichments in the individual rods and in practice the weights are aggregated and reported with a single element weight and fissile weight. This includes all enriched uranium pellets, as well as depleted and natural uranium pellets, commonly used as end plugs. Depleted and natural uranium are not reported separately but based on a nominal enrichment.

If a facility operator that uses unified uranium reporting imports natural uranium from a supplier, the operator will need to determine the isotope weight for reporting, as the shipping documentation may only include the element weight (but the isotopic weight for natural uranium is calculable).

Likewise, stratification of the inventory for development of sampling plans may require that the State or IAEA calculate the natural, depleted and enriched uranium on inventory. It is a good practice for the SRA to produce a stratified inventory list to support stratification needed in developing a sampling plan.

## 7.9. NUCLEAR LOSS AND PRODUCTION

Loss of material due to a nuclear reaction or decay must be reported as a nuclear loss. Normally, nuclear loss is reported for uranium burnup in a reactor or to report the decay of plutonium. Production of nuclear material due to a nuclear reaction is reported as nuclear production and most nuclear production applies to plutonium production in reactors. The FA will specify how nuclear loss and production must be reported.

### 7.9.1. Nuclear loss

Nuclear loss (burnup) is an ongoing process that is not reported from a nuclear material accounting standpoint until time of discharge of fuel from the reactor or within a specified time thereafter. The amounts reported reflect the accumulated loss for the time the material has been burned in the reactor core.

When burning mixed-oxide (MOX) fuel, there is a nuclear loss (due to burnup) of plutonium as well as a production of plutonium. In this case, the inventory change of nuclear loss reflects the net change in the nuclear material inventory, resulting from both processes together. Therefore, if the amount of plutonium produced exceeds the burnup, a nuclear production of the amount produced minus the burnup should be reported. However, if the amount of plutonium burned exceeds the production, the amount burned minus the production should be reported as a nuclear loss.

Nuclear loss can also occur due to decay of isotopes from nuclear material in storage. It is also typically reported prior to shipment, rather than periodically. The possibility of nuclear loss for each facility should be evaluated and will be specified in the FA.

### 7.9.2. Nuclear production

Like nuclear loss, nuclear production is not reported from a nuclear material accounting standpoint until time of discharge of fuel from the reactor or at a specified time thereafter. The amounts reported reflect the accumulated production for the time the material has been in the reactor. Nuclear production does not change the physical number of items on the inventory, but due to the production of plutonium, the number of items containing plutonium will increase. Although nuclear production is calculated for the period during which the fuel is in the reactor, the nuclear production will be reported on a single date in the ICR.

## 7.10. MATERIAL UNACCOUNTED FOR AND UNCERTAINTY CALCULATIONS

MUF refers to the difference between an MBA book inventory and physical inventory and is an important concept in nuclear material accountancy as it can be an indicator of the quality of control of nuclear material. Statistically significant MUF may indicate that nuclear material has been removed from the process. MUF is described in more detail in IAEA Services Series 15.

At the start of an accountancy period, the accounting books are consistent with the physical stock or inventory, i.e. the beginning physical inventory of a material balance period equals

the beginning book inventory for that period. As new items are brought into the inventory, the book account is increased, and as items leave the inventory, it is decreased. At the end of the accountancy period, the physical inventory is again compared with the book account. This is conceptually similar to inventory taking in shops, banks, warehouses and factories. However, the quantity of nuclear material is harder to measure than the amount of money or number of items in stock. Measurements of nuclear material inherently have some uncertainty, some variation from the ‘truth’. These uncertainties contribute to MUF.

MUF is calculated for each category of nuclear material in an MBA, i.e., natural uranium, depleted uranium, enriched uranium, plutonium and thorium. A negative MUF reflects more nuclear material present than accounted for, and a positive MUF reflects less nuclear material present than accounted for. SRDs are not a component of MUF.

The IAEA calculation of MUF is done at the end of a MBP, between two PITs. Generally, some level of MUF is expected at facilities that process bulk material, primarily due to measurement uncertainties. The MUF should be randomly distributed around zero unless there are, e.g. measurement biases or unmeasured process losses that lead to MUF being consistently positive or consistently negative. MUF is generally expected to be zero in facilities with only discrete items.

Following are some possible causes of MUF:

- Measurement uncertainty (weight, U/Pu concentration and fissile content by destructive assay, NDA);
- Estimation uncertainty (e.g. underestimation of unmeasured material in waste); and
- Estimations of material in process and material held up in a glove box or other processing equipment.

*Example: At a fuel fabrication facility, each MBP resulted in an increase in MUF, such that the cumulative MUF (CuMUF) was continuously increasing. The IAEA and the State worked together to identify each KMP’s contribution to MUF. A project was established to reduce the contributions to MUF, which successfully resolved the bias.*

Statistical approaches are used in the evaluation of MUF to determine whether MUF can be explained by measurement uncertainties or not. Therefore, an SRA should be familiar with the statistical approaches used for material balance evaluation. If the evaluation of MUF indicates that it is statistically significant, an investigation will begin to determine the cause.

#### 7.11. TECHNIQUES FOR MINIMIZING MUF AT BULK FACILITIES

In order to help minimize MUF, physical inventories at bulk facilities are taken when the nuclear material is consolidated into forms and at locations where **the most accurate measurement techniques** can be applied.

For example, measurements of waste and residues (usually heterogeneous and measured using NDA techniques) tend to have much larger uncertainties than, e.g. liquor in tanks. It is therefore important to limit amounts of waste and residues, to facilitate accurate accountancy.

Some nuclear material will inevitably remain inside a plant (so-called hold-up) even after a washout (e.g. plated out on the walls or pipes) but such amounts are normally small. Unmeasured discharges to the environment should, if they exist at all, be extremely small, but would generally put a negative bias on the MUF if they were present. Generally, unmeasured material should be very small as it is good practice to measure all streams in a plant.

*Example: Nuclear material accounting and control in an HEU processing facility were not properly implemented, resulting in a positive CuMUF over several years that did not follow the usual/expected pattern for that type of facility (e.g. MUF that randomly varies around zero). The escalating CuMUF in terms of quantities of U-235 raised a concern to both the State and the IAEA.*

*A collaborative project was initiated involving the IAEA, the SRA and the facility operator, to determine the origin of the problem and implement remedial actions. Process data were sent to the IAEA to determine the error sources and trends in different stages of the process. In parallel, an investigation was carried out by the operator to identify causes such as measurement/accountancy biases, hold-up and unaccounted material flows and to establish a plan for corrective actions.*

*In this framework, a technical visit by the IAEA to the facility was organized, in order (1) to conduct visual observations and obtain more comprehensive information about the facility's measurement and accountancy procedures, and (2) to agree on a time table for remedial action on the basis of the proposals made by the facility operator in their report. An audit was also performed by the SRA to evaluate the nuclear material accountancy, measurement error propagation and material balance evaluations. Technical documents related to the project and other supporting documents including lab results were reviewed. The IAEA proposed an action plan to be followed for implementing recommendations. One of the major contributors to CuMUF was found to be the nuclear material in waste generated by the facility that was not characterized and accounted for. The implementation of the recommendations in the action plan resolved the issue.*

## 7.12. DISCONTINUING NMA AND REPORTING IN AN MBA

Ending nuclear material accounting and reporting in an MBA is possible only when the nuclear material in an MBA is no longer under safeguards (e.g. as a result of termination of safeguards on the material, exemption or transfer to another MBA or out of the State). Before nuclear material accounting reporting can be discontinued, the following must be true:

- The physical inventory must be zero;
- There can be no batches on the inventory;
- A book inventory calculated on the basis of facility records and State reports should be zero for all types of material;
- There is no material in retained waste; and
- The status of the facility/LOF must be confirmed as 'decommissioned' by the IAEA.

As long as any one of the above prerequisites is not fulfilled, at least Null PIL and Null-MBR have to be submitted to the IAEA on an annual basis. While safeguards are applied, when the operator performs an inventory and there are no batches, a PIL and MBR must be submitted.

There is the possibility that the ending book inventory is relatively small but not zero, due to a variety of reasons, such as rounding. Nevertheless, the physical inventory must be zero and any differences not accounted for by an inventory change (e.g. accidental gain or loss) must be accounted for as MUF in the final MBR, with an attached null-PIL.

In addition to confirming that the book inventory is zero, all transfers to waste need to be analysed to ensure that there is no reported retained waste still remaining on the MBA accounts. If so, the material needs to be returned from waste and removed from the MBA accounts by means of the appropriate inventory change, such as a transfer to another MBA.

## 8. REPORTING NUCLEAR MATERIAL ACCOUNTING INFORMATION

### 8.1. INTRODUCTION

Each State that concludes a CSA with the IAEA is required to establish and maintain an SSAC. A cornerstone of both safeguards and the SSAC is nuclear material accounting and reporting. IAEA inspectors verify the declared information by checking records and reports, measuring and counting items, collecting nuclear material samples and verifying operator measurement systems. This section describes the various reports, the information submitted in each and the ways in which various nuclear material transactions are reported.

### 8.2. CODE 10

‘Code 10’ is part of the Subsidiary Arrangements (General Part) that deals with the content, format and structure of nuclear material accounting reports to be sent to the IAEA. There are two IAEA legacy versions of Code 10, one of which is referred to as the ‘fixed format’ Code 10 and the other is referred to as the ‘labelled format’ Code 10. A new version of Code 10 which permits the coding of NMA data in XML format is available and may be included in the Subsidiary Arrangements for a State.

Each format provides the data elements necessary for reporting nuclear material accounting information to the IAEA. (Labelled and fixed format Code 10 can be found on the Assistance for States webpage at [www.iaea.org/safeguards](http://www.iaea.org/safeguards) under the ‘Additional Documents’ tab.) The initial decision regarding which format will be used is made during negotiations of the subsidiary arrangements. If a State wishes to change their Code 10 format, the State should contact the IAEA to initiate the process.

The **fixed format Code 10** is based on 80-column punched card technology from the early 1970s. It provides for reporting electronically or on hard copy forms, defines reports that contain a maximum of 99 line entries and specifies fixed lengths for data fields.

The length of each field is specified in Code 10. Due to these field limitations, procedures may be needed to address the reporting of data that exceeds the limits. (See section 8.19 on Continuation Entries, which are used to report the longer data.) Also, batch names are limited to 8 characters under fixed format Code 10.

The **labelled format Code 10** was developed in the mid-1970s. Labelled format allowed for more flexibility in reporting, as preferred by some States.

The labelled format Code 10 is designed to be used with a **computerized** nuclear material accounting and reporting system and has few restrictions on report and data field length.

This format requires that all reports be provided electronically. It is possible to report more than one element in a single nuclear material accounting entry, which facilitates reporting ICRs and PILs where batches may have more than one type of safeguarded nuclear material, such as fuel discharged from a power reactor.

Labelled format reporting will look like a string of data delimited by labels that precede each piece of data. Figure 11 shows the data elements and the resulting data string for reporting a domestic receipt of irradiated fuel.

All formats of Code 10 support **electronic reporting to the IAEA**, and it is the recommended means for providing nuclear material accounting reports.

The State may choose whatever coding system it prefers, but ultimately the reports submitted to the IAEA have to conform to Code 10 (for States with a CSA). There may be accounting events defined in the State's codes that do not easily map to an IAEA code and this can cause problems when preparing IAEA reports. The conversion procedure to map internal State codes to IAEA Code 10 needs to be clear and well defined. Additionally, IAEA inspectors are accustomed to Code 10 terms, so having the State's and facility information systems consistent with Code 10 can reduce inspector time in the field.

| LABEL                      | REPORT TYPE   | DATA ELEMENT                                       |
|----------------------------|---------------|----------------------------------------------------|
| 001: OI / NN ; 000015 #    | ICR, MBR, PIL | REFERENCE NUMBER                                   |
| 002: 1 / 1 #               | ICR, MBR, PIL | ENTRY NUMBER / TOTAL NUMBER OF ENTRIES             |
| 003: 20150124 #            | ICR, MBR, PIL | REPORT DATE                                        |
| 006: NAME, I #             | ICR, MBR, PIL | ENCODER'S NAME                                     |
| 010: I #                   | ICR, MBR, PIL | REPORT TYPE                                        |
| 015: 20141201 / 20141231 # | ICR, MBR, PIL | REPORTING PERIOD                                   |
| 099: / #                   | ICR, MBR, PIL | CONCISE NOTE REFERENCE                             |
| 207: NND- #                | ICR, MBR, PIL | FACILITY CODE                                      |
| 307: NND1 #                | ICR, MBR, PIL | MBA CODE                                           |
| 309: N / ; / #             | ICR, MBR, PIL | ENTRY STATUS AND CROSS REFERENCE CODE              |
| 310: #                     | ICR           | STATE ACCOUNTABILITY SYSTEM RECORD IDENTIFICATION  |
| 370: NN / NN-B #           | ICR           | SHIPPER OF NUCLEAR MATERIAL                        |
| 372: NN / NND1 #           | ICR           | RECEIVER OF NUCLEAR MATERIAL                       |
| 390: #                     | ICR, MBR, PIL | CONCISE NOTE INDICATOR                             |
| 391: #                     | ICR, MBR, PIL | TEXT OF CONCISE NOTE                               |
| 407: 3 #                   | ICR, PIL      | KEY MEASUREMENT POINT CODE                         |
| 411: RD #                  | ICR, MBR      | TYPE OF INVENTORY CHANGE, TYPE OF ACCOUNTING ENTRY |
| 412: 20141215 #            | ICR           | DATE OF INVENTORY CHANGE                           |
| 430: B / Q / 1 / G #       | ICR, PIL      | MATERIAL DESCRIPTION CODE                          |
| 435: / #                   | ICR, PIL      | OPERATOR'S MATERIAL DESCRIPTION CODE               |
| 436: #                     | ICR, PIL      | OPERATOR'S MATERIAL DESCRIPTION (TEXT)             |
| 445: #                     | ICR, MBR, PIL | NON-LATIN ALPHABET IDENTIFICATION                  |
| 446: 045C8 #               | ICR, PIL      | BATCH NAME                                         |
| 447: #                     | ICR, PIL      | SHIPPER'S BATCH NAME                               |
| 469: N / / #               | ICR, PIL      | MEASUREMENT IDENTIFICATION CODE                    |
| 470: 1 #                   | ICR, PIL      | NUMBER OF ITEMS IN BATCH                           |

| WEIGHT DATA: |        |              |                |        |
|--------------|--------|--------------|----------------|--------|
| 600: #       | 610: # | 620: #       | 630: 163257G # | 640: # |
| 650: #       | 660: # | 670: 1306G # | 680: #         | 690: # |
| 700: 1498G # | 710: # | 720: #       | 730: #         | 740: # |
| 750: #       | 760: # | 800: #       |                |        |

The reported data string for the above receipt domestic would be:

001:OI/NN;15#002:1/1#003:20150124#006:NAME, I#010:I#015:20141201/20141231#207:NND-#307:NND1#309:N#  
370:NN/NN-B#372:NN/NND1#407:3#411:RD#412:220141215#430:B/Q/1/G#446:045C8#469:N#470:1#  
630:163275G#670:1396G#700:1498G#

FIG. 11. Example of labelled format reporting.

### 8.3. REPORTING PERIOD

The reporting period is a field specific to each report that describes the time frame covered in that report. It consists of ‘from’ and ‘to’ dates for ICRs and MBRs, and a single inventory date for PILs. The data element in NMA reports ICR and MBR are:

- Fixed format Code 10: in the header information, paragraph 3;
- Labelled format Code 10: label 015.

For ICRs, the reporting period must include the dates of all original (i.e. non-correction) entries in the report. Beyond that, there are several possibilities of what can be reported. Figure 12 shows reporting periods when a PIT is performed in the middle of a month.

For an MBA with regular (for example monthly) transactions, a good practice is to report **inventory changes in each calendar month** in which changes occur or were determined. In a month **in which a PIT occurs**, it is a good practice (or required if specified in the FA) to submit two ICRs in that month: one for the beginning of the month up to and through the PIT date, and the second one for the day after the PIT through the end of the calendar month.

## Nuclear Material Accounting Reports Physical Inventory Taking Within a Calendar Month

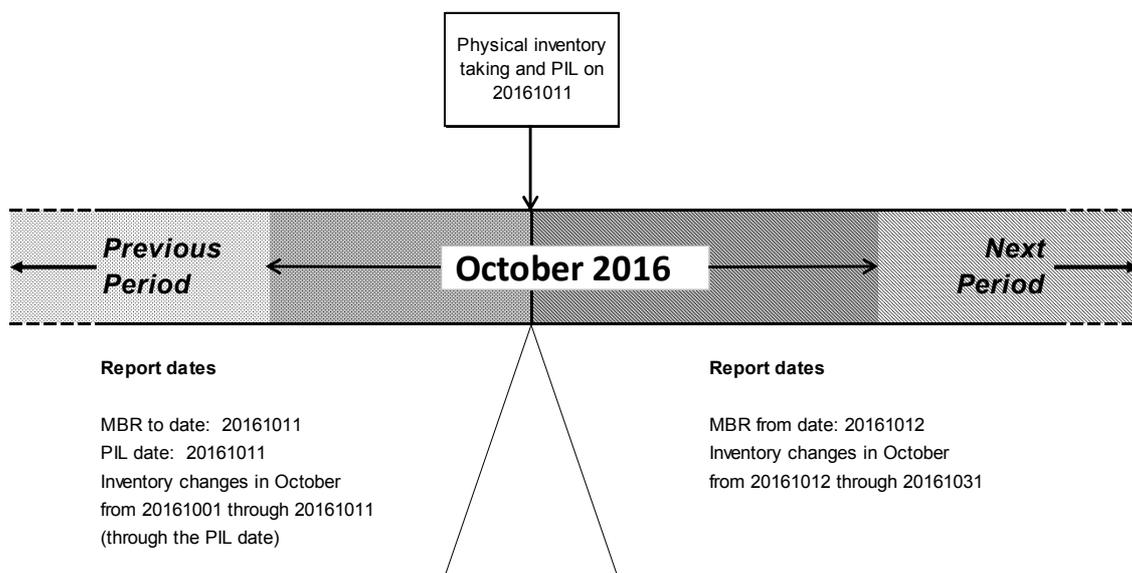


FIG. 12. Reporting periods for ICR, PIL and MBR in a month when a physical inventory is taken.

It is possible to have equal ICR ‘from’ and ‘to’ dates if all of the transactions have the same inventory change date. However, in the event that entries need to be added to the report at a later date, then only this one day period would be covered.

For reports containing corrections, the dates in the reporting period apply only to the newly reported entries in the report. For ICRs, the inventory change date of a correction entry needs to be within the reporting period of the report that includes the first ICR entry reporting the transaction. For PILs, the date of inventory in the reporting period field only applies to new PIL entries and does not reflect the associated inventory date of the entries being corrected. For MBRs, the material balance period only applies to new MBR entries and does not reflect the period related to the entries being corrected.

It is possible that a report consists entirely of corrections and the corrections also may refer to several different reports and periods. In this case, the reporting period dates of the report providing those corrections cannot really reflect a true ‘period’. A logical solution for PILs would be to use the date the corrections were made or, for ICRs and MBRs, the full period covered by all of the corrections. Nevertheless, the dates for the reporting period (ICRs and MBRs) or inventory date (PILs) must be reported.

### 8.4. BATCHES

Nuclear material accounting and reporting is on a batch basis under CSAs. Typical batches for an MBA within a facility are defined in the FA for each inventory change, each inventory KMP, each MDC and each measurement basis code. A batch may be composed of several items, as long as the items have the same specifications as provided for in the relevant FA.

All batches of nuclear material must be reported, even if the amounts are so small as to result in the weight rounding to zero. In such cases, a weight of zero must be reported, to indicate the existence of the batch and the type of material, and in this case Concise Notes are used to report the exact amount. A batch name is assigned to each batch of nuclear material, with the data element in ICRs and PILs as shown below:

- Paragraph 13 in fixed format Code 10 (Batch names can have 8 characters);
- Label 446 in labelled format Code 10 (Batch names can have 16 characters).

The batch name is formed by a combination of letters, numbers and special characters and is assigned by the organization that originally produces the batch. When the batch is shipped, the receiver can either accept the original batch name or rename the batch (called ‘rebatching’). It is a good practice to retain the original batch name (or a portion of it in case the shipper’s batch name is 16 characters and the receiver only allows for 8 characters). For bulk material, it will typically be necessary to rebatch it when it is processed.

It is a good practice for a SIMS to keep track of **the original batch name** for any batches which are renamed.

For imports and domestic receipts, the shipper’s batch name should be reported by the receiver in addition to the receiver’s batch name. Labelled format Code 10 allows for reporting in a single line entry both the shipper batch name and the receiver batch name. This assists the IAEA in matching the shipment and receipt.

The delimiter characters used for identifying data elements in labelled format Code 10 should not be used in a batch name (the delimiter characters are defined in paragraph 3 of labelled format Code 10.)

In principle, batch names should be unique within an MBA. For inventories, the batch identification should be unique within a PIL. Paragraph 67 of INFCIRC/153 (Corr.) requires that the physical inventory must list all batches separately and should specify the material identification and batch data for each batch. Figure 13 shows batch tracking for material in a State moving between MBAs.

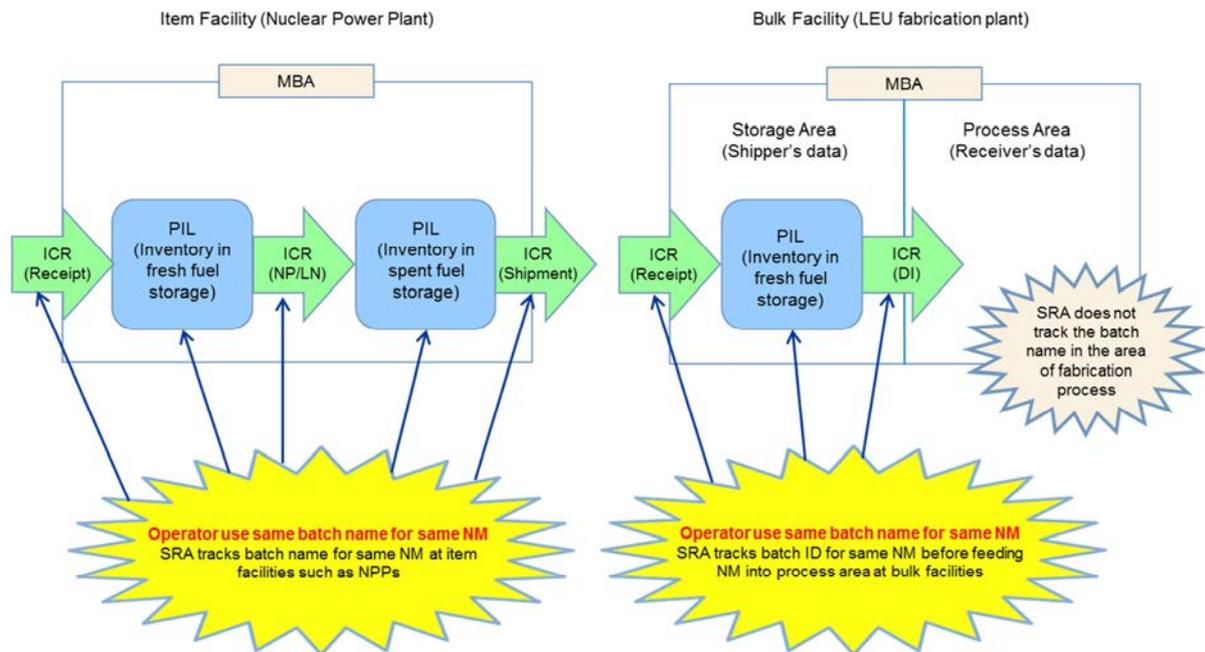


FIG. 13. Example of tracking batch names at item and bulk facilities.

It is useful for the State to have unique batch names in the State as a whole (or at least at the MBA level), particularly for spent fuel (or other material) if it will be kept in a long-term storage facility. It is useful to think ahead when determining the convention for naming batches.

For inventory changes, a batch name should be unique to the reporting MBA for any transaction on a single date. Every effort should be made to avoid repeating batch names. For example, if a shipping container identification number is used as a batch name, it will likely be repeated by another MBA using the same shipping container.

#### 8.5. TRACKING BATCHES AT A FACILITY AND REBATCHING

Some FAs include a requirement for tracking a batch within an MBA or more than one MBA at a facility. One common example is the reporting of pin exchanges in fuel assemblies at nuclear power plants. The way this is done is to use two inventory change codes: 'rebatching minus' (RM) and 'rebatching plus' (RP), which indicate a change in batch name or batch structure.

These inventory change codes are the only ones that can be used to report batch structure changes and provide information that can be used to follow a batch. In the event that batch name or structure changes are recorded in the facility records, the RM and RP entries in ICRs provide the mechanism for providing a corresponding report to the IAEA, noting that RM and RP entries have no effect on the nuclear material inventory.

#### 8.6. MATERIAL DESCRIPTION CODES

Each nuclear material batch reported in an ICR or PIL is described by a four-character MDC, which reflects the physical form, chemical form, containment and irradiation status and

quality. For each material type in a facility, the corresponding MDC is specified in the relevant FA. Operators should be fully aware of the types of material that are present in the MBA and the corresponding MDC for each.

In the event that nuclear material is going to be introduced into the facility for which there is no description code in the FA, the IAEA should be **notified in advance**, the design information updated, and the appropriate changes made to the FA.

States may have their own MDCs that then need to be mapped to the IAEA's MDCs. The MDCs are also used in stratifying the inventory for the purposes of creating a statistical sampling plan. They are also used in classification of material (e.g. irradiated or un-irradiated) for safeguards analysis and verification. A full list of the possible MDCs is in Code 10, paragraph 15 (fixed format) and label 430 (labelled format). Establishing a MDC is shown in Figure 14.

It is a good practice for the SRA to **assist the facility in identifying which MDC to use** in case of any uncertainty.

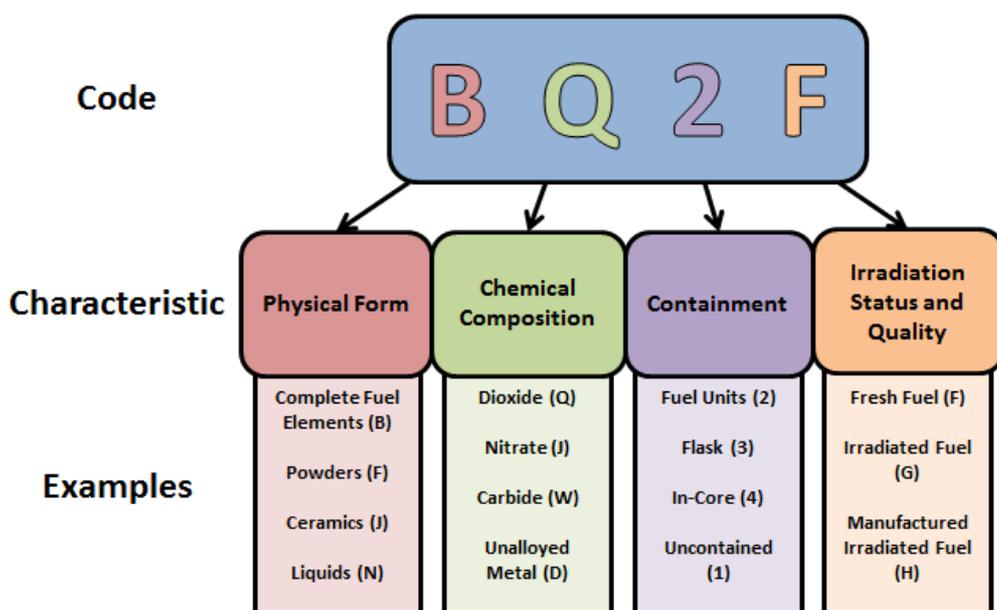


FIG 14. Example of how an MDC is determined.

## 8.7. INVENTORY CHANGE CODES

All changes to nuclear material inventories are defined in ICRs by a two-character code specified in Code 10, paragraph 11 (fixed format) and label 411 (labelled format). Inventory change codes are summarized and reported in MBRs as accounting entries, all of which are defined in Code 10, paragraph 48 (fixed format) and label 411 (labelled format).

It is obligatory, and very important, to use the **correct code for each ICR entry**. The code conveys key information to the IAEA about each change and its effect on the inventory.

## 8.8. INVENTORY CHANGE DATES

The inventory change date is the date within an ICR that indicates the date when an inventory change took place or was recorded. The date should be the date when the facility operator took possession of the material (for a receipt), relinquished the material (for a transfer) or established the change (for other changes). It should correspond to the date entered in the facility records and will determine the material balance period in which the entry will be included.

- Data element in NMA reports — ICR only:
- Fixed format Code 10: paragraph 9;
- Labelled format Code 10: label 412.

For inventory changes being reported for the first time, the date of inventory change must be within the period covered by the report as indicated in the ‘from’ and ‘to’ dates of the header information. If the date is in an entry that is an addition, then the date must be within the header date range of the report to which the addition is made. With respect to corrections, the date must be within the reporting period of the report being corrected and must be the same date as that of the record being corrected, unless the intent is to change the date. For a deletion, reporting the date is optional.

Some inventory changes may not be directly related to a specific date but instead reflect activity over a period of time. These will be specified in the FA, such as nuclear loss and production during reactor operation, and specific inventory changes of small amounts accumulated over a month, as defined in the FA.

## 8.9. CHARACTERS AND ALPHABETS

When reporting to the IAEA, States should not use the special symbol ‘Ø’ in any data field, but instead report the correct character for the letter ‘O’ and for the number ‘0’.

Labelled format Code 10 is the only format that provides the possibility to report in non-Latin characters. The only other permissible characters are Cyrillic. The use of non-Latin characters in a report is indicated in label 445 for ICRs, PILs and MBRs as a code that refers to a conversion table of characters; the corresponding bit configuration should be agreed between the IAEA and the State in advance. The only data fields that can be reported in non-Latin characters are:

- Encoder’s name (label 006);
- State accounting system identification (label 310);
- Text of concise note (label 391);
- Operator’s material description code (label 435). Cyrillic codes cannot be used if the operator’s codes are the same as those defined in Code 10;
- Batch name (label 446); and
- Shipper’s batch name (label 447).

For imports and exports, reports from one trading partner may be in Cyrillic while the other partner reports in Latin characters. This results in different batch names, requiring a manual effort for transit matching. In this case, both reporting partners could employ a good practice to develop a procedure to avoid Cyrillic characters; for example to use numbers only for batch names. With label 436 (Operator's material description text), the model Code 10 states that only Latin characters or agreed special symbols are to be used. It is therefore not permissible to use Cyrillic characters in this field as they are not considered as symbols.

## 8.10. PHYSICAL INVENTORY REPORTING

The results of a PIT are reported in a PIL and provide the basis for the beginning and ending physical inventories for a material balance period. The PIL is a report submitted by the SRA to the IAEA, reporting the amount of nuclear material on inventory by batch. The way that items are aggregated into batches is specified in the FA. In some item facilities such as nuclear power plants, it may be the case that each item is a batch, and the PIL includes all of the items. In other cases, a batch can contain more than one item. The facility operator prepares a 'List of Inventory Items' or LII, which includes all items on inventory. This report facilitates the stratification and sampling of the inventory during verification.

*Example: if a facility has loose fuel rods (not in a fuel assembly), then these rods may be aggregated into a batch, for example a box of rods placed in storage.*

The beginning physical inventory refers to the physical inventory that exists at the start of a material balance period. It is reported in the MBR with the code of 'PB'. The PB for each nuclear material account must be equal to the corresponding physical ending inventory (PE) at the end of the previous material balance period and reflects the status as of 0000 hours, the day following the most recent PIT.

The ending physical inventory refers to the physical inventory that exists at the end of a material balance period. It is reported in the MBR with the code of 'PE'. The PE for each nuclear material account must be equal to the corresponding total amounts in the physical inventory listing at the end of the material balance period and reflects the status as of 2400 hours on the date of PIT. The PE of a material balance period becomes the PB of the next material balance period.

Code 10 states that the physical beginning of one period must equal the physical ending of the previous period. Rounding adjustments to the PE (RAPE) in the MBR indicate a difference with the physical ending (PE) due to rounding as compared to the sum of the corresponding PIL. The RAPE resolves the ending physical inventory differences due to rounding for the MBP. However, reporting RAPE for one MBP does not mean that the rounding can be omitted for the next period. Rounding to physical beginning (RAPB) cannot be used to remove the need to report rounding in later MBPs. Therefore, it is possible that the reason for the rounding will still exist at the time of the next physical inventory and, if they continue to occur, rounding needs to be reported accordingly.

## 8.11. REPORTING NUCLEAR MATERIAL QUANTITIES

The amount of nuclear material in each batch must be reported in ICR and PIL entries. In addition, quantities of nuclear material summarized over the MBP must also be reported in the corresponding MBR accounting entries.

### 8.11.1. Measurement basis

The measurement basis data field (MB) is used to indicate how the value associated with an item or batch of nuclear material was determined. The measurement basis involves only the measurements, determinations or estimations made by the operator, not the verification measurements made by either an SRA or the IAEA. Measurement basis indicates two aspects of the determination of the nuclear material quantities (by batch for ICRs and PILs):

- If the nuclear material amounts in a batch have been determined in the reporting MBA or in another MBA; and
- If the weights have already been reported in a previous nuclear material accounting report for the reporting MBA.

The code should be reported for each batch of material and the possible code(s) to use can be found in Code 10.

Data element in NMA reports — ICR, PIL:

- Fixed format Code 10: paragraph 21
- Labelled format Code 10: label 469.

Although the title of the data field contains the word ‘measurement’ the choice of which code to report is based on the MBA in which the amounts are determined, not necessarily measured. A good example of ‘determined’ is the declaration in a power reactor of nuclear production: the amount of plutonium in an irradiated fuel assembly is reported with the code ‘M’ (measured in the MBA) even though no physical measurement is made. The plutonium production is calculated using codes for this purpose, based on reactor operation parameters.

For some measured discards, termination for use, or transfers to retained waste, the amount could be estimated and not necessarily measured. Because the **weights have been determined in the MBA**, the measurement basis would indicate ‘measured’ or ‘M’.

There are four possible codes for the measurement basis:

- ‘M’: The batch weights have been determined **by the reporting MBA** and this is **the first time** that the batch, with the determined weights, has been reported either in a PIL or ICR.
- ‘T’: The batch weights have been determined **by the reporting MBA** and the batch, with the determined weights, has **already been reported** in a previous PIL or ICR by the reporting MBA.

- ‘N’: The batch weights have been determined in **another MBA** and this is the **first time** that the batch, with the determined weights, has been included either in a PIL or an ICR by the reporting MBA.
- ‘L’: The batch weights have been determined in **another MBA** and the batch, with the determined weights, has **already been included** in a previous PIL or ICR by the reporting MBA.

These codes help the IAEA to see quickly, even in a PIL with a lot of batches, all of the cases where items have been measured (or determinations have been made) during the reporting period.

Material shipped out and received back in the same MBA cannot be reported with ‘L’ or ‘T’. For a batch on the inventory that is measured and no difference in quantity is found, the measurement basis would need to be reported as ‘M’, which is the only way for the MBA to indicate a measurement has been made.

It would be very uncommon, but not impossible, for a batch of material to be declared as ‘N’ in a physical inventory that is not an initial PIL. An example would be a batch of two discrete items that is later divided into two separate batches where the individual item masses are based on documentation (e.g. shipper values) from another MBA.

Figure 15 depicts an MBA ‘NNA3’ at a fuel fabrication plant, where the fuel assemblies are produced and immediately shipped to the power plant (in other words, the first report to the IAEA regarding these assemblies is made in the ICR reporting the ‘shipment domestic’ of fuel from the fabrication facility to the power plant); NN-B is the power reactor and NN-D is a separate storage facility. The measurement basis for each batch in each report is shown.

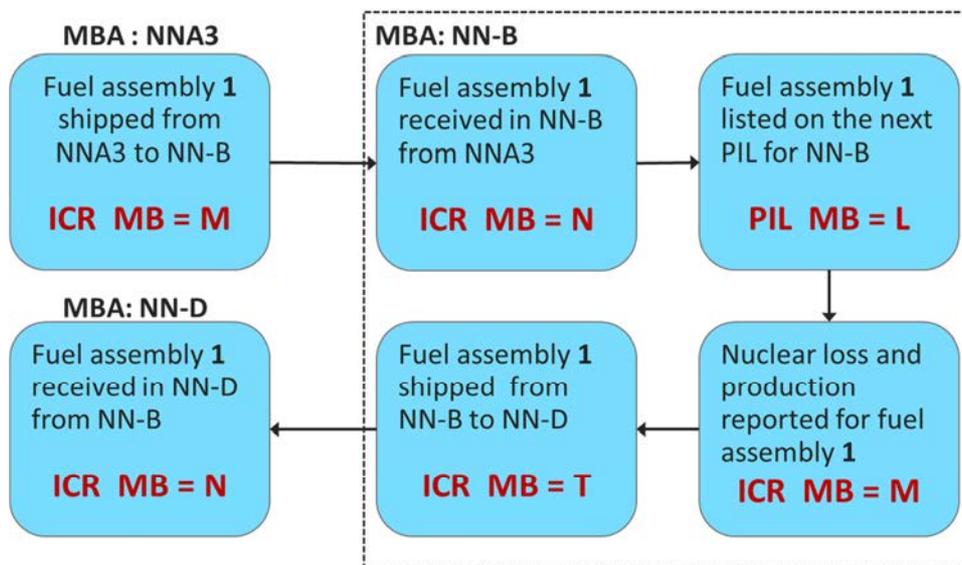


FIG. 15. Example of measurement basis for a power reactor fuel assembly.

The example shown in Figure 16 is a bulk facility with MBA ‘NNA2’ where Batch A is divided into two batches.

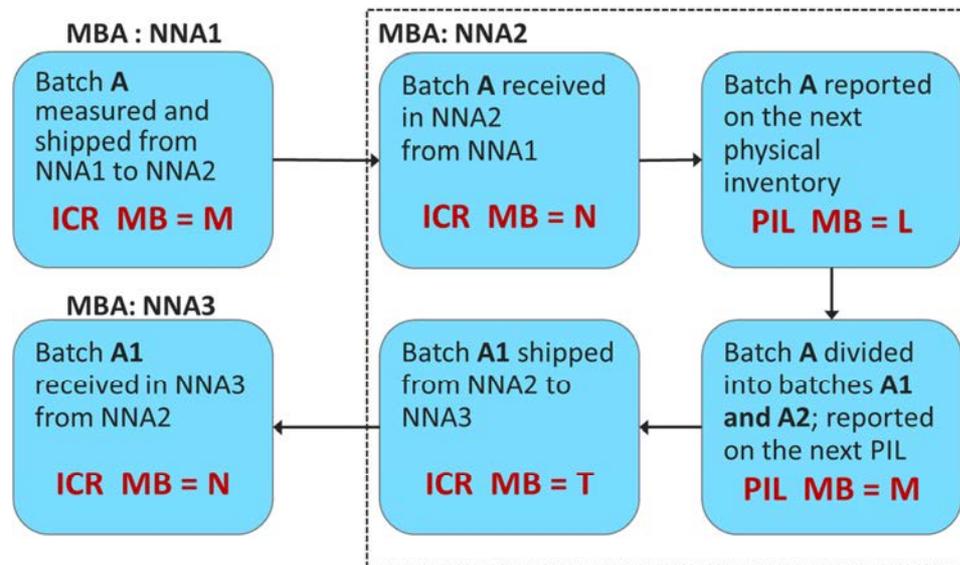


FIG. 16. Example of measurement basis for bulk material.

### 8.11.2. Units for reporting quantities of nuclear material batches

All material quantities must be reported to at least the minimum level specified in Code 10. Enriched uranium, unified uranium, plutonium and all isotope weights are reported in grams, while natural uranium, depleted uranium and thorium are reported in kilograms. The data elements for reporting weight in ICR, PIL and MBR are:

- Fixed format Code 10: (paragraph 18), indicated by “G” for grams and “KG” for kilograms;
- Labelled format Code 10: indicated by “G” or “KG” (in upper or lower case) following the numeric weight, in the weight data field.

It is highly recommended that all quantities — from the facility records through the reports to the State and the State’s reports to the IAEA — be maintained at the **same level of decimal significance**, thereby minimizing the need for rounding adjustments.

Unrounded numbers should be used throughout the State and when summing individual item weights to obtain the quantity of material in a batch.

If an amount rounds to zero grams for a batch, it is a good practice to **report this batch to the milligram level**. This facilitates the evaluation of the information. The IAEA requests that when zero amounts are reported for an accidental gain or accidental loss, the actual amount be **provided in an attached concise note**. If the amount is more than one milligram, then reporting to the milligram level will obviate the need for a concise note. All nuclear material masses are stored in the IAEA’s information system as **milligrams**.

The level of reporting significance is what is important, not necessarily the unit used; for example, a kilogram amount with three decimal places is equivalent to reporting at the gram level.

*Example: an item contains 0.4 grams of natural uranium in a uranyl nitrate solution. A small amount of this solution is used in a process approximately monthly. Due to the very small amounts, the item (which is unique at the facility) is a batch with a zero weight (rounding 0.4 grams to 0). And the amounts removed are also very small. The facility could report the measured discard each month of zero, resulting in a new value of the original item of zero. In such situations, it is recommended that the SRA discuss with the IAEA the timing for reporting these changes.*

To summarize, the highest significance for reporting is three decimal places at the gram level. Amounts reported with more than three decimals at the gram level are rounded at the IAEA to the nearest milligram.

States should avoid reporting at a **greater significance than the milligram** level to minimize unnecessary rounding adjustments.

### **8.11.3. Element weights of batches of nuclear material**

Element weight is the weight of the nuclear material (U, Pu or Th) in the batch being reported. The amount is the actual weight of the nuclear material element, not including any other elements that may be part of the total mass of the batch (such as the oxygen in uranium dioxide). The data element in NMA reports — ICR, PIL, MBR is:

- Fixed format Code 10: positions 38–45 (maximum of 8 positions);
- Labelled format Code 10: one of the labels 600–630, 700 or 800, depending on the type of element.

If a batch weight value rounds to zero, a zero still needs to be reported, and a Concise Note used to report the exact weight.

For enriched uranium, both the mass of U-235 isotope and the mass of total elemental uranium are reported. However, for plutonium, only the elemental mass needs to be reported (unless otherwise agreed in the FA). Mass of U-233 isotope is reported as the mass of total elemental uranium.

### **8.11.4. Weights of fissile isotopes in enriched, natural and depleted uranium**

Reporting fissile isotope weight refers to the amount of the fissile isotope of the nuclear material contained in the batch being reported. Reporting isotope weight is required for enriched uranium, unified uranium and, in some specific cases, for natural and depleted uranium, plutonium or other isotopes, if so required in the relevant FA.

For enriched uranium, the data element in NMA reports — ICR, PIL, MBR are:

- Fixed format Code 10: positions 48–55 (maximum of 8 positions);
- Labelled format Code 10: indicated by one or more of the labels 640 690 and 710–780 depending on the type of material.

In some MBAs, the FA requires fissile isotope reporting for plutonium, natural and depleted uranium (which are usually reported only in element weight). Separate accounting and

reporting of the depleted and natural uranium fissile content does not apply to MBAs that report in terms of unified uranium. If fissile isotope weights for natural and depleted uranium are required, the following applies:

- Fixed format Code 10: the isotope weights are reported in the isotope weight field, (paragraph 19) and the element code indicates the material category ('N' or 'D');
- Labelled format code 10: labels 770 and 780 for natural and depleted uranium fissile content, respectively;
- Accounting for the depleted uranium fissile content includes closing the natural and depleted uranium fissile material balances.

When fissile reporting is required, the field cannot be left blank; a zero needs to be reported.

#### 8.11.5. Negative weight values

There are situations where negative weights can be reported, but there are very few cases where it is possible; otherwise, positive values are to be reported.

For ICRs, the effect of an inventory change (plus or minus) is determined by the inventory change code. **A + or - should not be reported with weight values** except as noted below.

Possible negative values in ICRs:

- Shipper/receiver differences (shipper value minus receiver value);
- Nuclear loss and production associated with reactor fuel being reloaded into the core, and accounting for the change by returning the weights to shipper values;
- Only for States with an older version of Code 10 that does not include an inventory change code for accidental gains (GA), a negative accidental loss (LA) may be reported to indicate an accidental gain. States with such a Code 10 should initiate the process to update their Code 10 to include the inventory change code for accidental gains (GA).

Possible negative values in MBRs:

- Shipper/receiver differences;
- Material unaccounted for;
- Rounding adjustments;
- Nuclear loss and production when associated with reactor fuel being reloaded into a core and the material being returned to shipper values. In this case, it is possible to have negative values in an MBR, but it is not likely as there will probably be larger positive amounts of nuclear loss and production also included for discharged fuel;
- Book adjusted and book ending inventories; these are almost always positive, but in some cases where a physical ending is zero (no batches on the inventory) a negative book inventory may result due, for example, to rounding adjustments;
- Accidental losses when used to indicate an accidental gain (only for States with older versions of Code 10).

For PILs, negative values are not permitted — all weights must be positive.

## 8.12. CORRECTIONS AND ADJUSTMENTS

There are three kinds of adjustments to previously reported entries: corrections, additions, and deletions. Corrections are used to report a change to data contained in a previous report. Corrections and adjustments to prior accounting entries are described in detail in Annex VIII.

Nuclear material accounting requires clear and documented transactional history. Adjustments must be **transparent, explained and properly recorded**. Corrections are used to record changes to previously reported nuclear material accounting entries.

The IAEA's semi-annual statement uses the term 'modifications' to describe corrections, deletions and additions. The semi-annual statement has a notification regarding timeliness of reports, and a statement regarding all of the modifications, which reflects the time that lapsed from the date of an original report in which an entry was included, and the date the correction was reflected by the SRA. There is no timeliness requirement for corrections/modifications, but corrections should be addressed as soon as the need is identified.

Corrections are used to report a change to data contained in a previous report. A State may use a different principle for applying the effects of corrections than the method used by the IAEA. Correction principles are agreed upon between the IAEA and the State, and it is **preferred for the State and the IAEA to use the same correction method**.

Corrections are always conveyed using the same report in which the erroneous entry was made. In other words, an ICR can only correct another ICR, an MBR can only correct another MBR and a PIL can only correct another PIL. Code 10 does not specify a mechanism for correcting concise notes. However, concise notes can be corrected by sending a report that indicates a removal of a prior concise note by leaving the concise note indicator blank or by reporting a new concise note.

PILs are prepared for a single date, and any corrections to the physical inventory will be applied as of that date. MBRs cover the time between two physical inventory takings and any corrections will affect the balance entries reported at the end of the material balance period. Inventory changes that are recorded during a MBP are reported with the date when the event occurred or was established, as defined in Code 10.

When an inventory change **date** needs to be modified, there are two basic methods for making the change. The IAEA method applies a correction by replacing a previously reported nuclear material accounting entry with the correcting entry. Therefore, the date of the original event is also the date of the correction, even though the correction may have been made some time later. If the date needs to be corrected, the correcting entry should report the new date. If the new date is within a different MBP, then changes to other affected reports (MBRs and PILs) may be necessary. Some States and facilities will apply a correction on the date the correction is made, and not on the date of the original, corrected entry. Figure 17 shows corrections made within a single MBP. Figure 18 shows corrections made to a previous MBP.

For corrections and additions, all data fields must be reported, even those that have not changed. For corrections to a fixed format Code 10 'C' (continuation) entry, it is also required to provide all data fields, even those not corrected, in the correcting entry.

The data elements that are used to indicate the entry that is to be corrected are:

- 'To Report Number'
- 'To Entry Number'

The 'To Report Number' is the number of the report containing the entry to be corrected and the 'To Entry Number' is the entry number in that report that is to be corrected.

There are some data fields used to provide the reference to an accounting entry that cannot be corrected except by the IAEA, and the IAEA will not make a correction to any State reports without approval from that State.

For corrections to the following fields, the IAEA and the State need to coordinate:

- Country code
- Facility code
- MBA code;
- Report period/date
- Report number;
- Line entry number;
- Report number in a correction reference; and
- Line entry in a correction reference.

In addition, corrections to the following fields can only be made by the IAEA for States with a labelled format Code 10:

- Subfields in label 001 (type of entries, country code);
- Report type; and
- Entry status.

If the SRA or facility operator finds an obvious mistake in an accounting report such as a transcription error, a correction will need to be submitted.

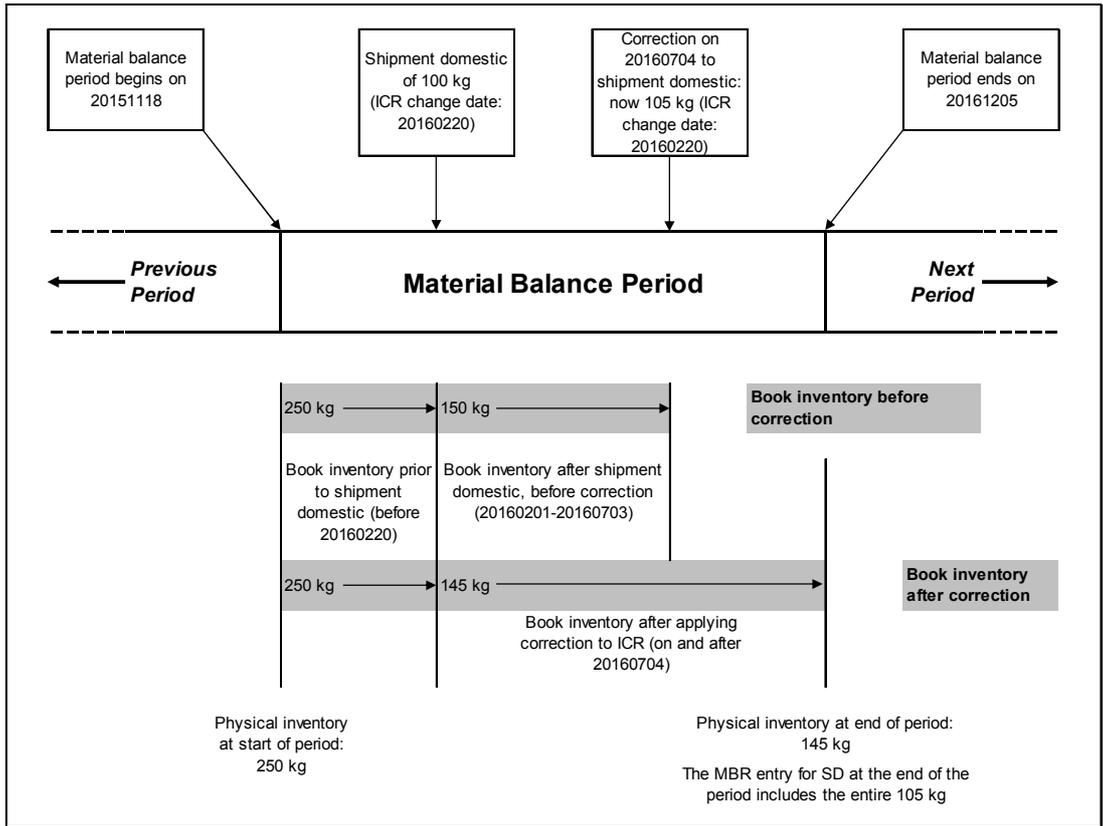


FIG. 17. Illustration of inventory changes occurring during the current MBP.

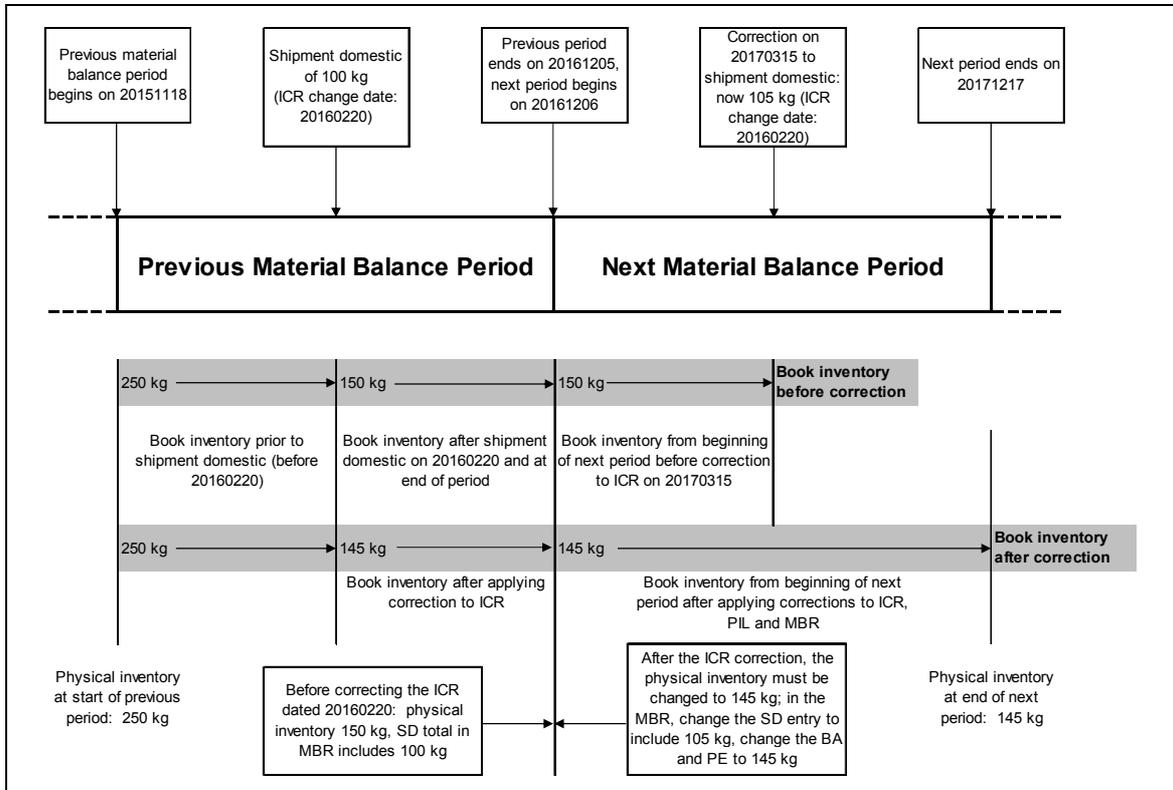


FIG. 18. Illustration of corrections made to inventory changes in a previous MBP.

It is required for the State and the IAEA to use the **agreed upon** correction method.

Remeasurement or change of calculation method should be discussed between the SRA and IAEA. If the operator knows the source of an incorrect inventory change or measurement previously reported, and knows the correct value, then the State should always report the adjustment of incorrect data using the appropriate correction method, rather than reporting a new inventory change.

*Example: An operator initially reported the amount of nuclear material contained in several batches (drums) without subtracting the weight of the container, due to a clerical mistake. The operator and SRA realized the mistake several months later. The SRA and IAEA discussed the problem and the operator submitted the corrections.*

### 8.13. CATEGORY CHANGES

Category changes are used to report increases and decreases in nuclear material accounts as the result of uranium changing from one category (enriched, natural or depleted) to another. They typically occur in enrichment plants, fuel fabrication plants and on-load reactors. In nuclear material balances, the accounts of the two categories of uranium involved will be affected; one will increase and the other will decrease by the same amount. The inventory change codes are EN, ED, NE, ND, DE and DN; the letters indicate the types of uranium involved (E=enriched, N=natural, D=depleted) and can be read as abbreviations where the first character indicates the original category of uranium and the second character shows the resulting category after the change has taken place. For example, NE is read 'natural to enriched' as it indicates a category change from natural uranium to enriched uranium.

If a batch of uranium is on an inventory in one uranium category (depleted, natural or enriched) and it is later determined that the material category is incorrect, the change is recorded as a component of MUF and not as a category change. Category changes are only used to report changes resulting from a process such as blending or enrichment.

#### **Reporting category changes with fixed format:**

When material changes category, only the element code with the higher enrichment ( $E > N > D$ ) must be reported in an ICR, for fixed format Code 10. However, reporting an entry for both categories (using each element code) in an MBR is a good practice and results in complete MBR reports for each type of material. An example for a category change **ND** is shown below:

MBR for N natural uranium:

PB: 100  
**ND:** -20  
BA: 80  
PE: 80  
MUF: 0

MBR for D depleted uranium:

PB: 50  
**ND:** 20  
BA: 70  
PE: 70  
MUF: 0

Reporting both weights in separate accounts reduces any issues arising due to possible rounding between the original and resulting weights.

*Example: when an operator has a category change from natural to enriched, the change of reporting from kg to g may result in rounding errors that will later need to be corrected. It is a good practice for the operator to ensure that the report of the kilogram decimals is exactly equivalent to the weight in grams.*

An example of a difference in units for a category change **NE** is shown below:

| MBR for N natural uranium (kg): | MBR for E enriched uranium (g): |
|---------------------------------|---------------------------------|
| PB: 100.000 kg                  | PB: 200.0 g                     |
| <b>NE: - 0.114 kg</b>           | <b>NE: 114.0 g</b>              |
| BA: 99.886                      | BA: 314.0                       |
| PE: 99.886                      | PE: 314.0                       |
| MUF: 0.000                      | MUF: 0.0                        |

### **Reporting category changes with labelled format:**

Labelled format Code 10 requires that the weights of both previous and resulting categories be reported in the same ICR line entry. The weights for both categories reported in a labelled format Code 10 entry should both be positive values. Therefore, the previous uranium category weights cannot be negative, as the reduction in the original category is indicated by the inventory change code.

Although it is technically possible in labelled format MBRs to report both categories in the same accounting entry, it is clearer to report the categories within the corresponding individual MBR nuclear material balances. Reporting both weights in separate accounts reduces any issues arising due to possible rounding between the original and resulting weights.

### **Example of reporting category changes:**

Taking an example where 1 kg natural uranium is blended with 20000 g uranium enriched to 3% (U235 weight 600 g):

- The category change is from natural to enriched uranium (inventory change code 'NE').
- For fixed format ICRs, report the element code 'E' with an element weight of 1000 g and a fissile weight of 7.120 g.
- For labelled format ICRs, report label 610 (natural uranium) with a weight of 1 kg, label 630 (enriched uranium) with a weight of 1000 g and label 670 (U-235) with a weight of 7.120 g.
- The resulting batch after the blending operation will have an element weight of 21000 g with a U235 weight of 607.120 g, for an enrichment of approximately 2.9%.

- As a result of this blending activity, the natural uranium account will decrease by 1 kg; the enriched element and U-235 accounts will increase by 1000 g and 7.120 g, respectively.
- In the corresponding fixed format MBR entry for 'NE', include the amount of material (with element code 'E') in the total; although not strictly required, also, it is preferable to report an entry for 'NE' with an element code of 'N'.

In the corresponding labelled format MBR entry for 'NE', include the amount of material (with labels 630 and 670) in the totals; also, it is required to report label 610 in the same entry for 'NE'.

#### 8.14. REPORTING NUCLEAR LOSS AND PRODUCTION

Nuclear loss and nuclear production are used to reflect the transformation of isotopes during irradiation in a reactor, for example. They are also used to reflect the change in composition of the material in spent fuel as it cools after removal from a core (reported with 'NL' for PU).

The element code in the ICR entry for nuclear loss is the code of the material as it was prior to the loss. For a fuel bundle removed from an on-load reactor, for example, the nuclear loss would be reported as natural uranium, the resulting bundle becomes depleted uranium and a category change of ND (natural to depleted) would be needed to account for the remaining uranium as depleted. (Also in this example, the nuclear production would be used to report the plutonium present in the fuel bundle.) See section 7.9 for more information on this topic.

#### 8.15. RETURNING DISCHARGED FUEL TO A CORE

Prior to returning discharged fuel to a reactor core when the corresponding nuclear loss and production have already been reported, an accounting change may be needed to report the fuel with the original shipper values. If this is required, it will be stated in the relevant FA. Another possibility is that the FA does not require the returned fuel to be accounted for based on shipper values. For FAs that require the return of fuel to be accounted for based on original shipper values:

- The total nuclear production to date for the assembly should be reported with a negative value of plutonium, equal to the corresponding total positive nuclear production most recently reported. The MDC indicates the irradiated status;
- The total nuclear loss to date for the assembly should be reported with a negative value of enriched uranium element and fissile weights, equal to the corresponding total positive nuclear loss most recently reported. For natural uranium fuel, only the element weight is necessary unless accounting is required for the fissile content of natural uranium. MDC indicates the irradiated status; and
- Upon final discharge, the latest associated nuclear loss and production reports will reflect the entire history of the fuel assembly.

For FAs that do not require the return to shipper values:

- Nuclear loss and production for every loading will reflect the inventory changes (nuclear loss and production) for each time period that an assembly is in the reactor core;
- No report should be made of negative nuclear loss and production;
- Upon final discharge, the nuclear loss will be only for the most recent period for the assembly in the reactor; and
- The total nuclear loss and production for a fuel assembly will be the sum of the relevant inventory changes reported for that assembly.

Taking an example in a facility where core fuel is always accounted for using shipper values, the following is a fuel assembly history from fresh fuel (received) weights through initial discharge from the core and subsequent reloading into the core and then a second discharge. Table 2 shows a fuel assembly that is burned in a reactor, discharged, reported on a PIL as irradiated and then returned to the reactor core.

TABLE 2. EXAMPLE OF REPORTING FUEL RETURNED TO A CORE USING TWO METHODS

| Event                                                                                                                                                                                                                   | Uranium element | U235  | Plutonium | Irradiation status |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------|-----------|--------------------|
| ICR receipt of assembly using shipper values                                                                                                                                                                            | 184219          | 5125  |           | Not irradiated     |
| ICR nuclear loss and production after first discharge                                                                                                                                                                   | 5374            | 3045  | 1310      | Irradiated         |
| PIL assembly values in spent fuel pond                                                                                                                                                                                  | 178845          | 2080  | 1310      | Irradiated         |
| The above three events are for the first time the assembly is burned in the reactor. The following five events are for the accounting and reporting when the assembly is reloaded into the core, burned and discharged. |                 |       |           |                    |
| ICR negative nuclear loss and production for assembly returned to core                                                                                                                                                  | -5374           | -3045 | -1310     | Irradiated         |
| PIL assembly values in core (original values, as received)                                                                                                                                                              | 184219          | 5125  |           | Irradiated         |
| After discharge, calculate nuclear loss and production for second time in core                                                                                                                                          | 1027            | 582   | 250       | Irradiated         |
| ICR nuclear loss and production for total time in the core                                                                                                                                                              | 6401            | 3627  | 1560      | Irradiated         |
| PIL assembly values in spent fuel pond                                                                                                                                                                                  | 177818          | 1498  | 1560      | Irradiated         |

## 8.16. CONCISE NOTES

Concise notes provide additional information to the IAEA for the implementation of safeguards. They are reported as **textual explanations** related to nuclear material accounting issues or facility/MBA operations.

Concise notes are used to provide additional information related to all nuclear material accounting reports to explain specific accounting issues or facility operations. For inventory changes such as exemptions, de-exemptions and accidental gains and losses, a concise note would always be used to explain the inventory change in more detail. The FA will specify reporting requirements for accidental losses, measured discards, and other inventory change codes, based on the process, throughput and other characteristics of the particular facility.

A gain of nuclear material associated with a trafficking incident should indicate the ITDB reference number in a concise note. Another use for concise notes is to provide additional information that could assist the IAEA with transit matching, such as foreign shipper and receiver information.

The IAEA recommends that concise notes be provided for the following types of entries:

- Exemptions;
- De-exemptions;
- Accidental gains;
- Accidental losses;
- Measured discards;
- Terminations;
- MUF (if reported in an item facility); and
- Corrections to previous reports.

Operational programme information may be submitted to the IAEA using a **concise note**. Examples of **good practices** in using concise notes include:

- To report actual quantities of Pu and HEU for which **zero amounts** are reported; the concise note specifies the actual weight using an appropriate unit (e.g. less than 0.5 milligrams).
- When a LOF operator ships nuclear material, a concise note may be used to **specify the receiver**.

Concise notes are very helpful to the IAEA in maintaining **information about exports** where a corresponding receipt may not be reported, such as a shipment to a NWS that may not report the import to the IAEA in time to support transit matching.

There is no correction mechanism for fixed format concise notes as there is for nuclear material accounting entries; however, when an accounting entry is reported with a concise note and then that entry is later corrected, the following applies:

- If the correcting entry does not include a concise note, then any concise note attached to the original entry no longer applies, at least with regard to the last record of the correction history;
- A concise note — attached to the correcting entry — can repeat the note attached to the original entry, or provide a completely new text or a verbal reference to the contents of the previous note;
- Since the concise note indicator means that a concise note is attached, the field should not be repeated when making a correction unless the correcting entry itself has a concise note attached.

#### 8.17. CONCISE NOTE INDICATOR

A one character code in nuclear material accounting reports indicates that a concise note is attached that refers to a specific line entry. The following information refers to the data element in accounting reports:

- Fixed format Code 10: paragraph 22;
- Labelled format Code 10: label 390;
- If the field is non-blank, there should be a corresponding note that relates to the entry in which the indicator is set;
- If there is a concise note at the report or entry level, the field should be left blank.
- For labelled format Code 10, the actual text of the concise note is contained in label 099, where it is possible to indicate if the note applies to a single entry or to a whole report.

#### 8.18. TEXTUAL REPORTS (LABELLED FORMAT)

In labelled format Code 10, textual reports are submitted under a separate record type. To indicate a textual report, the first subfield of label 001 should contain the characters “NC” and label 010 should contain a ‘T’. Additional labels (001, 002, 003, 099, 207, 307, 391) are used to relay the information pertaining to the note and the entry/report to which it refers. If a textual report refers to a line entry that is part of a set of continued entries, the text is associated only with the single referred to entry.

Only labelled format Code 10 permits reporting separate textual reports in addition to concise notes. Textual reports differ from concise notes primarily in that they have their own report number which needs to be in sequence with the report numbering of ICRs, PILs and MBRs.

#### 8.19. CONTINUATION ENTRIES IN FIXED FORMAT CODE 10

Continuation entries apply only to the fixed format Code 10. Because of field length limitations in the 80-position ICR, PIL and MBR fixed format forms, continuation entries are necessary to accommodate entries that take more than one line in a PIL/ICR nuclear material batch or MBR entry. A continuation entry is indicated by a ‘C’ in position 3 of the hard copy forms; the ‘C’ will result in certain data fields being copied from one line entry to subsequent line entries. In cases where the fixed format Code 10 specifies that the ‘C’ procedure can be

used, the data fields shown below can be left blank in the continuation line. In all other cases, these fields must be completed.

- Date of inventory change;
- MBA/Country from;
- MBA/Country to;
- Inventory change code;
- KMP code;
- Batch name; and
- MDC.

Continuation entries are needed when numeric values for an accounting entry are too large for a data field. Enough lines should be entered so that the sum of the values is the amount that is to be reported. This applies only to the *element weight*, *fissile weight* and *number of items* fields. Because the fixed format permits only one character for the element code, continuation entries are needed when more than one nuclear element is included in the same batch. An example of this is for spent fuel, where two line entries are needed to report the batch: one for the uranium and one for the plutonium.

If not all numeric fields (element weight, isotope weight or number of items) need to be continued on a subsequent entry, the other numeric fields not being continued must be reported as zero. Continuation entries must follow sequentially in a report. It is not possible to continue an entry from one report number to another.

For corrections to a 'C' entry, the continuation procedure does not apply since it is a requirement that the correcting entry provide all data fields, even those not corrected. Thus, if the 'C' was reported in position 3 of a correction entry, this would not be an error, but care should be taken that all data fields for the line are completed. (This presents the possibility that line entry one (1) of a report could have a 'C' in position 3, but only for a correction.)

If more than one line is necessary to report a nuclear material accounting entry, use of the 'C' procedure is not strictly required; however, if more than one entry is needed and the continuation ('C') is not used, then all data fields must be repeated on the original line and on all subsequent lines necessary to report the accounting entry.

*Example: In an MBR, the weight value is more than 8 digits, including the decimal point. The physical beginning inventory in an MBR for the enriched uranium element weight is 12345.678 g and the fissile weight is 308.642 g. Two line entries are necessary because the element weight (including the decimal point) has more than 8 digits. The whole number portion of the element weight (12345 g) and the entire fissile weight (308.642 g) will be reported on the first line entry. A 'C' in position 3, an element weight of .678 g (the decimal portion) and a fissile weight of 0 g will be included in the second entry. (Note that the fissile weight of 0 g is required in the second line entry; it cannot be left blank because it is a numeric field that must be reported for enriched uranium, even if it is 0 g.)*

For discharged (spent) fuel, there are two nuclear material elements in the batch. The first line reports the enriched uranium component with the element and isotope weights. The second line reports the plutonium content of the batch (element weight only).

## 8.20. EMPTY (NULL) ACCOUNTING REPORTS

When there are no items on an inventory or when there are no nuclear material balances, there still is a requirement to provide the corresponding PIL and MBR to the IAEA. The requirement for timely reporting still applies as well. A null PIL is used to meet reporting requirements where no nuclear material batches are to be reported and a null MBR is used to meet reporting requirements where no nuclear material balances are to be reported. There is no mechanism for reporting null ICRs. If no activity takes place during a reporting period, then no ICR should be submitted.

*Example: For an item facility that is closed down with no nuclear material inventory, the SRA should submit a null PIL and MBR until the IAEA has confirmed for safeguards purposes the decommissioned status of the facility.*

If there are no batches of nuclear material on the inventory of an MBA at the end of a MBP, then a null PIL is required and must be reported. If there are batches on inventory but their weights round to zero, the PIL should list batches with weights of zero, and include concise notes indicating the actual weight of each batch with less than 0.5 milligrams of material.

To submit a null PIL, the following fields are used:

- Fixed format Code 10: report a header and one line entry with the letter ‘A’ in position three; and
- Labelled format Code 10: report one PIL line entry with the letter ‘U’ in the first subfield of label 309; the data fields that must be reported with a ‘U’ entry are labels 001, 002, 003, 006, 010, 015, 207, 307, 309 and, optionally, 310.

*Example: It is possible, for example in a LOF, for some nuclear material to be present for which the SRA has not yet been able to determine weights. In this case, a PIL should be reported that lists all batches with weights of zero until the amounts can be determined. The corresponding MBR would report zero weights for the beginning and ending inventories. A concise note should be included explaining that measured quantities have not yet been determined.*

## 8.21. INVALID ACCOUNTING ENTRIES

A reporting option in nuclear material accounting reports for both Code 10 formats is to provide inactive entries. Except for use in fixed format Code 10 for reporting a deletion, inactive entries are not considered by the IAEA to be official data. The mechanism for indicating an inactive entry depends on the Code 10 format:

- Fixed format: report the letter ‘A’ in position 3;
- Labelled format: report the letter ‘U’ in the first subfield of label 309.

In some States' information systems, there are records in the facility's accounting system that are not required to be reported to the IAEA but are reported to the State by the facility based on the needs of the State. One example is reporting changes to nuclear material obligations (deriving from bilateral cooperation agreements), origin or ownership change. The data fields for reporting an inactive entry are:

- Fixed format: header information plus entry number, position 3, and, if a deletion, the To Report Number and To Entry Number fields;
- Labelled format: labels 001, 002, 003, 006, 010, 015, 207, 307, 309 and, optionally, 310.

It is possible for an inactive entry to correct an active entry as well as another inactive entry; conversely, it is possible for an active entry to correct an inactive entry. This addresses State needs in the event an active entry should have been reported as inactive.

## 8.22. TERMINATION

A State has the possibility to request termination of safeguards on nuclear material, pursuant to paragraphs 11, 13 and 35 of INFCIRC/153 (Corr.), on the basis that the nuclear material has been consumed, or has been diluted in such a way that it is no longer usable for any nuclear activity relevant from the point of view of safeguards, or has become practicably irrecoverable. The form to request termination is specified in Code 6 of the Subsidiary Arrangements (General Part).

### **Paragraph 11, INFCIRC/153 (Corr.)**

Termination of nuclear material in waste shall be subject to determination by the Agency that it has been consumed, or has been diluted in such a way that it is no longer usable for any nuclear activity relevant from the point of view of safeguards, or has become practicably irrecoverable.

### **Paragraph 13, INFCIRC/153 (Corr.)**

The Agreement should provide that if the State wishes to use nuclear material subject to safeguards thereunder in non-nuclear activities, such as the production of alloys or ceramics, it shall agree with the Agency on the circumstances under which safeguards on such nuclear material may be terminated.

### **Paragraph 35, INFCIRC/153 (Corr.)**

The Agreement should provide that safeguards shall terminate on nuclear material subject to safeguards thereunder under the conditions set forth in paragraph 11. Where the conditions of that paragraph are not met, but the State considers that the recovery of safeguarded nuclear material from residues is not for the time being practicable or desirable, the Agency and the State shall consult on the appropriate safeguards measures to be applied. It should further be provided that safeguards shall terminate on nuclear material subject to safeguards under the Agreement under the conditions set forth in paragraph 13, provided that the State and the Agency agree that such nuclear material is practicably irrecoverable.

Only after the request is granted by the IAEA, may the termination be accounted for and reported. Therefore, it is expected that the inventory change date for the termination is on or later than the date of IAEA approval. The inventory change code for termination is TU.

A common example of termination is for the thorium used in the manufacture of fluorescent light bulbs, or uranium is used for coating/colouring glass. The nuclear material in its end use form in the product is practicably irrecoverable. Thorium may also be added to magnesium alloys, after which it is practicably irrecoverable. For nuclear material in waste (See section 8.24), the first step in pursuing a termination is for the State to consult with the IAEA and reach agreement on the type of material for which termination may be possible. Where the State considers that the recovery of nuclear material is not for the time being practicable, the IAEA and the State can discuss the safeguards measures to be applied, such as for transfers to 'retained waste' that are awaiting conditioning (such as vitrification). Section 11.11 describes the reporting under an AP of waste containing HEU or Pu.

The IAEA determines when safeguards may be terminated on a batch of nuclear material. With regard to nuclear material in a waste stream, the IAEA and the State may discuss the possibility for termination of safeguards on nuclear material contained in waste streams at a facility rather than for a particular batch. In a FA, a KMP may be established in order to measure nuclear material in a type of waste (such as vitrified waste for reprocessing plants). The DIQ will describe the waste types at the facility, including the nuclear material categories, forms, containers, and average weight per item (or range of weight). The IAEA may then evaluate the possibility for termination of safeguards on nuclear material contained in particular types of waste generated at a facility.

Consultations may occur between the IAEA and the State during the facility design stage and during construction in this respect. Termination of nuclear material contained in waste only applies to conditioned waste, which involves the use of a specific matrix, such as bitumen, concrete or glass.

The State should always work with the IAEA to consult on possible re-application of safeguards measures to nuclear material contained in waste on which safeguards have been terminated, *before* further processing of the waste which will result in recovery of nuclear material. Information regarding the location or further processing of waste which contains plutonium, HEU or U-233 on which safeguards have been terminated must be declared per Article 2.a.(viii) of INFCIRC/540 (Corr.). Information relating any further processing of this type of waste must also be declared.

### 8.23. TRANSFERS TO RETAINED WASTE

Transfer of nuclear material on inventory to retained waste (inventory code TW) provides for some reductions in reporting and verification. Retained waste still requires accounting by the SRA and reporting of transfers from retained waste (FW) prior to any processing or movement to another location.

It is important to remember that nuclear material reported as transferred to **retained waste remains under safeguards**, and the IAEA and the State should consult on the appropriate safeguards measures to be applied to such material. From a safeguards point of view, the nuclear material in retained waste is considered to be **temporarily irrecoverable**, while nuclear material in waste on which safeguards may be terminated must be considered by the IAEA to be **practically irrecoverable**.

Figure 20 depicts the retransfer from waste for further processing of nuclear material for which safeguards had been terminated and associated reporting under an AP. This would only be necessary for medium and high active waste containing HEU or Pu or U-233 for which safeguards had been terminated.

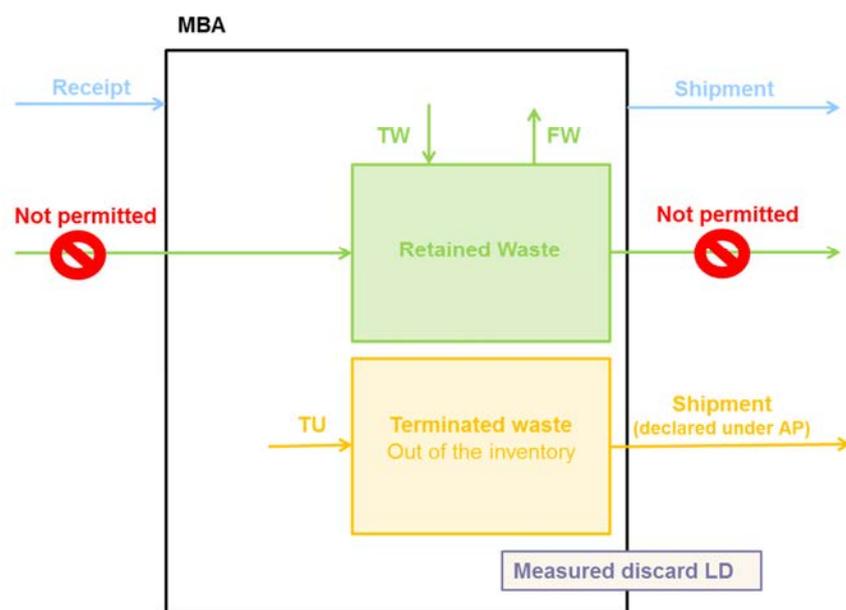


FIG. 20. Diagram depicting nuclear material in retained waste ('retained waste') and waste containing nuclear material on which safeguards have been terminated ('terminated waste').

#### 8.24. MEASURED DISCARDS

Material removed from the inventory as a result of process losses are reported as measured discards. Measured discards may be further defined in the relevant FA, where limits could be set for reporting the inventory change. The facility process may, routinely or occasionally, result in some discards that cause an operational loss of nuclear material, for example discards to the environment of gaseous or liquid effluent. These discards are clearly different from MUF or corrections and reported with inventory change code 'LD' in Code 10.

A measured discard is **only for process losses** and, therefore, cannot be used as an adjustment for any other changes to inventory, such as an accidental gain or loss or MUF.

Such types of discards must be evaluated as precisely as possible, and justified by operational records, enabling the evaluation and quantification of the loss. The DIQ should provide sufficient details describing the process steps that cause the loss to occur, and explain why

materials will not be suitable for further nuclear use (in many cases, it is induced by a dilution or an operational discharge). The measured discards limit is specified in the FA for regular operational releases. For a planned release, the SRA should inform the IAEA in advance.

Nuclear material that is captured in filters or on piping is material held up in process that **can be recovered and measured**. This is **not to be reported as a process loss**. Process losses account for material that is **no longer present at the facility** as it has gone out of or been released by the facility, e.g. in the air or down a drain.

## 8.25. EXEMPTION AND DE-EXEMPTION

Nuclear material can be exempted from safeguards upon request to, and granting by, the IAEA. A corresponding de-exemption calls for the re-application of safeguards to the material. There are two types of exemptions defined in INFCIRC/153 (Corr.), one based on the quantity of material (inventory change code EQ) and the other based on the use of the nuclear material (inventory change code EU). Each type has a related de-exemption, all of which are reported with different inventory change codes. Exempted material is de-exempted if it is to be stored or processed together with safeguarded material.

The article numbers in States' specific safeguards agreements may not be the same as the paragraphs of INFCIRC/153 (Corr.). States should refer to the relevant Articles in their CSAs which correspond either to **paragraph 36 or 37** of INFCIRC/153 (Corr.) when requesting exemption or de-exemption.

Material exempted based on use must also be de-exempted based on use, and material exempted based on quantity must be de-exempted based on quantity. Material exempted in one MBA can be de-exempted in another MBA. Exempted material has to be de-exempted before exporting it, transferring it to waste or before processing or storing it together with non-exempted material.

*Example: A company that owns and transfers a lot of DU containers (to ship radioactive sources) has two MBAs. One MBA is for storing containers with exempted DU which remain in this MBA. The other MBA holds the non-exempted DU. Only the containers in the MBA holding non-exempted DU are shipped or exported by the company.*

The Subsidiary Arrangements (General Part) have a form to be used for requesting exemption. When the SRA receives the notification from the IAEA granting the exemption, the nuclear material can be reported using the correct inventory change codes.

The IAEA recommends that requests for exemption include the **batch names and a 'reference tracking number'** as explained in **Annex IX**.

Although the State's reporting obligations on exempted material are reduced, the SRA must continue to account for and control the material. When exempted material will be exported, it must first be de-exempted. The only exception to this rule is for shipments of containers that use DU as shielding material and are shipped to another State and returned without changing

ownership. An IAEA letter providing instructions and information in this regard can be viewed on the Assistance for States webpage, under ‘Other Documents’.

In a State receiving a DU-shielded container, the SRA should determine whether or not the container has been purchased or is only being used temporarily to transport a source. If it is only being used to transport a source and is then returned to the exporting State, then the DU in the container is considered to be in transit and should not be reported. If the container is purchased and will remain in the State, then it should be reported as part of the inventory (as a receipt foreign, RF). Subsequently, the receiving State can request an exemption of the material, if it so desires.

A State has the possibility to request the exemption of material from safeguards, pursuant to paragraph 37 of INFCIRC/153 (Corr.), on the basis of the quantity of material. The material is recoverable and can be used for nuclear purposes. There are maximum limits that the total quantity of exempted material (based on quantity) cannot exceed. Those limits are specified in paragraph 37 of INFCIRC/153 (Corr.).

**Article 2.a.(vii) (a) of INFCIRC/540 (Corr.)**

Information regarding the quantities, uses and locations of nuclear material exempted from safeguards pursuant to paragraph 37 of INFCIRC/153 (Corr.).

There is a requirement in Article 2.a.(vii)(a) of the Model AP that a State declares the location of all exempted (quantity) material, which should be directly comparable to the exemption (quantity) amounts for a State as reported in ICRs.

When exempted (quantity) material is domestically transferred within a State, there is no nuclear material accounting and reporting requirement. However, the State needs to keep track of the transfer and update the 2.a.(vii) declarations.

Likewise, when material is de-exempted, the quantity declared under 2.a.(vii) will decrease, which should be reflected in the next update.

A State has the possibility to request the exemption of material from safeguards, pursuant to paragraph 36(b) of INFCIRC/153 (Corr.), on the basis of the expected non-nuclear use of the material. The material is recoverable and is not to be used for nuclear purposes. There are no maximum limits specified in the CSA.

There is a requirement in Article 2.a.(vii)(b) of INFCIRC/540 (Corr.) that the State declare all exempted (based on use) material under paragraph 36(b) of INFCIRC/153 (Corr.) that has not yet reached its non-nuclear end use form and whose total exceeds the limits specified in paragraph 37 of INFCIRC/153.

For any material that is de-exempted, if a new weight of the de-exempted material is determined, any changes from that used in the exemption should be accounted for in the facility/LOF MBA books, typically as MUF. Therefore, the material should be first de-exempted on the basis of the original weight values, then the new weight determined and the difference accounted for in the facility/LOF MBA as MUF with a Concise Note.

## 8.26. ROUNDING ADJUSTMENTS

A rounding adjustment is used to account for differences between summarized MBR values and the sum of amounts in the corresponding ICR or PIL entries. Rounding adjustments are reported only in MBRs and are **added to an MBR value** so that the MBR amount agrees with a consolidated sum of ICR or PIL entries. A rounding adjustment to MUF is also used to resolve rounding issues related to calculating MUF.

If the summary values in a PIL change due to rounding (i.e. if the number of digits used in the accounting system changes) then those changes must be reflected as a RAPE in MBRs. The subsequent MBR should report RAPB of the same magnitude but with opposite sign, otherwise the need to report RAPE will remain in subsequent MBRs. This is depicted in Table 3.

Rounding adjustments can be minimized by keeping all State and facility records and reports to the **same level of decimal significance**, while still maintaining the minimum reporting level of units as required by Code 10.

TABLE 3. EXAMPLES OF ROUNDING ADJUSTMENTS

| <b>Rounding adjustment to shipments domestic (SD)</b>                    | <b>Data type</b> | <b>Uranium element</b> | <b>U235</b> |
|--------------------------------------------------------------------------|------------------|------------------------|-------------|
| Total amount of SD in the MBR (rounded to the gram)                      | MBR: SD          | 34567                  | 864         |
| Total of all ICR SD entries (summed and reported to the tenth of a gram) | ICR: SD batches  | 34566.3                | 864.1       |
| Rounding adjustment in the MBR                                           | MBR: RASD        | -0.7                   | 0.1         |

| <b>Rounding adjustment to physical ending inventory (PE)</b>          | <b>Data type</b> | <b>Uranium element</b> | <b>U235</b> |
|-----------------------------------------------------------------------|------------------|------------------------|-------------|
| Total amount of PE in the MBR (rounded to the gram)                   | MBR: PE          | 67854336               | 1696358     |
| Total of all PIL entries (summed and reported to the tenth of a gram) | PIL: batches     | 67854337.1             | 1696357.2   |
| Rounding adjustment in the MBR                                        | MBR: RAPE        | 1.1                    | -0.8        |

## 8.27. QUALITY CONTROL REVIEWS OF NMA REPORTS

Each SRA is responsible to ensure that information submitted to the IAEA is correct, complete and timely. A good way to implement this requirement is to establish quality assurance programmes as part of the SRA's integrated management system. Quality control of the nuclear material accounting information (and AP declarations) at all steps – from acquiring, recording, processing, reviewing, to transmitting – will help to ensure any errors are caught and corrected prior to submission. While no auto-validation software can replace

an SRA's auditing function, the IAEA offers the QCVS programme, which checks for syntax errors in the Code 10 reports. QCVS can accept data from an excel spreadsheet and then identify errors. The errors can be fixed prior to the SRA's audit of the reports. But whatever was done to correct the errors has to be reflected in the corresponding facility records.

It is a good practice for the SRA to prepare a **preliminary draft MBR and PIL** before finalizing, to ensure there are no problems or discrepancies; if any are found, the SRA should resolve these with the facility/LOF operator before submitting the State reports to the IAEA.

Many SRAs do a desktop audit of the information submitted by the operators, using the operators' facility reports (e.g. general ledgers, summary of inventory change ledgers, reconciliation statements and final inventory listings) prior to compiling into State reports (ICRs, MBRs and PILs) for the MBA and submission to the IAEA. Other SRAs submit their operators' reports prior to performing a QC audit; if they find any errors or missing data, they request the MBA to submit a correction. Some operators have a nuclear material accounting or safeguards unit responsible for checking the quality of the reports prior to sending them to the SRA.

*Example: NMA reports are sent from the facilities to the SRA using a specified email address like safeguards@SRA.xx. Upon receipt, the reports are moved to the SRA NMA database by the SRA officer responsible for NMA. When the report is moved to the database, the software automatically performs all types of quality control and validation checks. For example, MBA names, various codes and license numbers are checked against the list of valid ones. If the report passes the quality check, then it is loaded into the SRA NMA database. If not the facility is contacted for explanations or requested to submit a corrected report. A copy of the facility's report file (original and corrected, as applicable) is stored in a separate archive library. From the database the SRA can produce all needed types of reports for submission to the IAEA, provision during inspections, preparing statistical reports, and so on.*

*Example: To help confirm that all domestic shipments and receipts are reported, a national data field can be introduced, called a transaction number, which assigns a unique number to each shipment which is then to be used by the recipient. This helps the SRA to automatically check that for each shipment, a matching receipt has been reported to the SRA. If not, a warning is indicated so the SRA can contact the MBA that failed to report.*

## 9. DETERMINATION OF 34(C) MATERIAL

Paragraph 34(c) of INFCIRC/153 (Corr.) specifies that nuclear material which is of a composition and purity suitable for fuel fabrication or for being isotopically enriched "shall become subject to the other safeguards procedures specified in the Agreement." Such safeguards procedures would apply when the nuclear material leaves the plant or the process stage in which it has been produced or imported into the State. This is often referred to as '34(c) nuclear material.'

### **Paragraph 34 of INFCIRC/153 (Corr.)**

The Agreement should provide that:

... (c) When any nuclear material of a composition and purity suitable for fuel fabrication or for being isotopically enriched leaves the plant or the process stage in which it has been produced, or when such nuclear material, or any other nuclear material produced at a later stage in the nuclear fuel cycle, is imported into the State, the nuclear material shall become subject to the other safeguards procedures specified in the Agreement.

Section 10 of this SIP Guide discusses reporting obligations associated with imports and exports of nuclear material. These requirements differ for 34(c) nuclear material and for pre-34(c) material (material containing uranium or thorium which is not 34(c) material). The SRA should consult with the IAEA in cases where it is unclear whether or not material meets the conditions of paragraph 34(c). If nuclear material is exported by one State as 34(c) material, then it should also be reported by the importing State as 34(c) material.

The State may **invite the IAEA to conduct a technical visit** at a location that possesses material that contains uranium or thorium to discuss and determine if the material is 34(c) or pre-34(c). For mines/concentration plants, the IAEA may make such determinations during complementary access pursuant to Art. 5.a.(ii) of INFCIRC/540 (Corr.).

## **10. INFORMATION ABOUT IMPORTS AND EXPORTS OF NUCLEAR MATERIAL**

### **10.1. INTRODUCTION**

Guidance on the requirements of the IAEA for reporting information on imports and exports is provided in IAEA Services Series 21, section 7. States are required to provide advance notification of certain exports and imports, to reflect the receipt and shipment of nuclear material as inventory changes for the respective MBAs, and to report imports and exports of any material containing uranium or thorium that does not meet the conditions specified in paragraph 34(c) of INFCIRC/153 (Corr.) (so-called pre-34(c) material). Many States also voluntarily report exports to NPT NWSs, and States may also join the voluntary reporting scheme to report relevant imports and exports.

### **10.2. COLLECTING INFORMATION FROM EXPORTERS AND IMPORTERS**

The SRA will need to establish mechanisms for receiving information about imports and exports. Often, the SRA will set up a coordination mechanism with the government organization responsible for issuing import and export licenses. The license applicant that wants to import or export the material will be responsible for submitting the application, which can be written in such a way as to provide all of the information the SRA needs for reporting to the IAEA. It can also contain conditions which must be met by the licensee, such as requiring the licensee to submit a copy of the customs declaration to the SRA that confirms the shipment took place. This is particularly important when a State issues a general license

that covers a larger quantity of material over a longer time period. In such a case, it is essential that the SRA receive information about each specific export in a timely manner.

It is important that information is provided to the SRA in **both the application for a license to import or export and in the reports of actual shipments** as they occurred.

The export license organization should also be responsible to ensure that the shipments are sent only to recipients and end users that are authorized to receive the nuclear material (see paragraph 94 of INFCIRC 153 (Corr.) for notification requirements).

The IAEA checks all international transfers of 34(c) nuclear material and pre-34(c) material between States (using information received in ICRs, VRS reports and 34 (a) and 34(b) reports received from all States, including those with VOAs or item specific safeguards agreements) to determine if there are any gaps in reporting (e.g. a shipment without a corresponding receipt).

### 10.3. REPORTING IMPORTS AND EXPORTS OF PRE-34(C) MATERIAL

The form to report imports and exports of pre-34(c) material and instructions for completing it can be found on the Assistance for States webpage at [www.iaea.org/safeguards](http://www.iaea.org/safeguards).

The exporter will typically be a producer of uranium ore concentrate (UOC) in a calcining plant or a refinery. Depending on how the State sets up its reporting obligations, information could come to the SRA from mines, mills or exporting organizations. The SRA will need to check the sufficiency of the data coming from each entity to ensure reporting requirements of the IAEA can be met.

Information concerning imports and exports of pre-34 (c) material should be submitted by the operators to the SRA at least semi-annually, to ensure the SRA has sufficient time to report the information to the IAEA. The IAEA prefers to receive the information monthly (when such transactions occur frequently) or at least quarterly, although the requirement is that an annual summary be submitted to the IAEA.

If uranium ore concentrate produced at a concentration plant is of a purity and composition suitable for enrichment or fuel fabrication (i.e. meets the conditions specified in paragraph 34(c) of INFCIRC/153 (Corr.)), then it would be considered 34(c) material, and be subject to full safeguards reporting.

*Example: An SRA may establish a national requirement that mines and mills report domestic transfers of UOC as well as imports and exports. This helps the SRA to track movements within the State as well as imports and exports. The tracking and accounting of these movements also helps the SRA to meet State obligations under bilateral supply agreements with other States.*

## 10.4. ADVANCE NOTIFICATION OF EXPORTS AND IMPORTS OF 34(C) NUCLEAR MATERIAL

### Paragraph 12 of INFCIRC 153 (Corr.)

“The Agreement .... shall provide, with respect to nuclear material subject to safeguards thereunder, for notification of transfers of such material out of the State, in accordance with the provisions as set out in paragraphs 92-94 below.”

States are required to provide advance notification of exports that meet certain specifications. These are not accounting reports, they are simply notifications to the IAEA sufficiently in advance of the export to allow for the IAEA to apply some measures prior to the export, should the IAEA choose to do so. For example, the IAEA may wish to verify the quantity, take samples, or apply seals to the containers. The notifications are to be provided at least two weeks prior to packaging the material for the shipment. The specifications include:

- 34(c) nuclear material (not pre-34(c) material);
- Shipments to a State that exceed 1 effective kilogram within a 3 month period;
- One shipment that exceeds 1 effective kilogram.

States may provide advance notification to the IAEA for transfers that are less than one effective kilogram. Some States also provide advance notification for shipments of pre-34(c) material. This is useful to the IAEA. The CSA also specifies the procedure for transferring the responsibility for the material from the exporting State to the importing State.

It is a good practice for the SRA to notify the IAEA if a planned export for which an advance notification was submitted is **postponed or cancelled**. If the SRA fails to provide such information to the IAEA, the IAEA will likely send correspondence inquiring about the failure to submit the associated inventory change.

When an export takes place, the transfer of the nuclear material from the exporting State’s MBA to the importing State’s MBA is reported as an inventory change. This is addressed in section 8.

## 10.5. TRANSIT MATCHING

The IAEA sends to the State periodic communications called ‘Import Communications’ and ‘Semi-Annual Statements.’ These reports request the State to provide information to assist the IAEA to identify any unmatched transfers between States, including:

- Shipments reported by a shipping State that are not declared by a receiving State; and
- Receipts reported by a receiving State that are not declared by a shipping State.

Both circumstances are reported by the IAEA to a State – unmatched shipments and unmatched receipts. There are several benefits of the transit matching process and the

resulting communication that takes place between the IAEA and the States. For example, such communication assists the IAEA to match every export from a State with a corresponding import by the other State. Matching transfers can increase the confidence of timely detection, and conversely, identify a potential diversion of material.

To manage the quantity of the data, the IAEA issued a letter dated 15 February 1985 providing clarification on **de minimum quantities** of material of a particular type in one transaction (import or export). Transactions at or below the de minimum quantities are excluded from the Statement issued by the IAEA to the State. Although such transactions are not reflected in the Statement, the transactions still must be reported in an ICR by both the shipping and the receiving States.

Not all unmatched transactions are communicated to the State by the IAEA in the Statements associated with transit matching. Transactions that are below an established threshold are not reflected in the Statements. The **de minimum quantities** are shown below.

| <b>Material Type</b> | <b>De Minimus Quantity in One Transaction</b>               |
|----------------------|-------------------------------------------------------------|
| DU                   | 30 kg of total element weight (currently under IAEA review) |
| NU                   | 20 kg of total element weight                               |
| LEU                  | 150 g of fissile content                                    |
| HEU                  | 50 g of fissile content                                     |
| Pu                   | 16 g of total element weight                                |
| Th                   | 40 kg of total element weight                               |

The IAEA can be most efficient when the transit matching can be performed **automatically using software algorithms**, which is facilitated when the receiving MBA reports the receipt in the same way that the shipping MBA reported it, i.e. the batch name and amounts match.

When nuclear material is received from two separate MBAs, and the receiving MBA combines them into one batch (no longer sharing the same batch name or quantity as the shipping MBAs), the IAEA must manually evaluate the information to try and determine which batches were combined. This practice does not facilitate transit matching and should be avoided. An example of an SRA procedure that helps the IAEA to resolve transit matching is shown below.

- 1) Receive and review associated communications from the IAEA, and gather information from:
  - a. NMA Database;
  - b. Inventory Change records or ICRs;
  - c. Discussion with accounting personnel, safeguards officer, clerks; and
  - d. Discussion with IAEA personnel in the Department of Safeguards, Division of Safeguards Information Management.

- 2) Determine, if possible, the cause of the discrepancy and gather information for further investigation by the IAEA with the other country involved.
- 3) Formulate an appropriate response to as many, if not all, of the outstanding discrepancies as possible. Due to the lag time between declarations, (e.g. some States may take longer to respond to the Agency) some recent discrepancies may be addressed by the next communication. Declarations made by the State and unconfirmed by the other party must be addressed by the Agency. Some unconfirmed declarations may involve pre-34(c) material (e.g. UOC) reported by the receiving State as 34(c) nuclear material (i.e. natural uranium), but not reported in an ICR by the shipping State.
- 4) Submit the final version of the communication, complete with appendices where necessary, such as import/export summaries, copies of State ICRs and/or inventory change records from the operator or the shipper.

The IAEA prefers to receive responses to problems with transit matching **early enough** so that unmatched transfers may be resolved before the next Statement is sent.

## 11. PREPARING ADDITIONAL PROTOCOL DECLARATIONS

### 11.1. INTRODUCTION

Detailed guidelines on preparing and submitting AP declarations are provided in IAEA Services Series 11. A comprehensive example describing the experience of a State in preparing for implementation of its AP is provided below.

The IAEA recommends that AP declarations are provided in **digital form** and prepared using the current version of Protocol Reporter software, which is made available by the IAEA. States that have concluded Subsidiary Arrangements Codes 11 – 18, which pertain to implementation of the AP, must use the specified mechanisms for preparing and submitting declarations (and digital submission is specified.)

*Example: An SRA with responsibility for all aspects of utilization of nuclear energy and ionizing radiation (safety, security, safeguards, radiation safety and protection, export-import control, licensing) had established a department responsible for implementation of safeguards. To prepare for entry into force of its AP, this department investigated possible impacts on the national safeguards framework. The areas of its responsibility that might be affected by AP implementation were evaluated, including legislation, regulations, cooperation with other government bodies, and the operators of facilities, LOFs and uranium mines in the State. This evaluation sought to determine where access to information and locations, as needed for implementation of the AP, was adequate in the legislation and where additional legal authority would be needed. The SRA analysed all of the articles, identifying impacts on legislation, requirements imposed on facilities and LOFs, research*

*and development entities in the State, operators of uranium mines, exporters and importers, waste processing operators, provision of access to information and locations, and provision of multiple entry/exit visas to IAEA inspectors.*

*Reviewing the legislation led to the following actions. First, the AP was translated into the national language and published in the 'Collection of International Agreements', which made its provisions binding on State entities as well as the Government. Changes needed in the State's nuclear law and associated regulations were identified. The SRA then prepared the inputs and requests to the national 'Legislation Plan', which established the fundamental legislative process for action by the Parliament and Government.*

*The SRA then introduced additional obligations on the facilities and LOFs operators in the State. The number of sites was determined (which was complicated by a large number of LOFs in the State). The SRA evaluated where all nuclear material at certain LOFs had been exempted, and excluded those locations from the list of sites.*

*The SRA then met with the facility and LOF operators together with the IAEA to discuss open questions related to implementation of the AP, including determination of site boundaries, which R&D activities not involving nuclear material should be declared, etc. After conducting these outreach meetings and resolving questions, the SRA reported to the Government on its readiness to implement the AP and informed that the internal procedures for entry into force can be completed. The Parliament then ratified its AP and the Government informed the IAEA that the internal procedures for entry into force had been fulfilled. Upon the entry into force of the AP, the 180 day period began for preparing the initial declarations. During that period, the SRA carried out its own verification of the declared information at each site.*

*In this State with a medium size nuclear programme and a mature safeguards infrastructure, very strict nuclear legislation and a powerful SRA, the process of preparing to implement its AP took a few years. The activities carried out by the SRA in that time were beneficial to strengthening its control of nuclear activities in the State.*

## 11.2. SUMMARY OF DECLARATIONS REQUIREMENTS BY DECLARATION TYPE

Table 4 reviews the content and timing of the declarations under each of the sub-paragraphs of AP Article 2. Article 3 specifies the timing for submitting declarations. Each column of the timeliness in the table corresponds to subparagraphs 3.a through 3.g of Article 3. Annual updates have to contain a beginning and an ending date to which the information refers.

TABLE 4. SUMMARY OF DECLARATION CONTENT AND SUBMISSION

| Article 3 of INFCIRC/540 | Timeliness                                |                                                                                  |                                                                |                                        |                                                      |                                  |                           | Comments |                                                                 |
|--------------------------|-------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------|------------------------------------------------------|----------------------------------|---------------------------|----------|-----------------------------------------------------------------|
|                          | Within 180 days of entry into force of AP | By 15 May of each year covering previous year                                    | 180 days before further processing, and by 15 May of each year | 60 days before the end of each quarter | Country and IAEA shall agree on timing and frequency | Within 60 days of IAEA's request | On consultation with IAEA |          |                                                                 |
|                          | 3.a.                                      | 3.b./3.c.                                                                        | 3.e.                                                           | 3.d.                                   | 3.f.                                                 | 3.g.                             |                           |          |                                                                 |
| Article 2 of INFCIRC/540 | Sub-Article                               | Required information                                                             | Declarations                                                   |                                        |                                                      |                                  |                           | Comments |                                                                 |
|                          |                                           |                                                                                  | Initial                                                        | Annual                                 | Quarterly                                            | Info identified by IAEA          | Only on request of IAEA   |          | Only on request of IAEA                                         |
| 2.a.(i)                  |                                           | NFC R&D Activities not involving NM – authorized or controlled by government     | X                                                              | X                                      |                                                      |                                  |                           |          | theoretical or basic scientific R&D not included                |
| 2.a.(ii)                 |                                           | Operational Activities at Facilities and LOFs where NM is customarily used       |                                                                |                                        |                                                      |                                  | X                         |          | on the basis of expected gains in effectiveness and efficiency  |
| 2.a.(iii)                |                                           | Buildings on sites                                                               | X                                                              | X                                      |                                                      |                                  |                           |          | use, contents, approx. size, map required                       |
| 2.a.(iv)                 |                                           | Scale of operations of each location – Annex I Activities                        | X                                                              | X                                      |                                                      |                                  |                           |          |                                                                 |
| 2.a.(v)                  |                                           | Mines and Concentration Plants                                                   | X                                                              | X                                      |                                                      |                                  |                           |          | location, operational status, estimated prod. capacity          |
| 2.a.(vi)                 | (a)                                       | Source Material –                                                                | X                                                              | X                                      |                                                      |                                  |                           |          | quantities, chemical comp., use or intended use                 |
|                          | (b)                                       | Exports of Source Material                                                       |                                                                | X                                      |                                                      |                                  |                           |          |                                                                 |
|                          | (c)                                       | Imports of Source Material                                                       |                                                                | X                                      |                                                      |                                  |                           |          |                                                                 |
| 2.a.(vii)                | (a)                                       | Exempted NM – Quantity                                                           | X                                                              | X                                      |                                                      |                                  |                           |          | complements par.37/INFCIRC153                                   |
|                          | (b)                                       | Exempted NM – Use                                                                |                                                                |                                        |                                                      |                                  |                           |          | complements par.36(b)/INFCIRC153                                |
| 2.a.(viii)               |                                           | Intermediate and High-Level Waste                                                |                                                                |                                        | X                                                    |                                  |                           |          |                                                                 |
| 2.a.(ix)                 | (a)                                       | Exports – Specified Equipment and NN-Material specified in Annex II              |                                                                |                                        |                                                      | X                                |                           |          |                                                                 |
|                          | (b)                                       | Imports – Specified Equipment and NN-Material specified in Annex II              |                                                                |                                        |                                                      |                                  |                           | X        |                                                                 |
| 2.a.(x)                  |                                           | NFC plans – 10 year period                                                       | X                                                              | X                                      |                                                      |                                  |                           |          |                                                                 |
| 2.b.(i)                  |                                           | NFC R&D Activities not involving NM – NOT authorized or controlled by government | X                                                              | X                                      |                                                      |                                  |                           |          | State shall make every reasonable effort to provide information |
| 2.b.(ii)                 |                                           | Activities identified by the IAEA                                                |                                                                |                                        |                                                      |                                  |                           | X        | State shall make every reasonable effort to provide information |
| 2.c.                     |                                           | Amplifications and Clarifications                                                |                                                                |                                        |                                                      |                                  |                           | X        |                                                                 |

DECLARATIONS MUST BE SUBMITTED TO THE IAEA EVEN IF THERE IS NO ACTIVITY RELATING TO ANY OF THE ARTICLE(S)

NFC=Nuclear Fuel Cycle

NN-Material=Non-Nuclear-Material

NM=Nuclear Material

R&D=Research & Development

Note: For Article 2.a.(v), once the IAEA has requested the State to provide information about the actual production of a particular uranium mine, it is helpful to the IAEA when the State **continue to provide updates** to this information in subsequent 2.a.(v) declarations without being requested.

### 11.3. COLLECTING INFORMATION TO GENERATE AP DECLARATIONS

Communication with entities that may need to submit information for an AP, but who are not licensed, can be complex. These entities need to be informed of their responsibilities under an AP, including provision of information and facilitating complementary access (CA). These provisions should be addressed in the State's legislation, to give the SRA the authority needed to collect the data. Informative open meetings, publication of information on a website, and providing explanations of the various declaration elements and other concepts in the national language, are useful means of communication. A brochure produced and circulated by a State to its AP reporting entities is provided in Annex X. To collect information for AP declarations, it is good practice for the SRA to:

- Conduct an open source search initially and periodically during updates;
- Incorporate reporting obligations into regulatory requirements;
- Conduct outreach to potential reporting entities and relevant ministries;
- Set up the needed communication channels to collect the information;
- Provide guidance through a brochure or a website for reporting entities; and
- Communicate with the IAEA about any questions, inconsistencies or uncertainties.

It may be helpful for an SRA that is preparing for AP implementation to **contact peers from other States** who have experience, and take advantage of their lessons learned.

To update the declaration, the SRA should communicate with each organization that provided information in the prior year's declaration. These organizations can be asked to update their declaration, include any new activities, and also notify the SRA of any other organizations which may be partnering with that organization in carrying out activities that are declarable.

*Example: An SRA distributed official letters informing relevant institutions (such as universities, research institutions, industrial radiography companies, hospitals, etc.) about a recent publication: 'Instructions on the conditions and procedures for the collection and provision of information and maintenance of records of activities relating to the application of nuclear safeguards and non-proliferation'. This document was posted on the SRA's website for public comments and contained detailed instructions on safeguards requirements reflected in the license application process.*

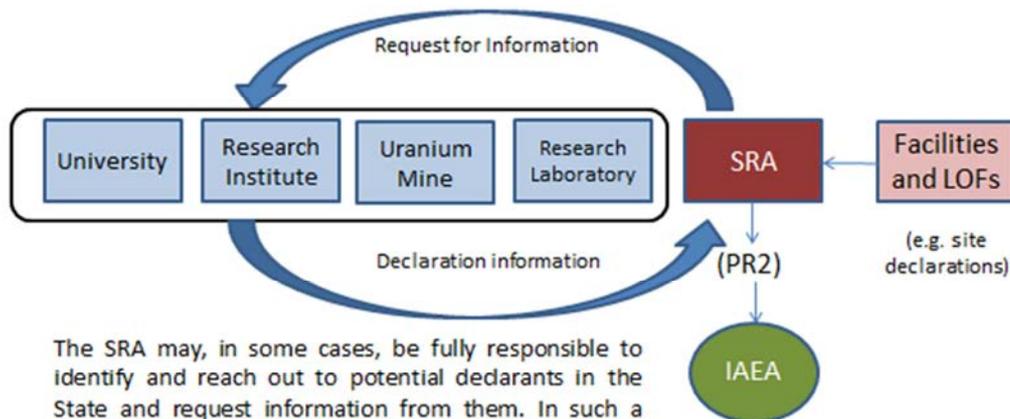
*Example: Before bringing into force an AP, one SRA communicated with the relevant organizations in the State, including existing facilities and non-licensees (such as universities), who acquired new reporting/access requirements associated with the AP. The SRA worked to prepare these entities by advising them of the new requirements and the likely issuance of a modified regulation, and informed them of the consultative process that would take place during the development of those regulations.*

The SRA could communicate directly with potential reporting entities to collect declaration information for an AP. This strategy, shown in Figure 21, puts all of the responsibility on the SRA for identifying these entities and making contact with them.

A second strategy (shown in Figure 22) would involve the SRA reaching an agreement with the other ministries in the State. The other ministries would collect the relevant information from the entities with which the ministry is affiliated, and submit it to the SRA. Those

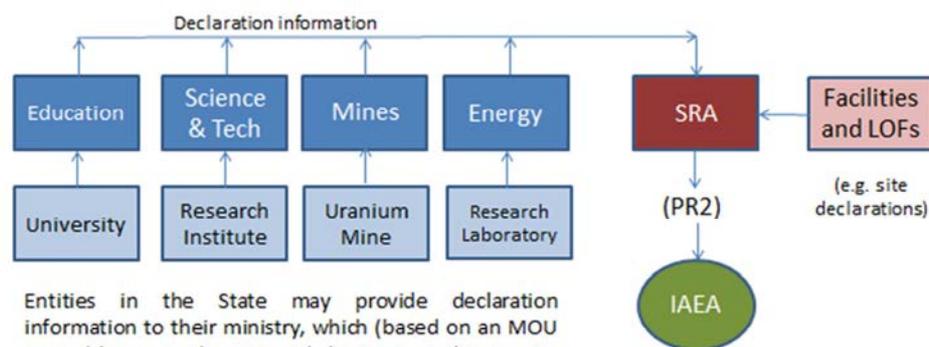
ministries would have some responsibility to confirm the completeness and correctness of the information prior to transferring it to the SRA.

Finally, the SRA could agree with the other ministries that each ministry would communicate the relevant requirements to the entities under their regulatory control. The entities would then submit relevant information directly to the SRA. In this scenario, it would be very important to determine who and how the completeness and correctness of the declaration submittals is assured. It is also important to ensure the necessary relationship/contact is established between the Ministries, reporting entities and the SRA (See Figure 23.)



The SRA may, in some cases, be fully responsible to identify and reach out to potential declarants in the State and request information from them. In such a case, the SRA may work with Ministries to identify the entities that are potential declarants and acquire contact information. The SRA then contacts these organizations directly and requests information. Detailed instructions may be necessary to explain the requirements to these organizations, and the potential for complementary access.

FIG. 21. SRA communicates directly with potential reporting entities.



Entities in the State may provide declaration information to their ministry, which (based on an MOU agreed between the SRA and the Ministries) transmits the information to the SRA. Facilities and LOFs may submit site declarations directly to the SRA. The SRA then compiles the declaration (and updates) using Protocol Reporter 2 software, confirms the correctness and completeness, and transmits it to the IAEA.

FIG. 22. Other ministries collect relevant information and submit to the SRA.

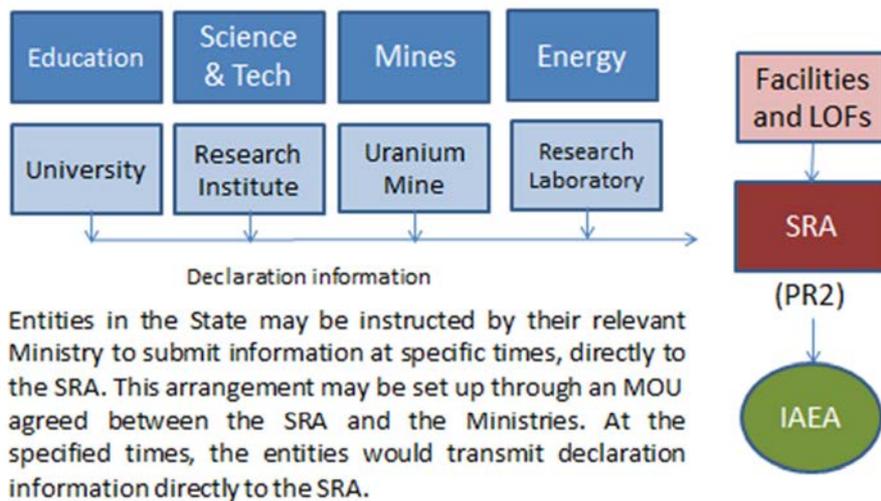


FIG. 23. Ministries communicate the requirements but the entities submit data to the SRA.

*Example: In preparing for entry into force of its AP, a State reviewed its legislation to see what regulatory power was needed to contact AP reporting entities with no license. The SRA also visited the licensed nuclear facilities informing them of the declaration requirements. The SRA provided IAEA PR software to each facility. No license was required to produce Annex II items, so the SRA conducted a survey to identify potential locations of relevant manufacture or export. Universities and research laboratories were contacted to determine what relevant R&D was being carried out and with whom the organizations collaborated. This State had some legacy activities related to a former nuclear weapons programme and contracted a university to research that past programme and prepare a report describing the facilities involved and their current status, and the State attached the report to the initial AP declaration.*

*Example: A State conducted outreach activities at facilities and other organizations that might be affected by entry into force of the State's AP. These activities included training in activities that are declarable under an AP, a review of AP declaration requirements and the relevant national legislation and regulations. Survey questionnaires were distributed to those who conducted R&D in the nuclear field. For those who had conducted activities that needed to be declared, workshops on how to use PR software were provided in cooperation with the IAEA and an experienced Member State (through its Support Program). To prepare the initial declarations, the SRA visited each facility and provided assistance in using the PR software. The SRA then merged the separate declarations into the national declarations. This resulted in good quality and comprehensive declarations. One problem that was encountered was that data from some of the facilities could not be merged, which required some manual data entry. In preparing the updated declarations in the subsequent year, the SRA established a requirement that updated declarations are to be submitted by 31 January to allow for checking the data and consolidating it into the national declarations. The SRA held another workshop on AP requirements, including relevant research activities, and a review of how to prepare a declaration. The workshop also described how to prepare for an IAEA CA.*

AP Article 2 specifies the information to be included in declarations. The declaration which causes most confusion about what should be declared, as it requires some judgement, is under Article 2.a.(i) on nuclear fuel cycle-related R&D activities that do not involve the use of nuclear material and which are authorized or controlled by the State. It is helpful to guide the

reporting entities to ask useful questions, especially as many researchers may consider their research to be basic in nature (and basic research is not declarable).

A simple software application is available online that asks questions intended to help determine whether or not a particular activity is declarable. It is designed to be used prior to using the IAEA's Protocol Reporter software to prepare the declaration. This pre-declaration analysis tool is called 'AP declaration helper' and is found at <http://www.aphelper.doe.gov/>.

Helpful questions to be asked may include:

- "Is this activity contributing to the development or improvement of any process of conversion, enrichment, fuel fabrication, reactors, critical facilities, reprocessing, or processing of intermediate or high level waste containing Pu, highly enriched uranium, or U-233?"
- "Does this activity involve the use of nuclear material?"
- "Which institutions in other countries are involved in this research?"

*Example: An SRA prepares a template in Excel or MS Word which is sent to the reporting entities along with instructions. The reporting entities provide their input into this file and send it to the SRA by email sufficiently in advance of the deadline for submitting it to the IAEA. The SRA then reviews the input, determines what needs to be provided in the draft declaration to the IAEA, and prepares a declaration for the State. The SRA sends the final version of the reporting entities' input back to them to be used in updating the information in the following year. The template that is sent may be tailored to the particular declaration type. For example, the template sent to a uranium mine will differ from the template sent to an organization who would provide information for the 2.a.(i) declaration.*

*Example: Every year in February, the SRA undertakes to prepare an update for all AP Article 2.a declarations. A project coordinator is appointed to liaise with all reporting entities, receive the updates, follow-up on questions and prepare a draft submission. Meetings are scheduled every week and 25% progress reports are expected weekly. The team members visit every facility to confirm updates and report findings to the project coordinator. When all updates are received, the team reviews the draft for corrections, consistency and completeness. The final version is provided to the authorities for approval and submitted to the IAEA before 15 May.*

#### 11.4. 2.A.(I) DECLARATIONS

The 2.a.(i) declarations describe nuclear fuel cycle related R&D activities not involving nuclear material which are funded, authorized, controlled or carried out on behalf of the State.

A State may wish to provide information to the IAEA about **legacy activities**, such as prior research and associated locations, in the initial AP declaration. This information can be provided in an attachment ('legacy nuclear activities'). These activities may show up in open source searches or their signatures may be revealed through environmental sampling. Providing the explanation with the declaration avoids having to respond to a request.

The declarations are not intended to address fundamental science, but rather research focused on the seven nuclear fuel cycle stages listed in the AP, and the research should be applied rather than fundamental basic science. If there is some uncertainty regarding whether the research is basic or applied, the State is encouraged to declare it.

One of the aspects of the declaration is the involvement of other States in each research activity. The IAEA prefers to receive some details regarding the role of the States that are involved and the particular scope undertaken by each, as possible.

*Example: Both basic and applied research may be carried out in multiple States collaborating together in an international project. One State may be conducting experiments using nuclear material, while other States are performing mathematical calculations or simulations not involving nuclear material. One State may be involved only in basic research, while other States are focused on applications to the nuclear fuel cycle. It is a good practice to include all States participating in a cooperative project, regardless of whether or not their contributions to the project would be declared and irrespective of whether the States are NWS or non-nuclear-weapon State (NNWS).*

*Example: After signing an AP, a survey was conducted of organizations that might be potential AP reporting entities. Those that were likely to have declarable activities were contacted and given instructions as to how and when to submit declaration information to the SRA. They were instructed to report research projects even if it was unclear whether the research should be declared. The SRA then made a determination before compiling the final declaration. Every year the SRA sends out a reminder letter to the previous year's declarants and also asks them if they have any knowledge of other institutions that might have projects that should be declared.*

#### 11.5. 2.A.(II) DECLARATIONS

This declaration provides for information to be submitted by the State about the operations at a facility or LOF for the purpose of aiding the implementation of safeguards, e.g. by achieving efficiencies. For example, the IAEA and the State could reach agreement that more timely information would be submitted under the 2.a.(ii) declaration, with respect to, e.g. nuclear material transfers, crane movement records, movements of empty spent fuel casks, isotope production programmes. The IAEA would use that information to more efficiently schedule its verification activities, or to facilitate the use of randomized short notice inspections.

#### 11.6. 2.A.(III) DECLARATIONS

It is important to recognize that 2.a.(iii) declarations, often called 'site declarations', are required for the site of each facility and the site of each LOF (unless the inventory of nuclear material at the LOF has all been exempted from safeguards by the IAEA). Each facility and LOF in the State must submit a site declaration until such time as its decommissioned status has been confirmed by the IAEA for safeguards purposes. Once that occurs, a site declaration is no longer required to be submitted for that respective site. Site declarations must be updated each year.

**INFCIRC/540 (Corr.) Article 2**

[The State] shall provide the Agency with a declaration containing:

(iii) A general description of each building on each *site*, including its use and, if not apparent from that description, its contents. The description shall include a map of the *site*.

**INFCIRC/540 (Corr.) Article 3**

- a. Information identified in 2.a.(iii) shall be provided within 180 days of entry into force of the additional protocol.
- b. Annual updates to the information provided under a should be sent by 15 May ...

Site declarations are used by the IAEA to better understand the activities going on at or near places where nuclear material is present. Many buildings on sites directly support nuclear operations, so they are important components of the nuclear fuel cycle capabilities of the State. These buildings are significant to safeguards because they could be readily used for nuclear activities, benefitting from the same infrastructure and expertise available at the site for the declared facility.

The ownership or administrative responsibility for each building is not a factor when determining whether a building should be included in the site. It is expected that many sites will contain buildings owned or administered by different parties. Generally, a site should be a geographically coherent area.

**11.6.1. Collecting information about sites**

The SRA will need to interact with the site personnel to acquire the needed information to prepare the site declaration. It is a good practice to identify a 'site representative' who is responsible to interact with all of the organizations present on the site to collect the information and work with the SRA. The SRA can then prepare the complete site declaration.

The SRA could also work with the personnel at the facility on the site which is responsible for safeguards implementation at the facility. These personnel would then need to interact with others on the site (other companies or organizations) to collect the information.

A nuclear research centre might have a few buildings that are carrying out nuclear research activities on a site where there are also a very diverse collection of activities going on in many other buildings. The initial site declaration will provide a description of the use and contents of all buildings (see IAEA Services Series 11 for specific guidance) on the site. Updates to the site declaration need to include information to reflect changes to the site that occurred since the initial declaration. The information that has not changed does not need to be included in the updates, but if there are no changes at all, this should be stated in the header note field. The use of Protocol Reporter software (version 3) will facilitate the updating of initial declarations.

An important component of this declaration is a detailed, annotated map of the site, which clearly indicates the site name, site code, site boundary, geographical coordinates, scale and orientation and labels the buildings with their names so that they can be matched with each entry in the declaration. The boundary should surround all of the buildings, structures and

other relevant features which are located within the site boundary. If a building is excluded, an explanation should be provided. To facilitate use of its internal 'Geospatial Exploitation System' (GES), the IAEA prefers that maps be submitted digitally, in the geographic information system (GIS) format of a geodatabase (.gdb) or a shapefile (.shp). Although these are ideal formats, it is also possible to convert most computer aided design (CAD) drawing files (.dwg or .dxf) which have geospatial information to a format compatible with the GES. The use of Protocol Reporter (version 3) allows map files to be attached in GID, CAD, pdf or any other image file.

The definition of a building may cause some confusion. Buildings may include power stations, pump houses, storage buildings, warehouses, and many other kinds of dedicated areas or structures. Features of a site, such as a piece of land used for storage of items or equipment should be described despite not being a 'building'. Any location within the boundary of the site that is visible in a satellite image should be described. Underground structures, even though these will not be visible, should also be included.

There may also be temporary structures or tents erected to support activities from time to time. If these will remain in place for a substantial period of time, such as a year, they should be reported in the site declaration. If they are erected and removed within a year, they would not need to be included. While the declaration is supposed to reflect the situation as of the end of the calendar year, if a temporary building that was there on the 31<sup>st</sup> of December but is taken down when the site declaration is being prepared (several months later), it does not need to be included.

*Example: While the definition of the site boundary is fairly straightforward in the case of, e.g., nuclear power stations, it is less clear in the case of sites used for R&D activities involving nuclear material. Many buildings on the site of a research centre may have an obvious connection to the nuclear fuel cycle. But many other buildings may be used by companies for non-nuclear activities. The variation in the tenants each year can complicate access. Initially, the SRA included all of the buildings on the campus in the site declaration, separately listing those with no relation to nuclear fuel cycle-related activities. These buildings were used for office complexes, automobile garages, conventional storage buildings and basic research.*

Discussions between the SRA and the IAEA in determining the boundaries of a site are helpful when the situation is not fully clear.

When the site has buildings that are very far from the main facility, it is a good practice to **submit two maps** so that the details of each map can be clearly seen. The 2<sup>nd</sup> map will include only those buildings located a long distance from the main facility.

New facilities can be on a new site or may be part of an existing site. If a new facility is part of an existing site, as in case of building a new reactor facility at an existing nuclear power plant site, then the existing site boundaries will typically need to be expanded. In the case of a new facility in a new location, a new site declaration will need to be prepared. To develop the declaration, the SRA should discuss plans with the forthcoming facility operator to identify where boundaries and fences will be established. After site boundaries have been identified,

the facility operator will need to define the purpose and activities for all buildings located in the site boundaries. This information provided by the facility operator to the SRA will be evaluated and incorporated into the 2.a.(iii) declaration.

The site boundary should realistically represent the physical limits of the working site, with no areas artificially or arbitrarily separated by fencing to limit verification access. Several facilities (MBAs) or LOFs may share the same site. Sites should normally not be smaller than one building, and must include ‘installations co-located with the facility or LOF for the provision of essential services’, such as hot cells, waste treatment and manufacturing activities.

While the determination of a site boundary is fairly straightforward for most facility types, it can be more difficult in the case of sites used for training, research and development. Several buildings of such a site have evident relation to the use of nuclear material and to the nuclear fuel cycle, while other buildings could be used for unrelated purposes or leased to companies with no nuclear activities at all. If the site boundary is chosen to be the physical boundary, all the buildings must be included into the declaration, separately listing those that are not related to the nuclear fuel cycle. IAEA inspectors can request access to any buildings included in the site declaration with 24 hours notification, or with 2 hours notification if the request is made during the conduct of an inspection or DIV carried out on the site.

If the non-nuclear-related buildings on a site are occupied by different companies from year to year, it may be necessary to provide updated information to the SRA at the time of signing of a lease, so that the declaration can be updated. Alternatively, the owner or property manager of these buildings may be listed as a permanent contact point with the generic description of the building being given (e.g., ‘leased office space’ or ‘leased warehouse space’). However, the SRA will need to ensure that the property manager is prepared to grant access to the IAEA upon request.

**Names of buildings:** it is a good practice to use the names of the buildings that the organization uses, rather than inventing new building names. In this way, updates to information on buildings that is provided from the site representative, which will refer to the building identification used by the organization, will be clear to the SRA as to which building it refers to. Also, the point of contact for each building should be identified and known to the SRA, so that the SRA can inquire regarding any changes to the building, which can be very important during decommissioning or other modifications being undertaken at the building/site. The site working hours are required to be declared.

If the IAEA considers that a building that is not within the physical boundaries of a facility’s campus might be ‘functionally related’ to the site of that facility, the IAEA can request information about the general activities and the person carrying out such activities under Article 2.b.(ii). Examples could be buildings housing scientific activities, fabricating equipment, providing computer services or personnel. Difficulties can arise if buildings are not included in the site declaration so the IAEA has limited ability to judge whether or not the building is ‘functionally related’. Thus, the IAEA may have to judge by geographic

proximity, appearance, history, etc. It is good practice to discuss the buildings and their function with the IAEA and jointly agree whether or not to include them in the site declaration.

*Example: After a State brought into force its AP and on the recommendation of a partnering State, a core “AP Team” was set up. The team included representatives from organizations concerned with and affected by the implementation of the AP, such as the operating organization of the research reactor and the nuclear and radiological safety authorities. The first activity carried out by this team was the preparation of the initial AP declarations. The team received training and assistance on the preparation of the initial AP declarations through workshops focused on preparing the declaration and using Protocol Reporter software. The majority of declared activities concerned a ‘Nuclear Studies Centre’. After the submission of the declaration and during an IAEA DIV, just before performing a CA at this site, the IAEA discussed the initial declaration with the State authority, identifying any needed enhancements.*

### **11.6.2. How to prepare the site declaration**

Site declarations for sites of facilities are often sensitive from the security point of view as they describe the content and use of buildings on the site. Site declarations are therefore typically submitted using secure transmission and encryption. The site declaration should reflect the site name and site code. Subsidiary arrangements pertaining to an AP (Codes 11 to 18) may require that site codes be reflected in the declaration. The site name can simply be the name of the facility or LOF or primary organization on the site. However the name of the organization might change from time to time, so using a consistent site code is useful for analytical and consistency reasons.

A **site code** may be created by using some characters from the LOF or facility code. For example, a LOF code could be ABC and the site of a LOF could be ABC1. A site code could also be created by using the first 3 letters of the name of the State, followed by three letters of the facility code. The SRA and the IAEA can agree on the site code through an exchange of correspondence, or it may be specified in the Subsidiary Arrangements.

New sites are typically added in the annual declaration updates which must be submitted to IAEA each year by the 15th of May (covering the previous calendar year). However, new site declarations can be submitted at any time of the year. The declarations and attachments to declarations (e.g. maps and diagrams) should be submitted in electronic format and transmitted using encryption.

### **11.6.3. Providing information about managed access**

Managed access refers to arrangements to be made for CA to prevent the dissemination of proliferation sensitive information, to meet safety or physical security requirements, or protect proprietary or commercially sensitive information. For example, a storage location that is very infrequently visited may have a safety requirement where ventilation systems have to be activated at least 24 hours prior to accessing the location. In this case, it is

recommended that the 2.a.(iii) declaration associated with this location describe this situation in the comments.

Managed access arrangements that are anticipated can be described in the associated declaration line item. In other cases, managed access may not be foreseen and would then be declared when an inspector arrives. An example could be an unusually high radiation field or a contamination spill which has just occurred or is in the process of being cleaned up. In these cases, there should be discussions to determine what information and access can be provided to enable the inspectors to fulfill the objectives of the access.

In preparing the initial AP declaration, the State may wish to request that the operators of facilities and LOFs and other locations describe any foreseen need for managed access, the reason for the managed access and the measures envisioned to address it. A brief description of the managed access can be included at the end of the specific line entry, and updated annually as necessary.

When discussing managed access arrangements with the operator of a facility, LOF, or other location, the State should ensure that the managed access is reasonable to address the underlying concerns but is arranged such that the IAEA can be granted sufficient access to information and locations to fulfill its objectives.

*Example: A contaminated area with a high dose rate requires e.g., special permits, safety protocols, safety equipment and specific training for IAEA staff and/or specific personnel. The time required to put these measures in place should be specified in the declaration.*

*Example: A shut-down facility requires more than 24 hours for activation of ventilation or heating systems to enable safe access to the location.*

*Example: When a linear accelerator is turned off, there may be residual radiation and the safety interlocks will not release the door to the accelerator vault until the radiation level has reached an acceptable level. This may take a number of hours to achieve.*

Access to a location in a remote area may require specific logistical arrangements (i.e. the flight to the location may need to be coordinated with the facility and may include the inspectors going to the location on the regularly scheduled facility plane or a private plane may need to be hired.) The State should inform the IAEA of such logistical arrangements in the declaration for that location.

There could also be a situation where a specific building on a site belongs to another owner, and that owner is rarely on-site. It is a good practice for the SRA to ensure that someone at the site has a key to access the building, such as the security force.

*Example: In requesting managed access, the declaration stated 'for health and safety reasons, additional time will be required for accessing Building 6 to establish a method of protection for staff and visitors with respect to radiation and industrial hazards.' In another declaration, managed access requirements were needed to create a work plan for appropriate equipment and staff to be assembled due to radiological hazards at the location.*

#### 11.7. 2.A.(IV) DECLARATIONS

Activities contained in Annex I of INFCIRC/540 (Corr.) are to be declared under 2.a.(iv). To ensure that companies that may undertake such activities are aware of the reporting obligations, the SRA may need to carry out a communication campaign. The SRA may wish to engage organizations such as the radiation protection authority, customs authority, industry organizations and security ministries.

*Example: An SRA requested that the State's Export Control Authority provide a list of firms that had exported the relevant items in the past. The SRA communicated with the firms about the manufacturing activities. The SRA also requested the nuclear industry in the State to submit a list of their suppliers for AP Annex I items.*

*Example: A separate set of regulations was prepared to require companies that conduct activities listed in AP Annex I to report the required information to the SRA. To identify these companies, the SRA searched open sources, inquired with the nuclear industry regarding their suppliers, and worked with State Customs to get a list of exporters. Companies were identified that produced centrifuge components, hot cell components (windows, manipulators, etc.), and spent fuel flasks.*

*Example: An SRA issued a survey to companies in the State, inquiring about capabilities for conducting activities listed in AP Annex I. The survey was adapted from one provided by another State that had developed it earlier.*

#### 11.8. 2.A.(V) DECLARATIONS

This declaration reports annual estimated production of uranium ore concentrate from uranium mines operating in the State. IAEA Services Series 22 provides detailed information regarding reporting from uranium mines. The information about uranium production in mines is typically collected and controlled by a regulatory body in the State, such as a Ministry of Energy or a Ministry of Mines. It may be the same body as the SRA or a different body, in which case the SRA can coordinate with this body to collect the information for the 2.a.(v) and 2.a.(vi) declarations. Often the person responsible for tracking the necessary information is not a radiation protection officer at a mine but rather a logistics/transportation/export officer.

If uranium is extracted as a byproduct from another type of ore, like gold ore or phosphate, then the organization that tracks the uranium should be aware of such activities and be able to report any uranium obtained as a byproduct in the State. For example, the uranium byproduct could be produced at a calcining facility, or a copper or gold concentration plant or a mill.

The IAEA may request information on actual production for a specific mine. If this information is requested, the SRA should continue to provide annual updates to this information in subsequent years in the 2.a.(v) declaration.

#### 11.9. 2.A.(VI) DECLARATIONS

These declarations report holdings of source material (pre-34(c) material) in quantities exceeding ten metric tonnes.

*Example: In a case where UOC is sometimes stored awaiting transport, for example in a warehouse near a shipping dock, the State should be declaring either the stocks (if the material is in the warehouse at the end of the calendar year) or the exports (if the material has left the warehouse and is being exported).*

#### 11.10. 2.A.(VII) DECLARATIONS

These declarations refer to exempted material. Nuclear material should always be declared under a CSA before it is exempted by the IAEA, and subsequently declared under an AP as required. If no material is exempted in the State, then this declaration will contain ‘nothing to declare’. For the initial 2.a.(vii) declaration, the SRA can use the accounting records to identify the total quantity of exempted material to be reported.

If the quantities declared by the State for its 2.a.(vii) declaration **do not match** with the records of the IAEA, the IAEA will communicate with the State to resolve the difference.

#### 11.11. 2.A.(VIII) DECLARATIONS

These declarations are made in advance of changing the location, or planning for further processing, of intermediate or high level waste containing Pu, HEU or <sup>233</sup>U, on which safeguards have been terminated. Such material might be located, e.g. at a reprocessing plant or a waste conditioning facility. The SRA should work with such types of facilities to make them aware of these reporting obligations. A vitrification plant might ship material containing HEU or Pu and therefore change its location. The national regulations and/or licenses for these kinds of facilities may include a requirement that all plans for further processing, and all movements, of waste material containing HEU, Pu or <sup>233</sup>U, be reported to the SRA well in advance, so that the SRA can determine what should be included in the 2.a.(viii) declaration each year.

Typically, safeguards on this material is terminated under paragraph 11 of INFCIRC/153 (Corr.) and reported to the IAEA in an ICR with inventory change code TU (termination use). Monitoring the nuclear material for which safeguards was terminated using the TU code can assist the SRA in tracking this material.

If the conditioned waste containing HEU or Pu is moved, or if further processing is planned, it must be reported in the declaration at least **180 days in advance**.

#### 11.12. 2.A.(IX) DECLARATIONS

The items for which information regarding import and export is declared pursuant to Article 2.a.(ix) are found in Annex II of INFCIRC/540 (Corr.). To prepare the initial declaration, it may be useful to contact any facility operator that requested during the past year an export license for an Annex II item. Names of potential entities concerned can be provided by nuclear operators too, and some others by the ministry of industry, economy or trade if a national registry of companies is maintained. The national regulation should provide

sufficient legal power to the SRA to require the submission of information and provision of access from such companies.

It is a good practice for a State to include at least all of the items in the AP Annex II in its listing of controlled nuclear commodities. Some States may include only the Nuclear Suppliers Group (NSG) listed items (single use and dual-use), but there are a few items in the AP Annex II that are not included on the NSG lists, such as fuel flasks, and there are also items on the NSG list that are not listed in AP Annex II.

Another solution is to introduce in the national regulation the AP requirements, to ensure that information provided during the export license process can be directly transferred to the State authority to establish the declaration.

Some operators declare exports of items that are not listed in Annex II, to be sure that they do not miss or evade their legal obligations. The State authority may then need to clarify the requirements for the declarants, perhaps through a brochure, website, or training course.

The Protocol Reporter version 3 will enable the report of exports of any piece of equipment, even items not contained in Annex II, to simplify for the State the analysis and assessment of this declaration and enable reporting based on the lists used by the Nuclear Suppliers Group. In addition, the software will offer lookup tables containing the items in Annex I and Annex II of the AP.

#### 11.13. 2.A.(X) DECLARATIONS

The 2.a.(x) declaration of the State's approved ten-year nuclear development plans is updated each year. A State without an AP in force is welcome to provide this information on a voluntary basis. The information should be conveyed formally, rather than through an advisory mission team or a technical cooperation project meeting. The approved nuclear development plans are typically not formulated by the SRA within the State, but rather by a Ministry responsible for nuclear energy or technology promotion. Therefore, coordination is required and a mechanism for communication should be established by the SRA.

When a plan for nuclear development has moved into a phase of implementation, or has been cancelled or modified, the changes should be reflected in the updated declaration. Annex XI provides a series of examples of updates to a 2.a.(x) declaration, progressing from a conceptual plan for a new nuclear power plant through to early provision of design information, using a fictitious State.

#### **INFCIRC/540 (Corr.) Article 2.a.**

(x) General plans for the succeeding ten-year period relevant to the development of the nuclear fuel cycle (including planned *nuclear fuel cycle-related research and development activities*) when approved by the appropriate authorities in [the State].

#### **INFCIRC/540 (Corr.) Article 3**

a. [The State] shall provide to the Agency the information identified in Article 2.a (x)... within 180 days of the entry into force of this Protocol.

As the nuclear development plans are implemented, the updates to the 2.a.(x) declaration can include additional details which become available from year to year, until the preliminary design information or a first DIQ is prepared and submitted. Annex XI includes examples of increasingly detailed 2.a.(x) declarations leading to the preparation and submittal of a DIQ.

To ensure a cohesive set of information, it is important that the designers, operators and companies involved in the nuclear development project transfer the necessary information to the SRA. This can be achieved through, e.g. establishing a legal obligation linked to the AP implementation in the State's regulations or in the license conditions.

*Example: The planning and design of a nuclear reactor facility is a long project. The 2.a.(x) declaration is submitted when the State authority has authorized the plan for a new facility. The location of the new facility may not be known, nor the exact type, but a license may be issued first for siting, and later for allowing the invitation of bids. The safeguards considerations can be reflected in the bid specifications.*

As updates are due in May, the State may wish to initiate the information collection process by sending letters to the relevant ministries or other organizations (uranium mines, licensees, relevant State and private companies) reminding them to provide information on any changes to the approved 10 year nuclear development plans. The official declaration is prepared for submission, reviewed by the appropriate ministry and submitted to the IAEA.

*Example: The nuclear development plans in a State are often determined by a ministry (e.g. the ministry of energy, economy, trade or industry). The SRA coordinates with those bodies to update the 2.a.(x) declaration and submit it to the IAEA.*

#### 11.14. 2.B DECLARATIONS

The State is required to make 'every reasonable effort' to provide the IAEA with the information specifying the location of nuclear fuel cycle-related R&D activities not involving nuclear material which are specifically related to enrichment, reprocessing of nuclear fuel or the processing of intermediate or high level waste containing plutonium, high enriched uranium or uranium-233 that are carried out anywhere in the State but which are not funded, authorized, controlled or carried out on behalf of the State.

Regulations can be enacted which create a requirement that privately funded nuclear fuel cycle-related R&D not involving nuclear material be reported to the SRA by commercial, private (or other) organizations as applicable. Other 'reasonable efforts' could include issuing a questionnaire to universities, companies and research organizations which may carry out the R&D activities related to the nuclear fuel cycle (identified by searching open sources, science and technology publications and professional societies). The questionnaire would help to identify organizations performing nuclear fuel cycle R&D activities which are not funded, authorized, controlled or carried out on behalf of the government. In addition, the SRA can confirm the consistency between declarations and open source information including organizations' web sites.

The State could also review nuclear-related patent applications to identify companies to reach out to. Research organizations could also be requested to provide information about research which is transitioned to a commercial entity, such as through a spin-off company.

#### 11.15. REVIEW, APPROVAL AND SUBMISSION OF THE DECLARATIONS

To ensure that the information provided by the operators is correct and complete it is necessary to review, assess and verify the provided information. Reviewing of information (by the SRA) is performed to ensure that the format is correct, that all necessary sections are completed fully and in an appropriate level of detail. The SRA can also evaluate if the information is coherent and consistent with the previous declarations, and can verify the information during other activities, such as confirming the accuracy of 2.a.(iii) site declarations. The SRA should not simply forward the information submitted by the reporting entities but review, assess and validate the completeness and correctness of the information prior to submittal to the IAEA. In case of corrections and omissions, feedback should be conveyed to these entities to support continuous improvement.

*Example: An SRA receives submittals from reporting entities, analyses them and checks for correctness, completeness and internal consistency. If errors are found, the reporting entity is contacted and requested to submit a correction. After all corrections are received, the SRA inputs the declarations into Protocol Reporter software and exports the declarations for review. The SRA reviews and proofreads the whole set of declarations. Finally, the declarations are submitted to the IAEA via encrypted email.*

*Example: At the SRA, one officer has primary responsibility for AP declarations, handles communication with reporting entities, manages the AP database and is responsible for compiling and submitting the AP declarations to the IAEA. Assigning the responsibility to one person (while also identifying a backup) helps to ensure that the declarations will be correct, complete and timely.*

It is recommended to check the quality of AP declarations using Protocol Reporter software so that the format is consistent with the IAEA's system and the declaration can be correctly uploaded into the IAEA's database. If an error is found after submitting the declaration, it is a good practice to submit a correction immediately and not wait for the next annual update.

Attachments to AP declarations, such as maps, photos, notes or any attachment to any AP declaration, can be submitted separately to the IAEA using Protocol Reporter. It is recommended to encrypt AP declarations and associated attachments prior to submission to the IAEA. Version 3 of the Protocol Reporter software will facilitate the attachment of files (such as maps, photos, diagrams, reports) to AP articles to enhance the preparation and submission of AP information to the IAEA.

*Example: At a nuclear research centre with several different buildings (research reactor, radioisotope production, waste management and storage, non-destructive testing, environmental applications), a Nuclear Material Control Unit was established. The functions of this unit are separated from operational and overall facility management. The unit acts as the site representative for safeguards purposes, collects and manages the information necessary for AP declarations, and compiles and submits the declarations to the SRA.*

## 12.FACILITY OPERATORS' ROLE IN PROVISION OF INFORMATION

Much of the information provided by States to the IAEA regarding facility design, nuclear material inventories and transfers of nuclear material within or outside of a State originates at facilities and is produced by facility operators. Facility operators also generate information for preparing site declarations under an AP.

This section is provided **for facility operators**, and **shares experiences and good practices** of facility operators in providing information to the SRA and IAEA.

### 12.1. RESPONSIBILITY OF MANAGEMENT

The facility management should ensure that safeguards-related responsibilities are clearly defined and that each is assigned to an appropriate position/unit within the organization (e.g. nomination of Safeguards Site Officer, implementation of nuclear material accountancy and control system, communication with SRA, etc.). These responsibilities should be defined in the organization operating manual. Management is responsible for defining the safeguards high level programme of activities and team structure (strategy, quality check, responsibilities, etc.). Interfaces requiring coordination, such as between compliance, operations and security, need to be defined and mechanisms established for this purpose. Primary responsibility is often assigned to a particular role, which may be a 'Facility Safeguards Officer (FSO)', an 'Accountancy Officer', a 'Site Safeguards Officer' or other title, depending on the nature of the facility and the associated safeguards activities.

The remainder of this section will refer to the **position with primary safeguards responsibilities at a location as a 'facility safeguards officer' or FSO**. In reality, this role could have a variety of titles, and such a position should also be established at a LOF.

Management should communicate the contact details of the FSO and alternate to the SRA.

### 12.2. FUNCTIONS OF A FACILITY SAFEGUARDS OFFICER

The FSO is the primary facility contact person for the SRA, and liaises with the IAEA and facility management as necessary. Routine business can be discussed at a working level during inspections or by email exchange (e.g. announcement of IAEA inspectors performing the inspection, follow-up actions, submission of the sampling plan to the facility, preparation of shipments from IAEA to facility or vice versa). Communication that occurs through official channels is discussed between the SRA and the FSO.

**Good practice:** Assign all safeguards responsibilities associated with the facility to one person: i.e. the FSO is responsible for the facility safeguards activities, preparing the site declaration and facilitating CA at the site.

The FSO should be trained on safeguards in general and the individual agreements and protocols which are in force in the State and also, importantly, the FA. Additionally, health

and safety, radiation protection and quality assurance of safeguards arrangements implemented at the facility should be included in the training and familiarization programme.

The FSO should be responsible for the supervision of the timely submission of safeguards-related information to the SRA (e.g. declarations, reports, records, accountancy documents, operational programs) as required by the SRA. If the information is submitted by other departments within the facility, the FSO should supervise the correctness of the information and advise the departments concerning questions.

The FSO and the facility management should have close communication and the FSO should be involved in all safeguards-related discussions and discussions of changes with the potential to impact safeguards. The FSO should participate in discussion regarding new safeguards measures considered for the facility, e.g. to improve implementation effectiveness or efficiency, and also to consider the conditions of the facility with regard to the IAEA safeguards requirements. For example, to support the IAEA's establishment of a new safeguards approach for a storage facility on the site, the FSO would discuss the issue with management, hold working level discussions with the SRA, and participate in discussions between SRA and IAEA. Such proactive planning and coordination helps to ensure all conditions and requirements are mutually understood, concerns raised and the path forward communicated to all parties.

The FSO should manage the procedures to facilitate IAEA access at the site, such as:

- Arrangements that access for inspectors is granted on facility site (contact between the FSO and site Security);
- Information exchange in an “initial meeting” between the FSO, SRA and IAEA inspectors to discuss activities to be performed during inspections, DIVs or CA;
- Preparation and handover of all necessary records, reports, source documents and other information to inspectors;
- Act as contact person for safeguards inspectors in case of questions which can be addressed at the working level, and reference of other issues to the SRA by the FSO for resolution;
- Act as the interface between facility staff and inspectors (or SRA if a representative is present), particularly where information or support from other facility departments are necessary for the inspection;
- Be responsible to introduce new inspectors to health & safety requirements and other arrangements at the site, and ensure that all inspectors seeking access possess the needed training/certification;
- It is good practice for the FSO to document and circulate procedures for safeguards activities to all affected staff, and ensure they are adhered to during inspections; and
- It is a good practice for the FSO to hold a “close out meeting” after an inspection to review performed safeguards activities, try to clarify any open questions, provide source documents or other non-restricted or sensitive documents as necessary to resolve issues, and review any lessons learned. For continuous improvement, the FSO

may wish to discuss corrective actions with staff as needed, following the inspection/access.

In general, the FSO should be available to address any requests or needs of the IAEA inspectors or SRA, and well prepared to assist the IAEA to successfully complete the inspection and assure objectives can be achieved.

### 12.3. COMMUNICATION CHANNELS BETWEEN FACILITY, SRA AND IAEA

Contact persons on safeguards-related matters should be clearly defined for all entities. To enable a reasonable workflow during inspections, direct communication among the parties is helpful. Mutual arrangements in writing about detailed communication needs/expectations are also useful to avoid misunderstandings or delays. Clear communication protocols should be defined for working level and official communication, identifying who will be informed, about what, by whom, and when.

The Subsidiary Arrangements specify the timing, content and format for reports. The AP defines the reporting requirements and timing for associated declarations. See the relevant sections of this SIP Guide for details in this regard. The submission of reports and declarations in electronic format is highly preferred by the IAEA. It is a good practice for the FSO to attach an official letter signed by the facility management or by the FSO (as specified by the facility management) to the email transmitting official information to the SRA from the facility.

Security requirements will need to be followed by the FSO in submitting information. Classification of the documents (reports, declarations, operational programme information) should be clarified in the facility procedures in advance as needed. The period of retention and methods for destruction and archiving should also be specified. See Section 4.2 for more information about means for secure electronic communication channels between the facility, State and SRA.

### 12.4. INFORMATION ABOUT THE FACILITY DESIGN

The facility management creates a DIQ based on the templates made available by the IAEA. The FSO should be familiar with the features of the facility which are relevant for the initial preparation of the DIQ and be involved early with regard to any planned modifications. As specified in the FA, some modifications will need to be reported in advance. To ensure the FSO receives the needed information about the facility design features and any planned modifications, some possible strategies include:

- The FSO could arrange with the facility management to be invited to participate in recurrent technical meetings, where potential facility modifications would be discussed;
- The minutes from such recurrent meetings could be shared with the FSO; and
- The FSO can raise awareness among relevant staff about the existence and content of the DIQ and their role in ensuring the FSO remains informed accordingly.

**Example:** Steps in preparation of the DIQ by FSO:

- The FSO is assigned responsibility for the preparation of the initial DIQ and subsequent updates.
- The FSO requests the SRA to send the appropriate DIQ template, to be used in preparing the design information. The FSO may also wish to request the SRA to obtain additional guidance from the IAEA to assist in preparing the DIQ (the SRA could email the IAEA to request such guidance).
- Additional to the answering of the questions in the DIQ, the FSO requests from relevant facility staff, copies of floor plans and overview maps of the buildings and areas on the site and submits them in an annex to the DIQ.
- MBAs and KMPs of the facility are reflected in a diagram. The flow of nuclear material through the facility (bulk or item) is demonstrated in a separate flow diagram.
- Examples of the facility source documents (e.g. weighing form, transport sheet, analysis form, advice note, and calibration certificate of measurement equipment) for the nuclear material accountancy and control system is provided in an annex to the DIQ with reference to the associated DIQ section.
- Health and safety, security and radiation protection information valid on facility site and to be followed by inspectorates is described in the DIQ.
- The FSO provides the draft DIQ to facility management for review and approval. The facility manager signs the DIQ. The FSO prepares an official letter of transmission of the DIQ to the SRA.
- The DIQ is retained at the facility and made available to inspectors upon request, to support design information verification.
- Updates of the DIQ are prepared as required, following a similar approach as was undertaken to prepare the initial DIQ.

## 12.5. NUCLEAR MATERIAL ACCOUNTING CONCEPTS AND INFORMATION

The facility's nuclear material accountancy and control (NMAC) system will include the procedures, processes, databases, forms, measurement methods and instruments, quality control programmes, records, source documents, reports and other elements. The accounting software used at the facility could be provided by the SRA or could be developed by the facility operator or purchased from a third party. In any case, the entire NMAC system will need to be designed to meet all relevant national requirements, including those related to the submission of information to the IAEA. The complexity and functionality of the NMAC depends mainly on the nature of the facility.

*Example: A facility operator has been enhancing NMAC systems throughout more than 35 years of operations. The NMAC system is tailored to the needs of each plant and is based on the relevant regulations for the State in which the plant operates. In every case, the system meets the functional requirements of the IAEA. Fundamental changes and modifications in*

*the NMAC systems are reported in the DIQ for each facility. The NMAC systems are developed and improved based on a continuous dialogue with the SRAs and the IAEA.*

The facility management should decide which department of the facility will be responsible for the functioning and use of the NMAC. On the one hand, the FSO may be responsible for the execution of nuclear material accountancy. In this case the FSO can also supervise the correctness of the accounting entries in line with requirements and also produce the accountancy reports to be submitted to the SRA. On the other hand, most of the information relevant for nuclear accountancy is produced in other departments of the facility (e.g. logistics/shipments or quality control). In this case, logistics staff could input entries into the NMAC, which supervision and advice are the responsibility of the FSO.

*Example: At a facility, much of the relevant information for nuclear material accountancy (weighing, analysis, transfers between MBAs, export- and import-documents, information for concise notes, advance notifications) is generated in the Operations section. The FSO is not part of Operations, in order to ensure the independent function of safeguards. The well-trained employees working on nuclear material accountancy in Operations enter information into the NMAC system which is used to generate the routine safeguards reports and records. To ensure the high quality and correctness of such records and reports, they are checked by two Operations employees and then the quality and correctness is audited by the FSO. This system (depicted in Figure 24) produces reports that can be directly generated in Operations, validated by the FSO and submitted directly from the NMAC system to the SRA with the approval of the FSO.*

**Good Practice:** The accountancy reports should be submitted in electronic format to facilitate the IAEA's processing of data and avoid transcription errors. An official letter should convey the submission.

Source data for nuclear material accountancy should be as far as possible processed in real time in the NMAC system to obtain a situation in the nuclear material accountancy books which is identical with the physical situation of nuclear material inventory at the site. The source data are based on source documents which are archived by the operator (as long as necessary). The source data used to prepare the accountancy reports (ICR, MBR, PIL) should be available for the IAEA during inspections.

The preparation and submission of the nuclear material accountancy reports should be subject to a quality control process which also meets the time limits of submission. It is preferable that several people (in case of absence of the principal accountant) are able to prepare and submit the reports.

In case of any questions regarding nuclear material accounting the FSO should always have the opportunity to get in contact with the prior defined contact persons (see communication channels) to resolve any questions.

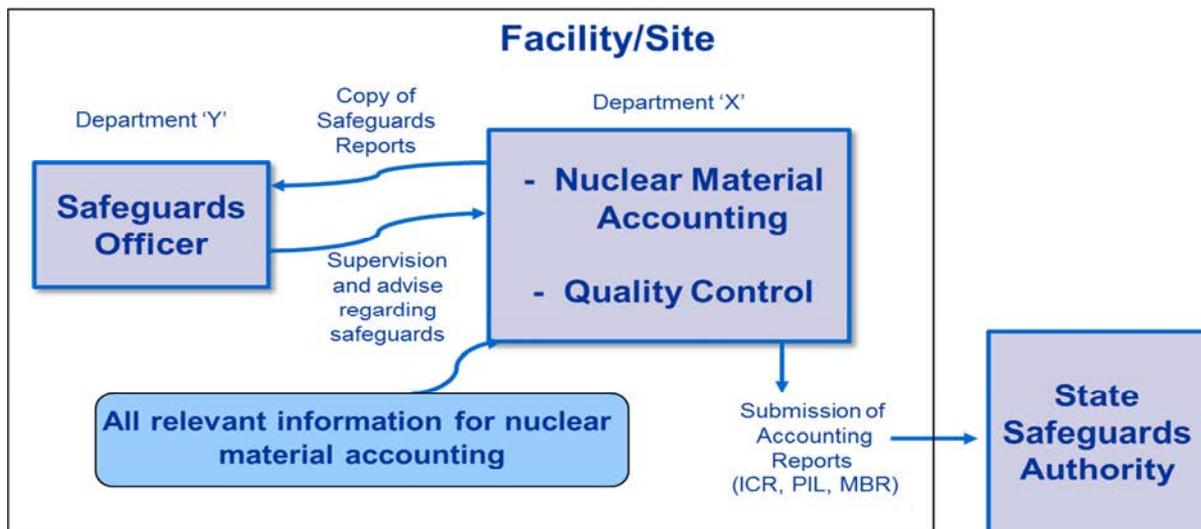


FIG. 24. Nuclear material accounting concepts at a facility/site.

**Good Practice:** all safeguards accountancy reports should be generated by the operator using information generated in the same NMAC system to avoid transcription errors or implementation errors from transfer of information from one system to another.

Changes to the facility's NMAC system need to be described in an updated DIQ. It is a good practice for the facility's accounting system to facilitate the SRA's preparation of reports to the IAEA (i.e. consistent with Code 10).

## 12.6. INFORMATION ABOUT IMPORTS AND EXPORTS OF NUCLEAR MATERIAL

Reporting and notifications related to the import and export of nuclear material is discussed in Section 10 of this SIP Guide, where the general requirements are described. It is recommended that the advance notification (AN) of a planned export (or import) be prepared in the relevant department where the data is generated. However, the FSO will play an important supervisory role in reviewing and approving the final AN to be submitted.

**Good Practice:** Send the AN to the SRA as soon as the shipment date is available.

**Good practice:** It is good practice for the AN to include detailed information which is typically quite helpful for the IAEA's evaluation. Some of these details are specified in the Subsidiary Arrangements and therefore obligatory, so the FSO should be familiar with the requirements for his or her facility.

- Reference Number: to track the status of shipment notified on the AN.
- Amendment number: specify if there are changes of shipment which have to be notified on the AN (it is preferable that the amendments are submitted directly as soon as the information becomes available); and apply an identification system that enables tracking of related previous notifications.

- Number of items (Import/Export AN) and Batch number (only Export AN due to unavailability in advance of batch numbers from shipper).
- Last date when material can be identified (only Export AN) due to the fact that exported nuclear material is packed in special overpacks, and after packaging verification is difficult. Nuclear material would have to be unpacked again which would significantly delay the shipment process.
- Date when material is unpacked (only Import AN). This information is useful for inspectors to know when the nuclear material will be available to perform ad hoc inspection to verify the material (reference INFCIRC/153 (Corr.), Paragraph 96).

As with all official submissions to the SRA, the AN should be signed by the authorized person at the facility, and transmitted with an official letter from the FSO. Additionally, the AN should be sent in accordance with timeliness requirements and using the communication channel agreed between the IAEA and the SRA.

## 12.7. PREPARING AP DECLARATIONS

For States with an AP in force, declarations are submitted for each site (sites are associated with both facilities and locations outside facilities or LOFs). It is a good practice for the FSO of a facility to also act as the site representative (or closely liaise with the site representative) and to be responsible for the preparation and updating of the AP declarations associated with the facility and site. For example, manufacturing activities of items specified in AP Annex I could occur on the site that must be declared under AP article 2.a.(iv). The facility could be involved in the processing of waste containing Pu, and the FSO should be familiar with the reporting requirements associated with AP article 2.a.(viii). All FSOs will need to prepare a 2.a.(iii) site declaration, which is described in detail below.

**Example:** Preparation of 2.a.(iii) site declaration by the FSO:

- The FSO's reminder in his/her electronic calendar alarms well in advance of the deadline for submitting the declaration to the SRA. Updated site declarations must be submitted by the State to the IAEA by the 15<sup>th</sup> of May each year.
- The FSO collects all relevant information for the declaration.
- The general information to be reported are described in Article 2.a.(iii) of the AP. Declarations are usually prepared using either IAEA's Protocol Reporter software or 'CAPE' for EURATOM States. On the basis of the software, the FSO can easily prepare the site declaration. The IAEA's Protocol Reporter version 3 software will facilitate this exchange of information between the FSO and the SRA, and enable attachments such as site maps (see section 11.6.1) to be attached to the declaration and submitted electronically.
- The FSO collects all the relevant information (buildings, site specific holidays, attachments to building, status of building, description of building, site representatives, site map, managed access areas arrangements) from the individual departments on-site (see Figure 25).

## Collection of information for a site declaration



FIG. 25. Collection of relevant information for a 2.a.(iii) site declaration.

- After collection of all relevant information, the FSO fills in the site declaration form using IAEA Protocol Reporter or other SRA provided software, and requests its review by appropriate facility management or other experts.
- An official letter signed by the management confirming the correctness of the site declaration is attached to the site declaration.
- If the site declaration is prepared with declaration software, the declaration can be submitted by email. If confidential information is included in the site declaration, the email or the declaration file should be encrypted and securely transmitted. It is preferable that the site declaration is submitted by email and also as hard copy with the official letter enclosed to the SRA.
- The site declaration is retained by the FSO in accordance with document management procedures and archived as appropriate.
- The SRA makes arrangements with the IAEA as necessary to plan for and implement managed access.

## 13. OTHER INFORMATION

States provide other reports to the IAEA, albeit relatively infrequently. These are described below with examples of some situations which have taken place in States that necessitated a report.

### 13.1. SPECIAL REPORTS

#### **Paragraph 68 of INFCIRC/153 (Corr.)**

The Agreement should provide that the State shall make special reports without delay:

- (a) If any unusual incident or circumstances lead the State to believe that there is or may have been loss of nuclear material that exceeds the limits to be specified for this purpose in the Subsidiary Arrangements; or
- (b) If the containment has unexpectedly changed from that specified in the Subsidiary Arrangements to the extent that unauthorized removal of nuclear material has become possible.

The special reports are to be sent as quickly as possible to the IAEA, but in any case within 72 hours from the discovery of the event. The official report transmission may be preceded by a direct exchange by phone or mail to inform immediately the IAEA of the event. In case of loss (or suspected loss) of nuclear material, the special report should describe:

- Estimated amount of nuclear material which has been lost;
- The loss circumstances, indicating clearly when the loss has been established or discovered;
- Explanations on the causes of the incident, and the experience drawn from this analysis; and
- Modifications and countermeasures implemented to avoid any reoccurrence.

If a FA has been concluded, it will specify limits associated with accidental losses, measured discards, and other inventory change codes, for the particular facility, based on its characteristics, throughputs and processes. When the relevant inventory changes are within those specified limits, they are reported routinely in an ICR with a concise note.

Another common case for special report may be the unexpected breaking of an IAEA seal. The reporting to the IAEA must be immediate, to ensure better conditions for knowledge recovery on the involved material. In this particular case, the report should indicate:

- When the seal has been broken (and where, if the seal is broken during an internal transfer or a shipment).
- Why the seal has been broken (inadvertently cut by an operator, ripped off during handling, seal wearing during time, etc.).
- What countermeasures have been implemented immediately to facilitate knowledge recovering (e.g. immediate information to the IAEA, SRA sealing to freeze the situation in the facility, transfer to an area under IAEA C/S system).
- What has been modified in the process/procedures to avoid breaking in the future (changes in items routes within the facility, evolution in sealing procedure, protection from shock, etc.).

Every special report must be kept by the SRA and the facility to support discussions during the inspections which may be carried consequently to the report (special inspection as provided for by paragraph 73.a of INFCIRC/153).

*Example: In a State, the implementation of safeguards is regulated by the Ministerial Decree on the rules of accounting and control of nuclear material. The Decree regulates the submission of special reports: “The organization possessing nuclear material shall report in writing to the Authority of Nuclear and Radioactive Materials without delay, if:*

*a) any loss or gain has been found in the physical inventory of nuclear material;*

*b) accidental loss of nuclear material has occurred or may occur, or a well-grounded suspicion exists;*

*c) such accidental event has occurred or may occur, which will affect the ability to control the nuclear material.”*

*Example: in a State, a special report was submitted regarding an accidental loss of a small amount of nuclear material. The ICR contained a ‘loss accidental’ line for a Pu source with 0.0 g of Pu-239. The Pu source was used as a sensing component in an instrument for soil moisture measurement. During the inventory taking process, one day before the PIV, the operator notified the SRA that the batch was missing. The operator was very cooperative during and after the inspection and tried to find the source and its relevant documents. The documents showed that there was a gap in the continuity of knowledge on the physical presence of the source, since it was stored and closed in the instrument. During the annual PIT - due to the difficulties in opening the equipment - only the presence of the equipment was checked but not the nuclear material itself.*

*Example: A State submitted a special report on an accidental gain of a small amount of nuclear material. A plutonium source was found with a weight of 0.059 g. The source was entered in the State’s inventory and the inventory change was reported to the IAEA with a concise note. The State did not need to submit a special report in this case; the ICR with a concise note was sufficient.*

Natural uranium in powder form and shielding containers with depleted uranium are very common items at many companies and laboratories. SRAs are faced with accidental gains of nuclear material, which are found during cleaning of old production halls, storage sites or former laboratories. The national legal framework should require that anyone who finds nuclear material must inform the police and the national regulatory body without any delay. The SRA will need to verify the possible discovery and according to the results (i.e. if the material is U, Pu or Th), add the nuclear material to the State’s inventory by submitting an ICR for the appropriate MBA with the inventory change code, ‘GA’ and include a concise note. If the State participates in the IAEA’s ITDB, which is highly recommended, the SRA would also send the report to the ITDB. In case the nuclear material is found at an unsecure location (such as in an abandoned building or a forest), the SRA will need to arrange transport to a secure facility, such as a radioactive waste repository.

### 13.2. AMPLIFICATIONS AND CLARIFICATIONS

Both CSAs and APs have provisions for the IAEA to request amplifications (additional information) or clarifications (resolution of a question or inconsistency) with regard to information provided by the State or information obtained by the IAEA.

If it will not be possible to quickly respond to an IAEA request for amplification or clarification, it is a good practice to quickly **acknowledge receipt**, ask questions if the request is unclear, and inform the IAEA of the anticipated time needed to respond to the request.

*Example: A State's nuclear act specifies that the SRA may request data from an entity regarding its activity independent of whether the SRA obtained its information from the organization performing the activity or from another authorized source. The requested person or organization shall provide the requested data within the deadline determined by the SRA.*

*Example: The IAEA requested clarification with regard to a State's AP declaration. The SRA had informed the IAEA that fuel assembly cladding made from zirconium alloy had been exported and that these items had previously been imported for use at an NPP. The IAEA requested clarification on the date on which these items were imported by the State and the quantity, use and location(s). The zirconium tubes were transported to a research centre with the purpose to analyse the formation of oxide layers on the zirconium tube samples and their behaviour under high temperature. Material test analyses were performed only on two zirconium tubes because in course of the research it was found that the specifications of the zirconium tubes were different from the ones required by the NPP. Therefore the remaining 18 zirconium tubes were shipped from the research centre to the NPP and shipped back from the NPP to the manufacturing company.*

*Example: The IAEA requested clarification based on open source information regarding the restart of uranium mining in a State. The State informed the IAEA that a Government decision on restarting uranium mining had been adopted and a feasibility study begun on impacts of restarting uranium mining activities.*

## 14. INFORMATION PROVIDED VOLUNTARILY BY STATES

The voluntary reporting scheme (VRS) for nuclear material and specified equipment and non-nuclear material such as heavy water and nuclear grade graphite was endorsed by the Board of Governors in 1993 as a means to strengthen safeguards. Information which is received pursuant to the VRS is being used on a routine basis as part of the more systematic analysis by the IAEA of information about States' nuclear activities - a safeguards-strengthening measure. The conclusion of an AP has no connection to participation in VRS. A State with or without an AP can participate in the VRS. Importantly, concluding an AP does not affect the reporting commitment undertaken through participation in the VRS.

The participation of a State to the VRS is effected through **an exchange of letters** with the Agency.

Where an AP is in force, the SRA should ensure consistency between declarations under the VRS and relevant to articles 2.a.(vi) and 2.a.(ix) under its AP. States with CSAs and APs provide regular detailed reports on imports and exports of pre-34(c) material as required. Participation in the VRS provides for reports on exports of pre-34(c) material to NPT NWSs

for nuclear purposes, which is not required under an AP. Table 5 summarizes the reporting mechanisms regarding imports and exports by States with a CSA.

TABLE 5. REPORTING REQUIREMENTS FOR THE IMPORT AND EXPORT OF PRE-34(C) MATERIAL

|                              | Nuclear Weapons State     |                                   | Non-Nuclear Weapons State |                                  |
|------------------------------|---------------------------|-----------------------------------|---------------------------|----------------------------------|
|                              | Nuclear Use               | Non-Nuclear Use                   | Nuclear Use               | Non-Nuclear Use                  |
| <b>Exports by NNWS to:</b>   | VRS*                      | INFCIRC/540 Article 2a.(vi)(b)**  | INFCIRC/153 Article 34(a) | INFCIRC/540 Article 2a.(vi)(b)** |
| <b>Imports of NNWS from:</b> | INFCIRC/153 Article 34(b) | INFCIRC/540 Article 2.a.(vi)(c)** | INFCIRC/153 Article 34(b) | INFCIRC/540 Article 2a.(vi)(c)** |

\* VRS provides for this information, because INFCIRC/153 paragraph 34(a) does not require exports to NPT NWSs for nuclear purposes to be reported, unless the material is intended to be trans-shipped to a final destination which is a NNWS. A State that has not joined the VRS can also simply report such exports in the 34(a) report on a voluntary basis.

\*\* Reporting of exports/imports of pre-34(c) material for specifically non-nuclear purposes under INFCIRC/540 (Corr.) Article 2.a.(vi)(b) and 2.a.(vi)(c) is required if a single or the total of successive exports/imports of such material exceeds 10 metric tons of uranium or 20 metric tons of thorium.

There may be circumstances, particularly the first export to a particular end user, where the State may need to work with the shipper and/or the recipient, to determine the specific purpose (nuclear or non-nuclear). Nuclear purpose involves the use of the nuclear properties of the element (e.g. ability to fission), while non-nuclear purpose involves the use of other characteristics of the element (e.g. density, colour).

States are encouraged to report **all imports and exports of pre-34(c) material** to the IAEA. Information not required to be submitted pursuant to an AP should continue to be provided under the VRS. States may report all imports and exports of pre-34(c) material in **34(a) and 34(b) reports**, regardless of nuclear or non-nuclear purpose, and regardless of whether the other State is a NPT NWS or NNWS.

#### 14.1. REPORTING STOCKS OF HEU AND PU TO THE IAEA

The *Guidelines for the Management of Plutonium*, published for the information of Member States as INFCIRC/549 in 1998, introduce in Annexes B and C, a declaration by participating States of their national inventory of civil plutonium.<sup>6</sup> Participation in such reporting is voluntary.

The reporting of civil stocks of plutonium is divided between unirradiated and irradiated plutonium of seven types:

<sup>6</sup> In 1998, the IAEA published the Guidelines for the Management of Plutonium (INFCIRC/549). These guidelines, agreed to by the five NPT NWSs and Belgium, Germany, Japan, and Switzerland, increased the transparency of the management of civil plutonium by publishing annual statements of each participating State's holdings of civil plutonium.

#### Annex B:

- Unirradiated separated plutonium in product stores at reprocessing plants;
- Unirradiated separated plutonium in the course of manufacture or fabrication and plutonium contained in unirradiated semi-fabricated or unfinished products at fuel or other fabricating plants or elsewhere;
- Plutonium contained in unirradiated MOX fuel or other fabricated products at reactor sites or elsewhere; and
- Unirradiated separated plutonium held elsewhere.

#### Annex C:

- Plutonium contained in spent fuel at civil reactor sites;
- Plutonium contained in spent fuel at reprocessing plants; and
- Plutonium contained in spent fuel held elsewhere.

In addition, Annex B includes:

- Plutonium belonging to other States;
- Plutonium held in locations in other States and therefore not included above; and
- Plutonium which is in international shipment prior to its arrival in the recipient State.

The annual figures sent by Member States are published on the Agency website.

The categorization above is clearly different from Code 10 requirements. The SRA will need to track such information to calculate this annual balance. This could be accomplished by categorizing facilities, MBAs, or operational areas within facilities. However, the reports will be expected to be consistent with the State's accounting reports. Some States also provide a statement for HEU, similar to the plutonium statement but with adapted categories:

- HEU stored at enrichment plants;
- HEU in the course of fabrication at enrichment plants;
- Unirradiated HEU at fuel fabrication or processing plants;
- Unirradiated HEU at civil reactor sites;
- Unirradiated HEU not located at enrichment plants, fuel fabrication or processing plants, or civil reactors (for example: laboratories, research centres);
- Irradiated HEU at civil reactor sites; and
- Irradiated HEU at locations other than civil reactor sites.

The IAEA publishes this information together with the statements on stocks of civil plutonium.

## 14.2. THE IAEA'S INCIDENT AND TRAFFICKING DATABASE (ITDB)

In the recent past, increased emphasis has been placed on the prevention and detection of illegal trafficking of nuclear and other radioactive materials. States should be capable to prevent, detect and respond to any illegal activities in connection with nuclear and other radioactive materials that take place on their territory, or have a plan in place to request assistance from States with such capabilities.

In 1995, the IAEA established the ITDB system to track incidents of illicit trafficking and other unauthorized activities and events involving nuclear and other radioactive material outside of regulatory control. The ITDB is a unique asset that assists the IAEA, participating States and selected international organizations to combat illicit nuclear trafficking and improve nuclear security.

The ITDB contains a growing collection of authoritative information on the subject. Reporting to ITDB is voluntary, but the IAEA recommends that all Member States join and participate in it.

When a State seizes **nuclear material (uranium, plutonium or thorium)**, it must report such material to the IAEA through an ICR with the code 'accidental gain' or GA. The quantity of nuclear material should be based either on measured values or an estimate. At the same time, the State is encouraged to **report the seizure to the ITDB**.

Regulations regarding seizure of nuclear or radioactive material should contain aspects for prevention, detection and response. The elements of the prevention are: (i) establishment of adequate legal authority, (ii) accountancy of nuclear and other radioactive materials, (iii) prevention of nuclear and other radioactive materials escaping regulatory control. Specifically, the State's efforts in the following areas contribute to prevention: maintaining a national registry of nuclear and other radioactive material; export/import controls; regulation of transport and packaging; regulation of physical protection; and licensing of all activities in relation to nuclear and other radioactive materials. Border control that incorporates the use of radiation detection also contributes to detection of illegal transport.

Regulations will also need to assign tasks and duties of the various State organizations involved in a seizure - from the initial reporting of the seizure to the accurate identification and characterization of the material to its storage and accounting.

*Example: To prepare for and test the State's procedures and protocols, a simulation exercise may be useful. A State held such an exercise as part of a comprehensive national review of its nuclear and radiological security provisions. The one day exercise took place on the site of a research reactor and simulated the case of an abandoned foreign-licensed car found in a forest by a passer-by. Two packages were in the trunk and the front seat of the car. In the trunk there was a radioactive source of 11,8 GBq  $^{60}\text{Co}$  inside of a depleted uranium container with a radiation symbol. On the front seat was a glass jar containing low enriched uranium (2.6 %) pellets. Several national authorities participated in the exercise, and followed the steps outlined in the relevant decree complemented by an action plan for seized/found radioactive or nuclear material. The evaluation of the exercise highlighted some weak points of the model plan, and it was revised based on the results.*

The response to an event involving nuclear and other radioactive material out of regulatory control will differ based on the type of incident. For example, missing material would include those incidents involving the disappearance of material through, e.g. theft or loss; discovery of material involves finding material where it is unexpected and thus out of control; seizure and confiscation involve putting discovered material back under regulatory control.

In case of discovery, seizure and confiscation, the nuclear or radioactive material is transported to a dedicated nuclear forensics laboratory for secure storage of the material and detailed investigation as requested by a competent authority.

*Example: A steel factory received a scrap metal shipment by rail from a company. During the routine check of two train cars, high levels of radiation were detected at the entrance of the factory by the radiation portal monitors. The steel factory sent the two cars back to the shipping company. The State radiation laboratory analysed the source of the radiation, which was found to be six Ra-226 sealed sources. The activity of one source was about 1.5 to 2 million Becquerels. The sources were transported to the State's radioactive waste treatment and disposal facility.*

### 14.3. AMERICIUM AND NEPTUNIUM REPORTING

For many years the nuclear community has recognized that some transuranic elements other than plutonium, in particular Np and Am, if available in sufficient quantities, could be used for nuclear explosive devices. These elements are found in spent fuel and may be separated through a reprocessing process. However, Np and Am are not covered by the definition of special fissionable material<sup>7</sup> in the Agency's Statute and are not subject to safeguards.

Based on a report by the Director General on the proliferation potential of Np and Am, a monitoring scheme for separated Np and Am was approved by the Board of Governors in 1999. States that have agreed to report separated\* Am and Np should report annually to the IAEA the following specific information:

- i. The inventory, to the nearest tenth of a gram, of "previously separated" neptunium-237, in any form, on 31 December of the previous calendar year. Inventories of less than 1 gram of such material need not be reported.
- ii. The inventory, to the nearest gram, of "previously separated" americium-241, -242m, or -243, in any form, on 31 December of the previous calendar year. Inventories of less than 10 grams of such material need not be reported.
- iii. Receipts and exports of quantities greater than 1 gram of "previously separated" neptunium-237, in any form, during the previous calendar year.
- iv. Receipts and exports of quantities greater than 10 grams of "previously separated" americium-241, -242m, or -243, in any form, during the previous calendar year.

*\* Separated Np and Am means separated to a point where these materials are not mixed with fission products or safeguarded nuclear material.*

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<sup>7</sup> The term "special fissionable material" is defined in Article XX.1 of the Statute as "plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing; and such other fissionable material as the Board of Governors shall from time to time determine; but the term 'special fissionable material' does not include source material". The terms "uranium enriched in the isotopes 235 or 233" and "source material" are defined, respectively, in Article XX.2 and 3 of the Statute.

Information on each receipt should specify the quantity and origin of material concerned and the date of receipt. Information on each export should specify the quantity of material concerned, the date of export and the destination and end user and intended end use. 'Previously separated' means the application of any process intended to increase the concentration of neptunium-237 or americium-241, -242m or -243. Example reporting forms can be found in Annex XII.

The monitoring approach includes provision of annual information about current inventories of separated Np and Am; past, current and planned activities to separate Np or Am; and past and future exports of separated Np or Am. Flow sheet verification for neptunium at nuclear facilities is also provided for. Some information regarding Am and Np is provided annually, as shown below:

- Current inventories of separated Np and Am (indicating the element, the location, name of facility or laboratory, and the quantity of material);
- Past, current and planned activities to separate Np or Am (indicating the location, name of facility, time periods, separation process involved, and the amount of separated material); and
- Export of separated Np or Am (indicating the recipient State, the date, quantity, end user, intended use and any remarks).

Flow sheet verification is performed at nuclear facilities having a function to separate the neptunium more than 100g per year and to separate actinides (including pyro-processing). The IAEA confirms the declared operational status such as operational parameters, equipment status and determination of Np (usually through routine destructive analysis samples taken for verification of nuclear material inventory or flows). The detailed monitoring scheme is discussed and agreed between the IAEA and the State.

*Example: In order to facilitate flow sheet verification, the SRA investigated the candidate nuclear facilities and assessed the technical capabilities to separate the americium and neptunium. The SRA, IAEA and operator carefully assessed the technical function for separation of Np and held technical discussions to determine where flow sheet verification would be applied. The SRA requested the relevant operators to voluntarily provide the information about Np distribution data in the process for flow sheet verification and requested the nuclear facilities to report Np separation annually.*

## **15. CONSIDERATIONS FOR TRAINING STAFF**

### **15.1. TRAINING ON NUCLEAR MATERIAL ACCOUNTING AND REPORTING**

Training of personnel responsible for accounting and control of nuclear material at State and facility levels is critical for the successful operation of an SSAC. Procedures identifying training needs for personnel performing measurements to determine the quantities of nuclear material should be prepared. Annex XIII describes a training and certification programme used by a Member State for its nuclear material accounting and control officers.

The relevant staff should be qualified on the basis of appropriate education, training and experience, as required. Appropriate records of training should be maintained. It should be stated that the best techniques, method or equipment cannot ensure a quality result without a trained and experienced person performing the measurement.

The first line of training should be the staff of the State authority itself. IAEA training courses, workshops, fellowships and scientific visits are possible. It is suggested that the IAEA be contacted for the necessary training resources available, including an IAEA SSAC advisory service (ISSAS Mission). Once the training of State authority staff is completed, the facility personnel can also make use of the training offered by the IAEA at their headquarters, at international courses or in specific States. Such training should be a continuing activity.

The State should facilitate the provision of adequate technical assistance from external sources, if necessary, to the facility operators in nuclear material accounting and control in order to enable the operator to fulfill requirements relating to the State. This could include help in establishing adequate record and measurement systems which may incorporate data processing and analysis procedures.

Assistance should also be given toward meeting international standards and establishing containment and surveillance measures. In bulk-handling facilities, for instance, considerable technical assistance to the operator may be necessary to establish complex measurement systems and programmes to control measurement that could ensure the success of the SSAC. Also, the evaluation of such SSAC programme results could be complex.

*Example: An SRA can hold a training session periodically, such as once per year, on NMA and reporting, and invite the operators and new staff to participate.*

The State authority is advised to seek the assistance, guidance and recommendations of the IAEA whenever needed and especially in ensuring that effective nuclear material accounting and control systems are developed, implemented and applied at the State and facility level.

A regulatory document may be prepared that provides guidance for “Accounting and Reporting Nuclear Material” which all effected operators/facilities must follow. These requirements cover accounting and reporting of nuclear material by the operators to the SRA to comply with requirements to prepare and submit reports and declarations, and the oversight undertaken by the SRA to ensure such reports and declarations are correct and complete and submitted in a timely manner. The SRA can use such regulations as the basis for a training programme for facility operators.

Some States use outreach sessions to explain reporting requirements to licensees. These may take the form of a course for staff of one facility or to particular facility types. Webinars and video conference presentations may be offered to multiple facilities a long distance from the SRA. Extensive use of **practical examples** is very helpful in such outreach.

AP training courses can address to three types of audience: regulators and National Authorities, nuclear operators and entities without nuclear activities (universities,

research...). It is necessary to take into account the different level of knowledge and involvement in safeguards. Below is an example of a training module for AP new declarants:

1. International safeguards: agreements, protocols, objectives and legal framework
2. Requirements for States and the IAEA
3. SRA structure and missions
4. Declarations
  - a. National requirements for statements
  - b. Software for declaration
  - c. Examples
  - d. Relevant data, evaluation and submission of information to national Authorities
  - e. Clarification requests
  - f. Good practices
5. CA to resolve a question upon a statement
  - a. Management of the CA by the SRA
  - b. Management of the CA by the verified entities
  - c. Timeline
  - d. National requirements for entities
  - e. Good practices
  - f. Evaluation and conclusions
6. CA to assure the absence of undeclared activities
  - a. Management of the CA by the SRA
  - b. Timeline
  - c. National legal framework
  - d. Evaluation and conclusions
7. Examples from the field / National CA exercises

*Example: In a State that carried out training courses for safeguards officers, feedback from several years of training and close cooperation with AP declarants showed a significant improvement in the completeness and correctness of information received by the SRA.*

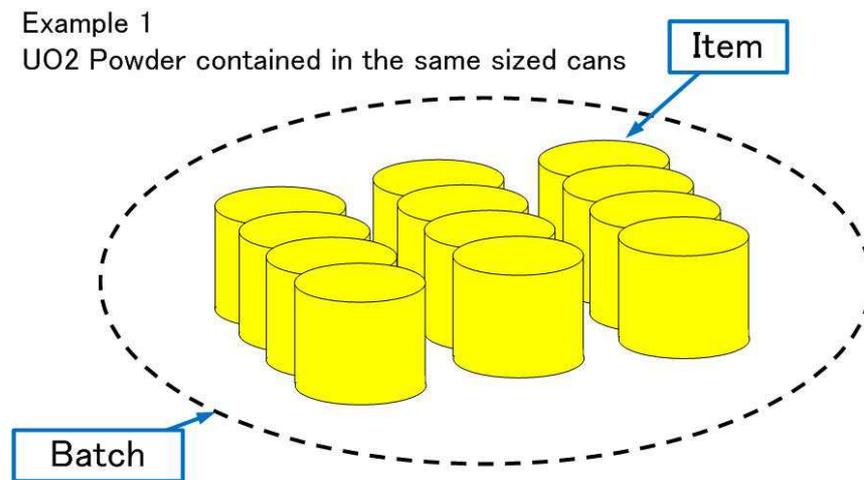
Courses can be supported by a national guideline or reference manual which is distributed to all declarants, to sustain knowledge after the course and to provide responses to frequently asked questions. The relevant information can also be shared on the SRA's website. The site can provide an overview of non-proliferation, the relevant national legal framework including the regulations and related forms and templates, and provide ready access to all reference manuals (including AP).

## 15.2. TRAINING OPERATORS ON PROVISION OF INFORMATION

Examples of contents for a comprehensive training course on provision of information for facility operators might include:

- Overview of the safeguards agreement and domestic law.
- Requirements for the operator on NMA reports, record keeping and supporting documentation.
- Procedures to prepare AP declarations including details on site map and drawings.

- Overview of nuclear material accounting reports (ICR, PIL and MBR) and accountancy concepts such as MBA, KMP, batch and item, material description codes and measurement basis codes (using graphics such as the two examples shown in Figure 26).



Example 2  
One fuel assembly should be reported as one batch and one item by ICR/PIL at Nuclear Power Plant

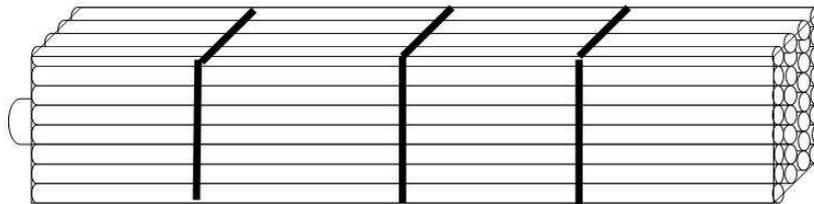


FIG. 26. Examples of diagrams used to train facility safeguards officers.

- Exercises for preparing nuclear material accounting reports (ICR, PIL and MBR).
- Procedures for preparing advance notification for import/export and operational semi-annual plans.
- Exercise on preparing the General Ledger and List of Inventory Items for the IAEA book examination.

SRAs can also encourage operators to participate in training courses offered by the IAEA.

It is a good practice to form a network of **safeguards practitioners in the State** who meet together periodically, share their experiences, exchange information, answer questions and work as peers. The SRA can attend these and provide updated guidance, and the IAEA can be invited to attend and share information on updates, changes, developments as needed. This is also a good way for new staff to quickly learn about safeguards.

## 16. PROVISION OF INFORMATION FROM THE IAEA TO STATES

### 16.1. INTRODUCTION

The IAEA communicates with the State regarding the information provided by the State. Some correspondence acknowledges receipt of information, others may request further clarification, or request a correction be made. Table 6 summarizes the communication initiated by the IAEA, and the expected response of the State, including the timing of such responses.

TABLE 6. SUMMARY OF IAEA COMMUNICATIONS RELATED TO INFORMATION PROVIDED BY THE STATE

| Issue                                                 | Purpose                                                                                                                                                                                 | Response and Timing                                                                                                                                                                        |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reminder letter                                       | Remind a State of an obligation which has not been met, e.g. an overdue initial inventory report or AP declaration                                                                      | Acknowledge receipt of the letter as soon as possible, and respond with information about the obligation (e.g. when it will be submitted), or submit the report or declaration in question |
| Request                                               | Request a State to undertake an action, such as correcting an error in a report, facilitating the receipt of IAEA equipment, or nominating a person to participate in a training course | Respond to the letter as soon as possible and take action to fulfill the request                                                                                                           |
| Request for amplification or clarification (CSA)      | Request amplification or clarification about the content of a State's report                                                                                                            | Respond to the request in a timely manner, providing the additional information (States with Subsidiary Arrangements must respond within the time period defined therein)                  |
| Import/export notifications                           | Notify a State regarding any exports or imports which were not reported by the other party                                                                                              | Inform the IAEA of any errors or omissions in the report of exports or imports as soon as possible                                                                                         |
| Semi-annual Statement of consolidated book inventory  | Notify a State of the book inventory on record at the IAEA for nuclear material in the State                                                                                            | Respond as soon as possible if issues exist; inform the IAEA of specific differences; respond if there is agreement with the inventories                                                   |
| Semi-annual transit matching Statement                | Notify a State on the matching status of shipments and receipts, where the State is indicated as the shipper                                                                            | As soon as possible, provide the IAEA with information on possible matches; also respond if there is agreement with the Statement                                                          |
| Quarterly communication on transit matching Statement | Notify a State on the matching status of shipments and receipts, where the State is indicated as the receiver                                                                           | As soon as possible, provide the IAEA with information on possible matches; also respond if there is agreement with the communication                                                      |
| Semi-annual Statement on timeliness of reporting      | Inform a State on the timeliness of dispatch for nuclear material accounting reports                                                                                                    | Inform the IAEA of agreement or disagreement with the timeliness Statement                                                                                                                 |

| <b>Issue</b>                                    | <b>Purpose</b>                                                                                                                   | <b>Response and Timing</b>                                                                                        |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Summary of NMA reports received at the IAEA     | Provide a summary of NMA reports received and information on any issues identified that may require a correction or adjustment   | As soon as possible, provide the IAEA with responses to issues or indicate if there is agreement with the summary |
| Summary of AP declarations received at the IAEA | Provide a summary of AP declarations received and any issues noted                                                               | As soon as possible, provide the IAEA with responses to issues or indicate if there is agreement with the summary |
| Request pursuant to article 2.c. (AP)           | Request amplification or clarification about content of an AP declaration                                                        | Respond in a timely manner, providing the additional information                                                  |
| Request pursuant to article 4.d. (AP)           | Provide the State with an opportunity to clarify and facilitate resolution of a question or inconsistency identified by the IAEA | Respond in a timely manner with information to facilitate resolution of the question or inconsistency             |

## BIBLIOGRAPHY

INTERNATIONAL ATOMIC ENERGY AGENCY, Agreement on the Privileges and Immunities of the Agency, INFCIRC/9/Rev.2, IAEA, Vienna (1967).

INTERNATIONAL ATOMIC ENERGY AGENCY, The Agency's Safeguards System, INFCIRC/66/Rev.2, IAEA, Vienna (1968).

INTERNATIONAL ATOMIC ENERGY AGENCY, Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/140, IAEA, Vienna (1970).

INTERNATIONAL ATOMIC ENERGY AGENCY, The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/153 (Corrected), IAEA, Vienna (1972).

INTERNATIONAL ATOMIC ENERGY AGENCY, Standard Text of a Protocol to an Agreement, GOV/INF/276/Annex B, IAEA, Vienna (1974).

INTERNATIONAL ATOMIC ENERGY AGENCY, Model Text of Subsidiary Arrangements (General Part) to Comprehensive Safeguards Agreements, (1974).

INTERNATIONAL ATOMIC ENERGY AGENCY, Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards, INFCIRC/540 (Corrected), IAEA, Vienna (1998).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design Measures to Facilitate Implementation of Safeguards at Future Water Cooled Nuclear Power Plants, IAEA Technical Reports Series 392, Vienna (1998). [http://www-pub.iaea.org/MTCD/publications/PDF/trs392\\_scr.pdf](http://www-pub.iaea.org/MTCD/publications/PDF/trs392_scr.pdf).

INTERNATIONAL ATOMIC ENERGY AGENCY, Training the staff of the regulatory body for nuclear facilities: A competency framework, IAEA-TECDOC-1254, Vienna (2001). [http://www-ns.iaea.org/downloads/ni/training/rgbd\\_trg.pdf](http://www-ns.iaea.org/downloads/ni/training/rgbd_trg.pdf).

INTERNATIONAL ATOMIC ENERGY AGENCY, Handbook on Nuclear Law, IAEA, Vienna (2003).

INTERNATIONAL ATOMIC ENERGY AGENCY, Guidelines and Format for the Preparation of Declarations Pursuant to Articles 2 and 3 of the Model Protocol Additional to Safeguards Agreements, IAEA Services Series No. 11, IAEA, Vienna (2004).

INTERNATIONAL ATOMIC ENERGY AGENCY, Modified Text of the Protocol to an Agreement Concluded on the Basis of GOV/INF/276, Annex A, GOV/INF/276 Mod 1 and Corr. 1 Annex B, IAEA, Vienna (2005).

INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Statute, as amended up to 23 February 1989, IAEA, Vienna (2006).

INTERNATIONAL ATOMIC ENERGY AGENCY, The Nuclear Material Accounting Handbook, IAEA Services Series No. 15, IAEA, Vienna (2008).

INTERNATIONAL ATOMIC ENERGY AGENCY, Handbook on Nuclear Law – Implementing Legislation, IAEA, Vienna (2010).

INTERNATIONAL ATOMIC ENERGY AGENCY, Safeguards Implementation Guide for States with Small Quantities Protocols, IAEA Services Series No. 22, IAEA, Vienna (2013).

INTERNATIONAL ATOMIC ENERGY AGENCY, Safeguards Implementation Practices Guide for Facilitating IAEA Verification Activities, IAEA Services Series No. 30, IAEA, Vienna (2014).

INTERNATIONAL ATOMIC ENERGY AGENCY, International Safeguards in the Design of Nuclear Reactors, IAEA Nuclear Energy Series No. NP-T-2.9, IAEA, Vienna (2014).

INTERNATIONAL ATOMIC ENERGY AGENCY, Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure, IAEA Services Series No. 31, IAEA, Vienna (2015).

INTERNATIONAL ATOMIC ENERGY AGENCY, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols, IAEA Services Series No. 21 (updated), IAEA, Vienna (2016).

*Note: Many of these documents can be found for convenience at [www.iaea.org/safeguards](http://www.iaea.org/safeguards) under the Assistance for States webpages.*

## ABBREVIATIONS

|         |                                                                                                                                              |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------|
| AN      | Advanced Notification (of a planned export or import)                                                                                        |
| AP      | Additional Protocol                                                                                                                          |
| APRS    | Additional Protocol Reporting System                                                                                                         |
| BA      | Book Adjusted (adjusted book inventory)                                                                                                      |
| BE      | Book Ending (ending book inventory)                                                                                                          |
| CA      | Complementary Access                                                                                                                         |
| CSA     | Comprehensive Safeguards Agreement                                                                                                           |
| CUMUF   | Cumulative Material Unaccounted For                                                                                                          |
| DA      | Destructive Analysis (or Assay)                                                                                                              |
| DIQ     | Design Information Questionnaire                                                                                                             |
| DIV     | Design Information Verification                                                                                                              |
| DU      | Depleted Uranium                                                                                                                             |
| EEL     | Essential Equipment List                                                                                                                     |
| EIF     | Entry Into Force                                                                                                                             |
| EQ      | Exempted based on quantity (inventory change code)                                                                                           |
| EU      | Exempted based on use (inventory change code)                                                                                                |
| FA      | Facility Attachment                                                                                                                          |
| FSO     | Facility safeguards officer (generic term for the person with primary responsibility for safeguards implementation at a particular facility) |
| FW      | Transfer from retained waste (inventory change code)                                                                                         |
| GA      | Accidental gain (inventory change code)                                                                                                      |
| GIS     | Geographic Information System                                                                                                                |
| GES     | Geographic Exploitation System                                                                                                               |
| GUM     | Guidance on the Determination of Uncertainties in Measurements                                                                               |
| ICR     | Inventory Change Report                                                                                                                      |
| ID      | Identification                                                                                                                               |
| INFCIRC | Information Circular                                                                                                                         |
| ISSAS   | IAEA SSAC Advisory Service                                                                                                                   |
| ITDB    | Incident and trafficking database                                                                                                            |
| ITV     | International Target Values                                                                                                                  |
| KMP     | Key Measurement Point                                                                                                                        |
| LA      | Accidental Loss (inventory change code)                                                                                                      |
| LD      | Measured Discard (inventory change code)                                                                                                     |

|      |                                                             |
|------|-------------------------------------------------------------|
| LII  | List of Inventory Items (or List of Itemized Inventory)     |
| LN   | Nuclear Loss (inventory change code)                        |
| LOF  | Location Outside Facility                                   |
| MB   | Measurement Basis (a code reported in an ICR)               |
| MBA  | Material Balance Area                                       |
| MBP  | Material Balance Period                                     |
| MBR  | Material Balance Report                                     |
| MC&A | Material Control and Accounting                             |
| MDC  | Material Description Code                                   |
| MOX  | Mixed oxide fuel                                            |
| MUF  | Material Unaccounted For                                    |
| NDA  | Non-destructive Analysis (or Assay)                         |
| NMAC | Nuclear Material Accounting and Control                     |
| NNWS | Non-nuclear-weapon State (party to the NPT)                 |
| NP   | Nuclear Production (inventory change code)                  |
| NPT  | Treaty on the Non-Proliferation of Nuclear Weapons          |
| NSG  | Nuclear Suppliers Group                                     |
| NWS  | Nuclear Weapon State (party to the NPT)                     |
| OJT  | On the job Training                                         |
| PB   | Physical Beginning (beginning physical inventory)           |
| PE   | Physical Ending (ending physical inventory)                 |
| PIL  | Physical Inventory Listing                                  |
| PIT  | Physical Inventory Taking                                   |
| PIV  | Physical Inventory Verification                             |
| QCVS | Quality Control Validation Software (IAEA software)         |
| RAPE | Rounding Adjustment to Physical Ending (related to MBRs)    |
| RAPB | Rounding Adjustment to Physical Beginning (related to MBRs) |
| RD   | Receipt Domestic (inventory change code)                    |
| R&D  | Research and Development                                    |
| RM   | Rebatching Minus (inventory change code)                    |
| RP   | Rebatching Plus (inventory change code)                     |
| SBD  | Safeguards by Design                                        |
| SD   | Shipment Domestic (inventory change code)                   |
| SF   | Shipment Foreign (inventory change code)                    |

|      |                                                                                 |
|------|---------------------------------------------------------------------------------|
| SIMS | Safeguards Information Management System (of a State)                           |
| SIP  | Safeguards Implementation Practices (i.e. SIP Guides)                           |
| SIR  | Safeguards Implementation Report                                                |
| SNRI | Short Notice Random Inspection                                                  |
| SQP  | Small Quantities Protocol                                                       |
| SRA  | State or Regional Authority (with responsibility for safeguards implementation) |
| SRD  | Shipper-Receiver Difference                                                     |
| SSAC | State's System of Accounting for and Control of Nuclear Material                |
| UOC  | Uranium Ore Concentrate                                                         |
| VOA  | Voluntary Offer Agreement                                                       |
| VRS  | Voluntary Reporting Scheme                                                      |

**Annex I.**  
**EXAMPLE DIQ FOR A RESEARCH REACTOR**

# **EXAMPLE OF INFORMATION PROVIDED IN A DESIGN INFORMATION QUESTIONNAIRE FOR A NUCLEAR REACTOR**

*THIS FORM IS TREATED AS HIGHLY CONFIDENTIAL WHEN COMPLETED AND  
SUBMITTED BY THE STATE TO THE IAEA AND ALL PAGES ARE SO MARKED*



**RESEARCH AND POWER REACTORS**

Date: .....

| <b>GENERAL REACTOR DATA</b>                                                                                                      |                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13. FACILITY DESCRIPTION                                                                                                         | GENERAL FLOW DIAGRAM(S) ATTACHED UNDER REF. Nos.<br><br><b>Attach General Flow Diagrams, these diagrams present the general layout of the facility and the location of the reactor core, fresh fuel storage room and spent fuel storage room.</b> |
| 14. RATED THERMAL OUTPUT, ELECTRICITY OUTPUT<br>(for power reactors)                                                             | <b>Indicate the steady state thermal power</b>                                                                                                                                                                                                    |
| 15. NUMBER OF UNITS (REACTORS) AND THEIR LAYOUT IN THE NUCLEAR POWER PLANT                                                       | <b>Not Applicable</b>                                                                                                                                                                                                                             |
| 16. REACTOR TYPE                                                                                                                 | <b>Example : TRIGA, MNSR,...etc</b>                                                                                                                                                                                                               |
| 17. TYPE OF REFUELLING<br>(on or off load)                                                                                       | <b>On or off load</b>                                                                                                                                                                                                                             |
| 18. CORE ENRICHMENT RANGE AND Pu CONCENTRATION<br>(at equilibrium for on-load reactors, initial and final for off-load reactors) | <b>Example : LEU Standard TRIGA fuel elements<br/>Enrichment: 19,9% of U235</b>                                                                                                                                                                   |
| 19. MODERATOR                                                                                                                    | <b>Example : TRIGA : Zirconium Hydride and light Water</b>                                                                                                                                                                                        |
| 20. COOLANT                                                                                                                      | <b>Example : Light water</b>                                                                                                                                                                                                                      |
| 21. BLANKET, REFLECTOR                                                                                                           | <b>Example: Graphite</b>                                                                                                                                                                                                                          |
| <b>NUCLEAR MATERIAL DESCRIPTION</b>                                                                                              |                                                                                                                                                                                                                                                   |
| 22. TYPES OF FRESH FUEL                                                                                                          | <b>Example : Standard TRIGA Fuel Element UZrH1.6</b>                                                                                                                                                                                              |
| 23. FRESH FUEL ENRICHMENT (U-235) AND/OR Pu CONTENT<br>(average enrichment per each type of assembly)                            | <b>Example : Standard TRIGA Fuel Element UZrH1.6 U 8,5% by weight enriched at 19,9%</b>                                                                                                                                                           |
| 24. NOMINAL WEIGHT OF FUEL IN ELEMENTS/ ASSEMBLIES<br>(with design tolerances)                                                   | <b>Fuel element of 8,5%: XXX g of U (average)</b>                                                                                                                                                                                                 |
| 25. PHYSICAL AND CHEMICAL FORM OF FRESH FUEL<br>(general description)                                                            | <b>The Fuel is a solid, homogeneous mixture uranium-zirconium hydride alloy</b>                                                                                                                                                                   |

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| <b>NUCLEAR MATERIAL DESCRIPTION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>26. REACTOR ASSEMBLIES*<br/>(indicate for each type)</p> <ul style="list-style-type: none"> <li>— types of assemblies;</li> <li>— number of fuel assemblies, control and shim assemblies, experimental assemblies in the core, in blanket zone(s);</li> <li>— number and types of fuel rods/elements**</li> <li>— average enrichment and/or Pu content per assembly;</li> <li>— general structure;</li> <li>— geometric form;</li> <li>— dimensions;</li> <li>— cladding material</li> </ul> | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p align="center"><b>Example : NA for TRIGA Mark II RR</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p>27. DESCRIPTION OF FRESH FUEL ELEMENTS</p> <ul style="list-style-type: none"> <li>— physical and chemical form of fuel;</li> <li>— nuclear material and fissionable material and its quantity (with design tolerances);</li> <li>— enrichment and/or Pu content;</li> <li>— geometric form;</li> <li>— dimensions;</li> <li>— number of slugs/pellets per element;</li> <li>— composition of alloy;</li> <li>— cladding material (thickness, composition of material, bonding)</li> </ul>    | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>The active part of each fuel moderator element is approximately XXX cm in diameter and XXX cm long.</b></p> <p><b>The cladding is stainless steel.</b></p> <p><b>Two sections of graphite are inserted, one above and one below the fuel, to serve as top and bottom reflectors for the core. Stainless steel and fixtures are attached to both ends of the can, making the overall length of the fuel element approximately XXX cm</b></p> <p><b>Attach drawings showing mainly:</b></p> <ul style="list-style-type: none"> <li>- <b>configuration of the core (position of fuel elements, control rods, in-core experimental devices,...),</b></li> <li>- <b>geometry, main parts and dimensions of fuel elements and control rods</b></li> </ul> |
| <p>28. PROVISION FOR ELEMENT EXCHANGE IN ASSEMBLIES OF EACH TYPE<br/>(indicate whether this is foreseen to become a routine operation)</p>                                                                                                                                                                                                                                                                                                                                                      | <p><b>Example : e.g. NA – facility and fuel not designed for element exchange</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>29. BASIC OPERATIONAL ACCOUNTING UNIT(S)<br/>(fuel elements/assemblies, etc.)</p>                                                                                                                                                                                                                                                                                                                                                                                                            | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>Example: fuel element unit</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p>30. OTHER TYPES OF UNITS</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>e.g. targets (describe in detail)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <p>31. MEANS OF NUCLEAR MATERIAL/FUEL IDENTIFICATION</p>                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p><b>Each Fuel Element has an identification code, and composition is based on shipper values</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <p>32. OTHER NUCLEAR MATERIAL IN THE FACILITY<br/>(each separately identified)</p>                                                                                                                                                                                                                                                                                                                                                                                                              | <p><b>Example : Fission Chambers</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p>* Assembly is the combination of elements or handling units such as cluster or bundle.<br/>** Element is the smallest contained fuel unit.</p>                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |



**RESEARCH AND POWER REACTORS**

Date: .....

| <b>NUCLEAR MATERIAL FLOW</b>                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>33. SCHEMATIC FLOWSHEET FOR NUCLEAR MATERIAL<br/>(identifying measurement points, accountability areas, inventory locations, etc.)</p>                                                                                                                                        | <p>DIAGRAM(S) ATTACHED UNDER REF. Nos.</p> <p><b>Example of areas:</b></p> <p><b>1 Fresh fuel storage room</b></p> <p><b>2 Reactor Tank</b></p> <p><b>3 Spent fuel storage pool</b></p> <p><b>Attach a drawing showing these areas</b></p>                                                                                                                          |
| <p>34. INVENTORY STATE QUANTITY RANGE, NUMBER OF ITEMS, AND APPROXIMATE URANIUM ENRICHMENT AND PLUTONIUM CONTENT FOR<br/>(under normal operating conditions):</p> <p>i) Fresh Fuel Storage</p> <p>ii) Reactor Core</p> <p>iii) Spent Fuel Storage</p> <p>iv) Other Locations</p> | <p><b>i) Example: number of fresh fuel elements in storage and their enrichment,</b></p> <p><b>ii) Example: number of fuel elements in the core and their enrichment, fission chambers</b></p> <p><b>iii) Example: number of irradiated fuel elements in the spent fuel storage and their enrichment, Pu content</b></p> <p><b>iv) Fission chambers storage</b></p> |
| <p>35. LOAD FACTOR (power reactor only)</p>                                                                                                                                                                                                                                      | <p><b>N/A (for research reactor)</b></p>                                                                                                                                                                                                                                                                                                                            |
| <p>36. REACTOR CORE LOADING<br/>(number of elements/assemblies)</p>                                                                                                                                                                                                              | <p><b>Indicate the number of fuel elements in the core (e.g. 60 fuel elements)</b></p>                                                                                                                                                                                                                                                                              |
| <p>37. REFUELLING REQUIREMENTS<br/>(quantity, time interval)</p>                                                                                                                                                                                                                 | <p><b>Refuelling intervals and quantities will vary based on usage of the reactor. Estimated time interval is XX months.</b></p>                                                                                                                                                                                                                                    |
| <p>38. BURN-UP<br/>(average/maximum)</p>                                                                                                                                                                                                                                         | <p><b>Burn up will depend on the utilization of the reactor (which will be operated in pulsing and steady-state modes).</b></p>                                                                                                                                                                                                                                     |
| <p>39. IS THE IRRADIATED FUEL TO BE REPROCESSED OR STORED?<br/>(if stored, indicate site)</p>                                                                                                                                                                                    | <p><b>Examples: temporarily stored (~10 years); shipped back to the vendor; reprocessed</b></p>                                                                                                                                                                                                                                                                     |

RESEARCH AND POWER REACTORS

Date: .....

| NUCLEAR MATERIAL HANDLING                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>40. FRESH FUEL</p> <p>i) packaging (description)</p> <p>ii) layout, general arrangements and storage plan</p> <p>iii) capacity of store</p> <p>iv) fuel preparation and assay room, and reactor loading area (description and indication of layout and general arrangement)</p> | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>i.) Example : B(U) transport package</b></p> <p><b>ii.) Example: Attach a drawing presenting the layout of the storage room</b></p> <p><b>iii.) Indicate the store capacity (e.g. 6 fuel elements)</b></p> <p><b>iv.) In some cases a preparation room is not required and the loading area is located at the top of the reactor</b></p> |
| <p>41. FUEL TRANSFER EQUIPMENT (including refuelling machines)</p>                                                                                                                                                                                                                 | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>Examples of Fuel element handling tool and transfer cask</b><br/><b>Attach drawings of these pieces of equipment</b></p>                                                                                                                                                                                                                 |
| <p>42. ROUTES FOLLOWED BY NUCLEAR MATERIAL (fresh fuel, irradiated fuel, blanket, other material)</p>                                                                                                                                                                              | <p><b>Indicate in the drawings these routes</b></p>                                                                                                                                                                                                                                                                                                                                       |
| <p>43. REACTOR VESSEL (showing core location, access to vessel, vessel openings, fuel handling in vessel)</p>                                                                                                                                                                      | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>Attach a figure showing the tank, core location, support structures of fuel elements</b></p>                                                                                                                                                                                                                                             |
| <p>44. REACTOR CORE DIAGRAM (showing general disposition, lattice, form, pitch, dimensions of core, reflector, blanket; location, shapes and dimensions of fuel elements/assemblies; control elements/assemblies; experimental elements/assemblies)</p>                            | <p><b>Example: attach a drawing that shows the reactor core, including the lattice of the core and the reflector assembly and the experimental devices.</b></p>                                                                                                                                                                                                                           |
| <p>45. NUMBER AND SIZE OF CHANNELS FOR FUEL ELEMENTS OR ASSEMBLIES AND FOR CONTROL ELEMENTS IN THE CORE</p>                                                                                                                                                                        | <p><b>There are XXX channels for fuel elements (indicate size) and xxx for control rods (indicate size).</b></p>                                                                                                                                                                                                                                                                          |
| <p>46. AVERAGE MEAN NEUTRON FLUX IN THE CORE:</p> <p>thermal:</p> <p>fast:</p>                                                                                                                                                                                                     | <p><b>A table can be attached to present the thermal and fast flux in different positions in the core (mainly in the experimental devices)</b></p>                                                                                                                                                                                                                                        |
| <p>47. INSTRUMENTATION FOR MEASURING NEUTRON AND GAMMA FLUX</p>                                                                                                                                                                                                                    | <p><b>XXX fission chambers and XXX ionisation chambers</b></p>                                                                                                                                                                                                                                                                                                                            |



**RESEARCH AND POWER REACTORS**

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| <b>NUCLEAR MATERIAL HANDLING</b>                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>48. IRRADIATED FUEL</p> <p>i) Layout, spent fuel storage plan and general arrangements (internal and external)</p> <p>ii) Method of storage</p> <p>iii) Design capacity of storage</p> <p>iv) Minimum and normal cooling period prior to shipment</p> <p>v) Description of irradiated fuel transport equipment and shipping cask (if no information on site, where is it held?)</p>                                     | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>i) Example: Include a drawing of a storage tank</b></p> <p><b>ii) Example: Wet Storage</b></p> <p><b>iii) The storage racks can receive XXX spent fuel elements</b></p> <p><b>iv) E.g. 120 days minimum; 200 days typical</b></p> <p><b>v) To be completed, shown in drawings/diagrams</b></p> |
| <p>49. MAXIMUM ACTIVITY OF FUEL/BLANKET AFTER REFUELLING<br/>(at the surface and at a distance of 1 metre)</p>                                                                                                                                                                                                                                                                                                             | <p><b>XXX rem/h at the surface of spent fuel element</b></p> <p><b>The calculated dose rates after 30 days of decay are XXX mRem/h at the surface of the transfer cask and XXX mRem/h</b></p>                                                                                                                                                   |
| <p>50. METHODS AND EQUIPMENT FOR HANDLING IRRADIATED FUEL<br/>(except for that already given under Qs. 41, 48.v)</p>                                                                                                                                                                                                                                                                                                       | <p><b>To be completed, shown in drawings</b></p>                                                                                                                                                                                                                                                                                                |
| <p>51. NUCLEAR MATERIAL TESTING AREAS<br/>(except as already given under Q. 40)<br/>For each such area briefly describe:</p> <p>i) Nature of Activities</p> <p>ii) Major Equipment Available<br/>(e.g., hot cell, fuel element decladding and dissolution equipment)</p> <p>iii) Shipping Containers Used<br/>(main material, scrap and waste)</p> <p>iv) Storage Areas for both unirradiated and irradiated materials</p> | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>To be completed, explained in drawings</b></p>                                                                                                                                                                                                                                                 |
| <b>COOLANT DATA</b>                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                 |
| <p>52. FLOW DIAGRAM<br/>(indicating mass flow, temperature and pressure at major points, etc.)</p>                                                                                                                                                                                                                                                                                                                         | <p>DRAWING(S) ATTACHED UNDER REF. Nos.</p> <p><b>Include a figure that presents the general layout of the cooling systems (primary and secondary systems, heat exchanger) with mass flows, temperature and pressures.</b></p>                                                                                                                   |

| <b>PROTECTION AND SAFETY MEASURES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>53. BASIC MEASURES FOR PHYSICAL PROTECTION OF NUCLEAR MATERIAL</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p><b>Example: e.g. perimeter fencing, intrusion alarms and cameras; inspectors will be briefed on physical security</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p>54. SPECIFIC HEALTH AND SAFETY RULES FOR INSPECTOR COMPLIANCE (if extensive, attach separately)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>e.g. Inspectors will receive a health and safety briefing; an escort trained in radiation protection will accompany inspectors</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>NUCLEAR MATERIAL ACCOUNTANCY AND CONTROL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p>55. SYSTEM DESCRIPTION<br/>Give a description of the nuclear material accounting system, of the method of recording and reporting accountancy data, the procedures for account adjustment after inventory, and correction of mistakes, etc., under the following headings:</p> <p>i) General<br/>(This section should also state what general and subsidiary ledgers will be used, their form (hard copies, tapes, microfilms, etc.) as well as who has the responsibility and authority. Source data (e.g. shipping and receiving forms, the initial recording of measurements and measurement control sheets) should be identified. The procedures for making adjustments, the source data and records should be covered as well as how the adjustments are authorized and substantiated.)</p> <p>ii) Receipts</p> <p>iii) Shipments</p> <p>iv) Physical Inventory<br/>Description of procedures, scheduled frequency, methods of operator's inventory taking (both for item and/or mass accountancy), including relevant assay methods and expected accuracy, access to nuclear material, possible verification method for irradiated nuclear material, methods of verification of nuclear material in the core</p> <p>v) Nuclear loss and production (estimation of limits)</p> <p>vi) Operational records and accounts (including method of adjustment or correction and place or preservation and language)</p> | <p>SPECIMEN FORMS USED IN ALL PROCEDURES ATTACHED UNDER REF. Nos.</p> <p><b>i) Example:</b></p> <ul style="list-style-type: none"> <li>- <b>The general and subsidiary ledgers that will be used are the IAEA templates,</b></li> <li>- <b>the responsible of the NM accountancy is the reactor manager and his deputy (attach organization chart).</b></li> <li>- <b>The Safety and Security Department has the responsibility of independent follow-up,</b></li> <li>- <b>source data: supplier of the NM (Reactor vendor).</b></li> </ul> <p><b>ii.) Example: Number of fuel elements, their identification and the amount of NM is based on data given by the supplier.</b></p> <p><b>iii.) Example: Shipments of cooled spent fuel, possible return of fresh fuel to vendor</b></p> <p><b>iv.) Frequency of physical Inventory: up to now the frequency is fixed for each year or immediately after the following event:</b></p> <ul style="list-style-type: none"> <li>- <b>After receiving or shipping NM.</b></li> <li>- <b>Any movement between the 3 areas.</b></li> </ul> <p><b>Attach procedure for performing physical inventory of storage, core and spent fuel pond.</b></p> <p><b>v.) Example: e.g. estimated using burnup calculation code (name) for each element</b></p> <p><b>vi.) Example: e.g. core monitoring system, core map and physical check of fuel element location recorded</b></p> |



**RESEARCH AND POWER REACTORS**

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| <b>NUCLEAR MATERIAL ACCOUNTANCY AND CONTROL</b>                                                                                                   |                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>56. FEATURES RELATED TO CONTAINMENT AND SURVEILLANCE MEASURES (general description)</p>                                                        | <p><b>Example: e.g. describe characteristics of physical containment (walls, doors) and means for material movements</b></p>                                                                                                                                     |
| <p>57. FOR EACH MEASUREMENT POINT OF ACCOUNTABILITY AREAS, IDENTIFIED IN PARTICULAR UNDER QS. 13, 33, 34, GIVE THE FOLLOWING (IF APPLICABLE)*</p> | <p>IF NECESSARY, ATTACH DRAWING(S)</p> <p><b>Example: Attach a table indicating the information in 57 (i) through (xv) for each KMP location and transaction (e.g. fresh fuel receiving, core, storage) and inventory change type (e.g. inventory/flow).</b></p> |
| <p>i) Description of location, type, identification</p>                                                                                           | <p><b>Example: E.g. flow</b></p>                                                                                                                                                                                                                                 |
| <p>ii) Anticipated types of inventory change and possibility to use this measurement point for physical inventory taking</p>                      | <p><b>Example: fresh fuel elements, irradiated fuel elements</b></p>                                                                                                                                                                                             |
| <p>iii) Physical and chemical form of nuclear material (with cladding materials description)</p>                                                  | <p><b>Example: Fresh fuel container</b></p>                                                                                                                                                                                                                      |
| <p>iv) Nuclear material containers, packaging</p>                                                                                                 | <p><b>Example: often N/A</b></p>                                                                                                                                                                                                                                 |
| <p>v) Sampling procedures and equipment used</p>                                                                                                  | <p><b>Example: fresh fuel shipper (.1%); estimation based on burnup calculations (+/- 10%); item count</b></p>                                                                                                                                                   |
| <p>vi) Measurement method(s) and equipment used (item counting, neutron flux, power level, nuclear burn-up and production, etc.)</p>              | <p><b>Example: example indicated in (vi)</b></p>                                                                                                                                                                                                                 |
| <p>vii) Source and level of accuracy</p>                                                                                                          | <p><b>Example: often N/A</b></p>                                                                                                                                                                                                                                 |
| <p>viii) Technique and frequency of calibration of equipment used</p>                                                                             | <p><b>Example: often N/A</b></p>                                                                                                                                                                                                                                 |
| <p>* For each measurement point fill in separate sheet.</p>                                                                                       |                                                                                                                                                                                                                                                                  |

| <b>NUCLEAR MATERIAL ACCOUNTANCY AND CONTROL</b>                                                                                                                                                                                                                            |                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <p>FOR EACH MEASUREMENT POINT OF ACCOUNTABILITY AREAS, IDENTIFIED IN PARTICULAR UNDER QS. 13, 33, 34, GIVE THE FOLLOWING (IF APPLICABLE)* (continued)</p> <p>ix) Programme for the counting appraisal of the accuracy of methods and techniques used</p>                   | <p>IF NECESSARY, ATTACH DRAWING(S)</p> <p><b>Example: e.g. vendor comparison; ITVs</b></p>                                                    |
| <p>x) Methods of converting source data to batch data (standard calculative procedures, constants used, empirical relationships, etc.)</p>                                                                                                                                 | <p><b>Example: often N/A</b></p>                                                                                                              |
| <p>xi) Anticipated batch flow per year</p>                                                                                                                                                                                                                                 | <p><b>Example: specific to each reactor, based on estimates</b></p>                                                                           |
| <p>xii) Anticipated number of items per flow and inventory batches</p>                                                                                                                                                                                                     | <p><b>Example: Items per batch typically 1, for fuel elements</b></p>                                                                         |
| <p>xiii) Type, composition and quantity of nuclear material per batch (with indication of batch data, total weight of each element of nuclear material and, in the case of plutonium and uranium, the isotopic composition when appropriate; form of nuclear material)</p> | <p><b>Example: e.g. fuel element</b></p>                                                                                                      |
| <p>xiv) Access to nuclear material and its location</p>                                                                                                                                                                                                                    | <p><b>Example: e.g. visual, hands-on</b></p>                                                                                                  |
| <p>xv) Features related to containment-surveillance measures</p>                                                                                                                                                                                                           | <p><b>Example: e.g. possibility for placement of seal on core</b></p>                                                                         |
| <p>58. OPTIONAL INFORMATION (that the operator considers relevant to safeguarding the facility)</p>                                                                                                                                                                        | <p><b>Example: information about hot cells and glove boxes used in the site (hot cells that can be used for radio-isotope production)</b></p> |
| <p>* For each measurement point fill in separate sheet.</p>                                                                                                                                                                                                                |                                                                                                                                               |

\_\_\_\_\_  
Signature of Responsible Officer

\_\_\_\_\_  
Date

## Annex II.

### GOOD REPORTING PRACTICES TO ASSIST IAEA TRANSIT MATCHING

Transit matching is the process for relating or “matching” nuclear material shipments and receipts (domestic and foreign) reported to the IAEA. The IAEA currently receives ~900,000 line items of reports annually, of which internal software can automatically match (“machine match”) about 75% of the domestic transfers and 25% of the foreign transfers. The remaining transfers are manually matched by IAEA staff. It is desirable to reduce manual matching as much as possible.

States can assist in this regard by implementing good practices for reporting relevant transactions, such as those described in this Annex, and by making their **facility operators aware** of relevant good practices as well.

#### **Internal SRA Policies and Procedures**

SRA submittal of timely ICRs is very important for transit matching. The reporting of receipts using shipper-declared values and batch names is also helpful. SRA efforts to resolve unmatched transfers listed in the IAEA’s ‘Quarterly Import Communications’ and ‘Semi-Annual Statements’ are also very important. The longer a transfer remains unmatched, the harder it is to resolve. Timely resolution is aided by clear and prompt communications.

SRA outreach to operators is also helpful, including on any relevant national software or reporting protocols. Some States provide a certificate of completion to participants of such training. Improving the awareness and capabilities of the people responsible for reporting such transactions will improve the quality of the reports submitted by the SRA.

It is a good practice for an SRA to establish a single point of contact (with backups) to address transit matching issues. A dedicated email address could be set up for this purpose, such as [IAEAtransitmatching@State.st](mailto:IAEAtransitmatching@State.st), with access to the account granted to the responsible safeguards officer(s). This address should be shared with the IAEA and reflected in the States’ contact information in the IAEA’s ‘*Transit Matching National Authority List for States/Euratom Reporting to the IAEA*’.

Good communications between the SRA and its operators is helpful for avoiding issues with transit matching, and resolving those that do arise. Face-to-face meetings can be very helpful in facilitating the resolution of open issues. If possible, an SRA may consider meeting with their operators periodically to discuss topics such as reporting. This enables an SRA to stress the importance of timely and high quality reporting by facilities.

Similarly, it is helpful for an SRA to meet periodically with the IAEA. As appropriate, the SRA may also contact the IAEA’s Division of Safeguards Information Management (SGIM), e.g. by video- or teleconference, to discuss topics related to reports and declarations.

Finally, discussions between SRAs of States that frequently ship and receive nuclear material to one another can be very helpful in establishing good reporting practices and communication channels for resolving issues. The SRAs can discuss similar challenges and can share lessons learned with each other as well. Such partners could also specify provisions for advance notifications and keep one another informed on related reporting actions to the IAEA, potentially facilitating coherent reporting and aiding in reconciling issues.

It is important to remember that receipts should be reported using the shipper-declared weights. Shipper-receiver differences are then used to report differences between shipper values and the measured value of the recipient State. Reporting the receipt using the shipper's batch name in the corresponding receipt report is also a significant help for transit matching.

### **Quality Control**

Unmatched transfers can be reduced when an SRA performs systematic quality checks and validations of domestic transfers, to ensure such transfers in the State match prior to submitting the reports to the IAEA. Software systems can help to generate error reports, helping to identify reporting issues, including unmatched domestic transfers, before reports are submitted, and can help with submitting report formats which can facilitate machine-matching by the IAEA. More information on State safeguards information management systems can be found in Annex III.

### Annex III.

## CASE STUDIES OF SRA EXPERIENCES IN DEVELOPING SAFEGUARDS INFORMATION MANAGEMENT SYSTEMS

**Case Study AIII-1.** A State with a relatively small nuclear fuel cycle programme went through the process in 2012-2013 of commissioning a major upgrade to the database used by the SRA for administering licence holder details, accounting for nuclear material in the State and preparing reports to the IAEA. This system is referred to herein as the State Safeguards Information Management System (SIMS) for this SRA. In planning the update of the SIMS, the range of functions was mapped and prioritized so that the project could be managed within the assigned budget. A representative range of functions identified is listed in Table AIII-1 with indications of which functions were incorporated into the SIMS design. An explanation of the basis for decisions on what to include in the database follows.

TABLE AIII-1. FUNCTIONS OF THE STATE'S SIMS

| Function                                                                                                | Included | Function                                                                       | Included |
|---------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------|----------|
| Licence holder inventory of 34(c) nuclear material                                                      | Y        | Licence holder of pre-34(c) material                                           | Y        |
| ICR, MBR, PIL preparation                                                                               | Y        | Database of past ICRs, PILs, MBRs                                              | Y        |
| Licence holder particulars (e.g. name, address, licence number, MBA, KMP)                               | Y        | Preparation of pro forma reports and correspondence to permit holders          | Y        |
| Preparation of 34(a) export reports and database record of past reports                                 | Y        | Preparation of 34(b) import reports and database of past reports               | N        |
| Preparation of para 92 advance notice reports of exports greater than 1 effkg                           | N        | Preparation of para 95 advance notice reports of imports greater than 1 eff-kg | N        |
| National inspector details                                                                              | Y        | IAEA inspector details                                                         | Y        |
| Log of basic particulars from inspections (e.g. dates, location or MBA, inspectors, type of inspection) | Y        | Full details of inspection activities and inspection findings                  | N        |
| IAEA seal application and removal details                                                               | N        | DIQ preparation and database record of past DIQs                               | N        |
| Log of all IAEA correspondence and decision                                                             | N        | AP declarations                                                                | N        |

As the list above shows, not all functions were included in the database. The budget was not sufficient to cover all aspects of safeguards so priorities were set. The highest priorities were management of the licence system, accounting for nuclear material and preparing IAEA reports. The AP reporting functions were not incorporated in the database because the IAEA Protocol Reporter served this purpose. Most of the other functions that were not included in

the database involved reports or activities that were not frequent and therefore could be managed through the standard record keeping system in place in the SRA.

At the beginning of the project, some observations were made regarding the basic structures of the database, to characterize the activities in support of fundamental decisions. For managing the details of licence holders, standard database structures were deemed sufficient. However, there were some complexities with nuclear material inventory management. It was determined that there were two database structural options for managing inventory: (1) a database of ICRs, PILs and MBRs from which licence holder inventory could be derived; or (2) a database of licence holder inventory from which ICRs, PILs and MBRs could be derived.

The first option had the advantage that licence holder inventory reports and ICRs could be uploaded directly into IAEA reporting formats. But in reviewing all of the functions the SIMS needed to support for the SRA, it was decided to use the latter of the two options. The fundamental obligation was for the SRA to account for and control nuclear material in the State, with IAEA reports deriving from this accounting. A database of licence holder inventory was considered to provide for greater overall oversight in the State. Structuring the database around inventory would also be easier for each licence holder to report through a web interface. This database structure could facilitate:

- Updating inventory details at any time, rather than at PIL reporting time;
- Maintaining an inventory of nuclear material not included in ICRs or PILs (e.g. material exempted from safeguards, and material with attributes that don't meet the INFCIRC/153 para 34(c) requirements for full IAEA safeguards), and;
- Managing inventory location information at a greater specificity than required in PILs (which list locations at the level of MBAs and inventory KMPs).

There were several lessons learned through the process of developing this database. The most important lesson was the need for **considerable and frequent consultations** between specialists in the SRA and the database development team. The Code 10 reporting requirements are not intuitive to developers. Another important lesson was that engagement with the primary stakeholders (i.e. the users of the database and the licence holders that submit reports for the database) was necessary to ensure the database was 'user friendly'. For example, interface aspects of the various database views related to formatting, data field locations and data entry functions were critically important to the overall usability of the database and therefore needed to be tested by the primary users of the database prior to full deployment. And lastly, when deciding on which of many available database management systems to use, consideration should be given not just to the attributes of the system that may support the required functions, but also the on-going maintenance requirements. In the case of the project described above, the system chosen was supported by the IT division so as to ensure that maintenance and adjustments were provided for.

**Case Study III-2.** Figure AIII-2 shows a diagram representing the flow of information between a regional authority (EURATOM) and the IAEA.

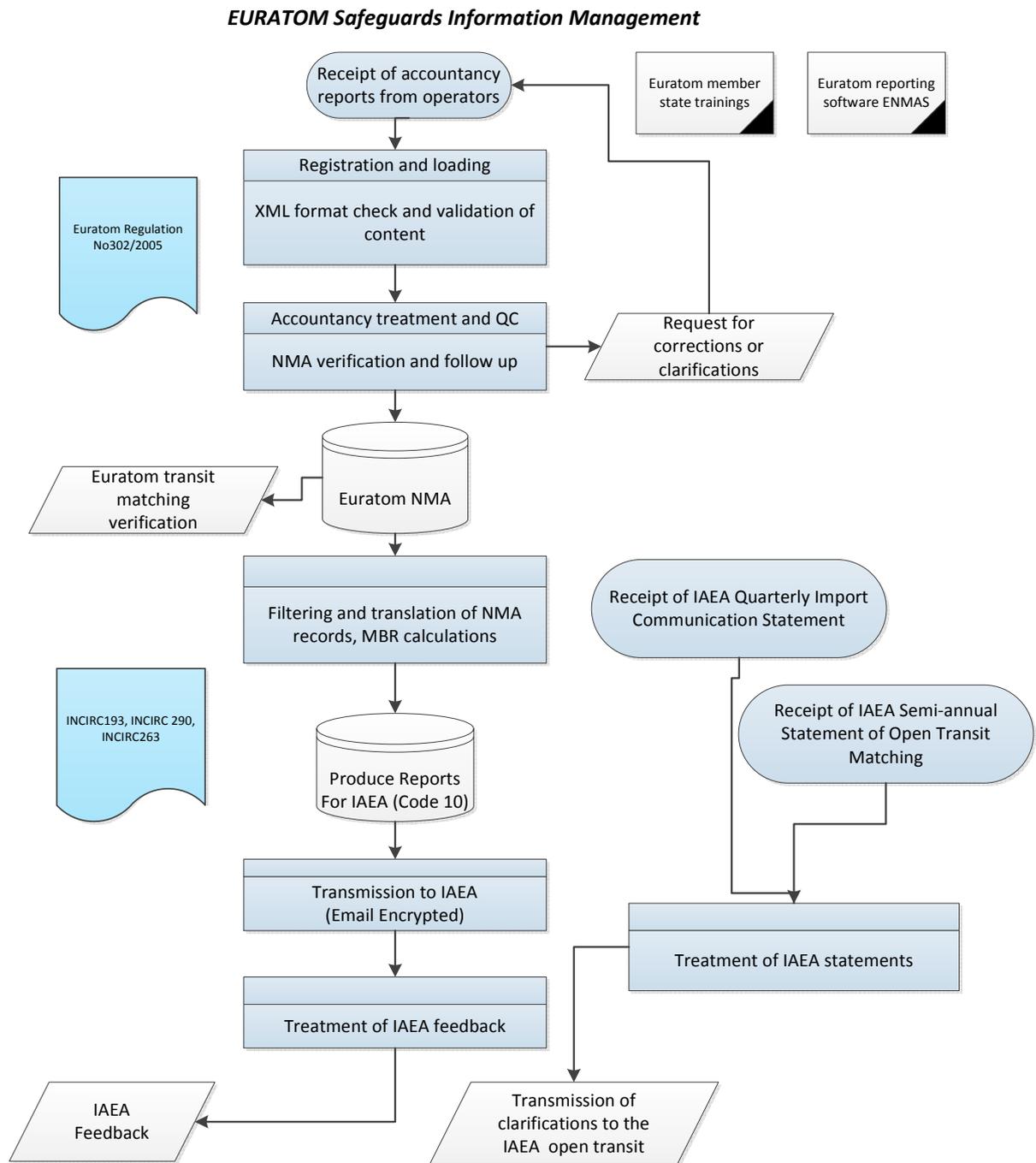


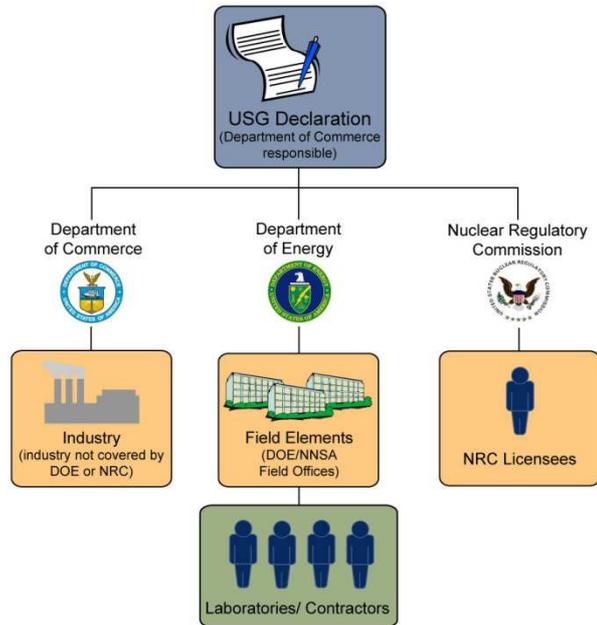
FIG. AIII-1. Information flow between EURATOM and IAEA.

**Case Study AIII-3:** This case study describes the approach taken by the United States in developing software tools and the associated processes and procedures to support the preparation of its AP declarations. Collecting, managing, and submitting AP declarations involves the consolidation of data from the US Department of Energy (DOE) National

Nuclear Security Administration (NNSA), the US Nuclear Regulatory Commission (NRC) and the US Department of Commerce (DOC), with DOC acting as the central coordinating organization. The role of each organization is illustrated in Figure A2-3.1.

To meet its reporting obligations, DOE/NNSA undertook development of the AP Reporting System (APRS) with the intent of automating the DOE/NNSA process as much as possible.

Development of the APRS software components involved numerous stakeholders and presented many challenges. The U.S. AP and the obligations that accompany it were new, so there was no established declaration process to model and the system and business requirements were largely undefined. As a result, early APRS development proceeded in an iterative manner along with development of DOE/NNSA policies and business rules. The IAEA's *Guidelines and Format for Preparation and Submission of Declarations Pursuant to Articles 2 and 3 of the Model Protocol Additional to Safeguards Agreements* (IAEA Services Series 11) and the DOC's information tool under development at the same time informed the data structure and transmission requirements.



The APRS includes two desktop applications (the Declaration Decision Assistant (DDA) and the Declaration Writing Assistant (DWA)) and a web application (Declaration Review Assistant (DRA)). These are the primary tools with which the users identify declarable activities and create, review, and submit declarations.

DDA is a Windows-based desktop application designed to help declarants identify local activities and locations that may be declarable under each article of the AP. It uses an automated interview process in which the user identifies some activities and answers a series of “yes/no” questions about each one. Based on the answers, the DDA suggests the activities that are potentially declarable under each article of the AP. It is similar in function to the AP Declaration Helper, an open access software tool available on NNSA’s website.

DWA is a Windows-based desktop application used by declarants to develop their local declaration data, which is then submitted to the DRA for DOE/NNSA HQ review. The DWA imports information from the DDA and provides entry forms to assist in gathering detailed data required for each one. It also provides file management tools to assist local AP coordinators in organizing DWA files, distributing them for local review, and submitting them to DOE/NNSA HQ after all necessary local approvals have been granted. The DWA is similar to the IAEA’s Protocol Reporter.

DRA is a web application used by DOE/NNSA HQ to manage the declaration process, conduct reviews, provide feedback, and transmit approved declaration data to and from DOC.

The broad range of stakeholder interests and lack of precedent required a multi-tiered approach to creating the APRS, taking into account not only the software development component but also organizational policy, roles/responsibilities, inter- and intra-organizational interfaces, administrative oversight, and training/outreach. APRS was therefore designed, developed, and deployed using an iterative approach with periodic validation by involved parties. The final product, though complex, was a well-tested tool with which users were familiar, resulting in a smooth preparation of NNSA's initial declarations.

Some of the more important aspects of information management and how each was addressed in building the APRS are described below.

**Scope:** Initially, the APRS was envisioned as a database to collect and manage AP declaration data. As the AP and DOE/NNSA's reporting obligations were better understood, the scope expanded to include workflow and process management. As is often the case when developing systems such as this, new business rules were defined and eventually became organizational policy, with the definition, approval, and implementation of formal processes occurring in parallel.

**Legislative Considerations:** The status of AP ratification was monitored closely as it moved through the government approval process. Adjustments to the project were made as necessary to take the timing into consideration.

**Data Flow, Timelines, and Schedules:** As the workflow was defined, process steps became clear and timelines were derived. Additional steps had to be added to allow for time for DOC to receive DOE/NNSA submissions, consolidate the data with NRC and other DOC data, and move the final submission through the remaining review/approval chain. Working backwards from the 180 day period between Entry into Force (EIF) and the Initial Submission due date determined the final schedule. Timelines and schedules were a part of every briefing and training event provided to stakeholders.

**Quality Assurance and Quality Control:** Initially, QA and QC were done on an informal basis as APRS software releases were deployed. It soon became apparent, however, that more attention was needed and a structured process was put in place. Results were immediate, lowering post-release bug fixes to near-zero.

**Iterative Process:** To test the system, a mock declaration process was conducted, involving all stakeholders. Three data calls were conducted, with each resulting in improvements and corrections to the APRS. This allowed for issues to be addressed prior to the actual declaration being prepared. A second benefit of the preparatory data calls was that they increased AP awareness for declarants, improved the declaration data with each iteration, and allowed the declaration preparation to become a routine activity of the declarants.

**Exchanges of Information:** Data transmission processes between the DWA and the DRA are fully automated, allowing two-way exchange of declaration data. In coordination with DOC, a formal interface document was developed to describe how the NNSA system and the DOC system would exchange data.

**Technical/Administrative Reviews:** Technical and administrative reviews were performed by each declarant prior to submitting data to the relevant NNSA Field Office. Each Field Office conducted similar reviews before forwarding the data to NNSA where a third review took place prior to transmittal to DOC. Any reviewer had the option to reject an entry or send it back to the source for revision. Reviews include checks for accuracy, redundancy and omission.

**Data Ownership:** Although NNSA was ultimately responsible for its AP data, each declarant was required to state in writing that the submitted data is correct and complete to the best of the provider's knowledge. Each NNSA Field Office was required to provide a written statement to NNSA HQ that the data being submitted was complete and correct.

**Training/Documentation:** Onsite training on both the AP and the APRS was provided for and funded by NNSA prior to entry into force. Additional onsite training was conducted when necessary. Web-based training videos describing the US AP process were made available to individuals with user accounts, and three APRS guidance documents were published: *The AP Handbook*, *the APRS Technical Manual*, and *the APRS How To Guide*. The DRA also contains an extensive library of AP-relevant material. Each year, NNSA invites all stakeholders to participate in a video teleconference prior to the start of the data collection process for the annual AP update. A typical agenda includes the upcoming timeline, preparatory activities (such as updating points of contact and obtaining software user accounts), reviews software changes, and holds a question and answer session.

**Auditing:** The DRA incorporates a robust transaction logging mechanism that tracks data transactions at the entry level and user information at the account level. One result is that, upon request, the entire multi-year history of an entry can be reported, including such items as upload/download dates, and reviewer assignments/recommendations. Another is the ability to track user logins and reasons for failed login attempts (such as incorrect password or a deactivated account.)

In conclusion, the effective implementation of a system such as the APRS is achieved by viewing the system as a whole – using system engineering principles to evaluate when and how the data is collected and managed from origination through final disposition and archival.

#### **Case Study AIII-4: Developing a new safeguards information management system**

Recognizing that a SIMS is broader than a record of accounting reports and should include information on procedures and policies, AP declarations, national inspections and nuclear security, A State took an initial step in developing software to prepare nuclear material accounting reports for the IAEA. The aim of this software was for nuclear facilities to report

their material accounting information online to enable the SRA to consolidate or merge the facility reports into the State's accounting reports, in a format suitable for quality checking using QCVS provided by the IAEA.

In order to develop the system, data sources, information receivers, data flows, stakeholders, and relational organization of all key elements of the SSAC were analysed. A comprehensive assessment was conducted, including all elements that can affect the quality, completeness, timeliness, and integrity of the reports. Aspects that were considered include:

- Technical Information Flow
- Administrative Information Flow
- Legislative Considerations
- Quality Control and Quality Assurance
- Issue Resolution
- Information Systems
- Communication and Correspondence

The accounting reports are based on the fixed format Code 10, so it was necessary for the developers to understand specifications on the format, description, content and business rules for those reports, which are specific to each type of report, including ICR, PIL, MBR and Concise Note.

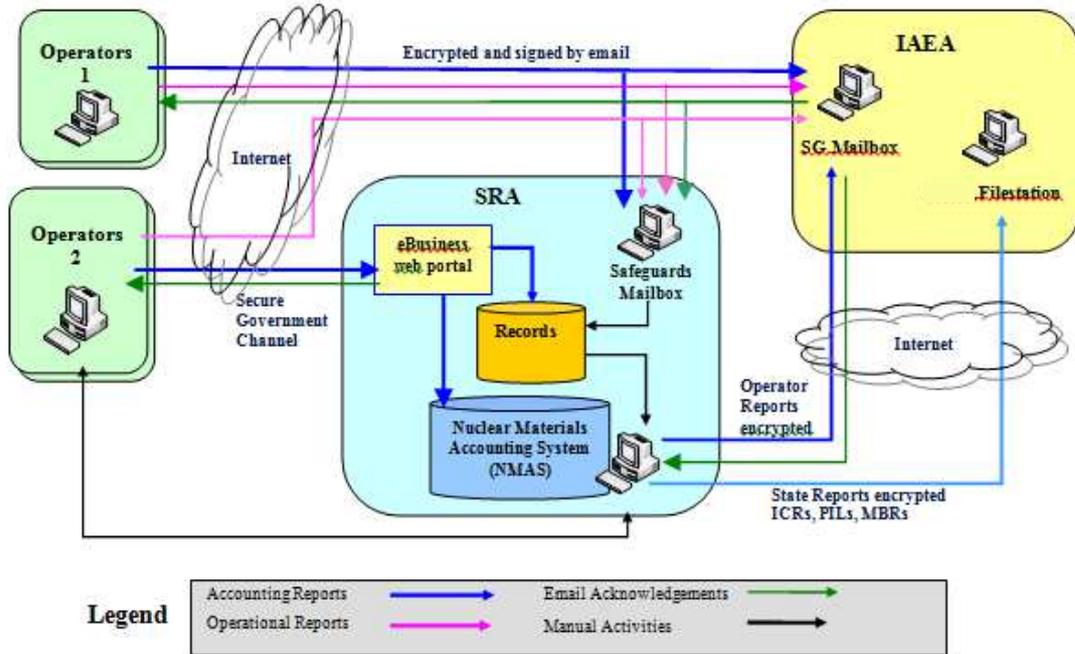
In addition to preparing nuclear material accounting reports, design specifications for nuclear material accounting and reporting algorithms were also necessary. For example, the procedures for application of the correction principle, calculating shipper/receiver differences, determination of material unaccounted for and specific considerations for inventory change codes were considered.

## Annex IV. DIAGRAMS DEPICTING SECURE COMMUNICATION BETWEEN A STATE AND THE IAEA

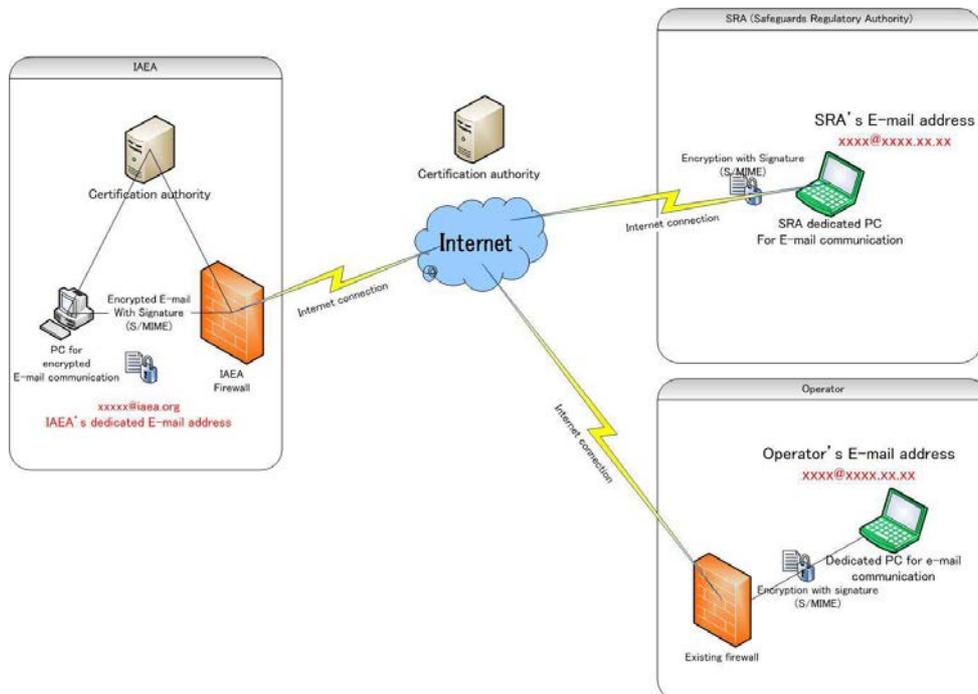
Diagram AIV-1 illustrates an SRA's electronic submission system.

Diagram AIV-2 illustrates a secure communication channel by encrypted email.

Diagram AIV-3 illustrates the secure communication channel through virtual private network.



*FIG. AIV-1. Electronic submission of information to the IAEA.*



*FIG. AIV-2. Secure communication channel for data submission.*

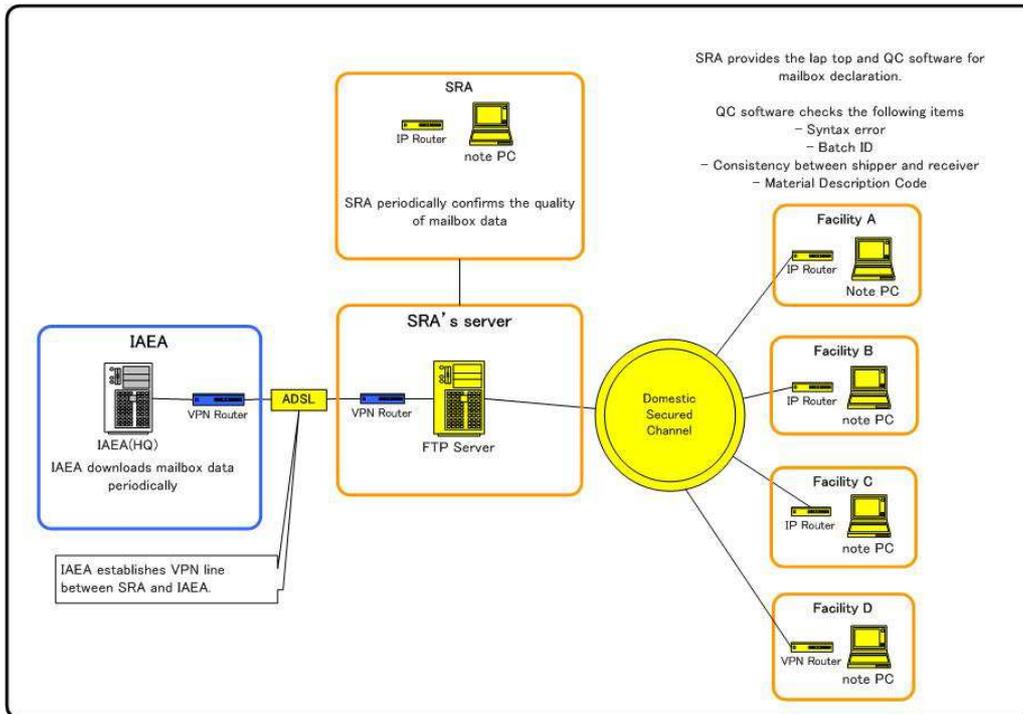


FIG. AIV-3. Example of electronic mailbox for data submission by the facility operator.

## Annex V.

### EXAMPLE OF INFORMATION FLOW FROM A LOF TO THE STATE AUTHORITY FOR VARIOUS EVENTS

| <i>Action at LOF</i>                                                                                                                            | <i>Information to be provided to SRA by LOF</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <i>Reports provided by State to IAEA</i>                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A sample is ordered by a researcher and received from abroad (imported)                                                                         | <ul style="list-style-type: none"> <li>• Receipt of nuclear material from abroad (reference import license)</li> <li>• date of receipt</li> <li>• country of origin</li> <li>• composition of material (liquid/solid/powder/container size/irradiated/un-irradiated)</li> <li>• weight (+fissile weight if appropriate)</li> <li>• type of element</li> <li>• Concise Note if needed</li> </ul>                                                                                                                                                                                                                                                                                  | <p>ICR not later than 30 days after the end of the month in which the change took place</p> <p>‘RF’ to be reported</p>                                                                                                                                                                                |
| nuclear material is dissolved (changing form)                                                                                                   | <ul style="list-style-type: none"> <li>• the portion of nuclear material that is used for the experiment/analysis has to be reported               <ul style="list-style-type: none"> <li>○ if a portion of the material is dissolved and kept on the inventory, it is reported rebatching minus (RM) and rebatching plus (RP)</li> <li>○ if a portion of the material is dissolved and discarded (irrecoverable), measured discard (LD) is reported for that portion</li> <li>○ if all of the batch is dissolved and discarded, then LD is reported for the whole batch</li> </ul> </li> <li>• date when the action took place</li> <li>• batch-name and item number</li> </ul> | <p>ICR not later than 30 days after the end of the month in which the change took place</p> <p>RM, RP, LD to be reported as applicable</p> <p><i>Note: If the <u>whole batch</u> is dissolved no new batch name has to be reported. Only the change of material description code is reported.</i></p> |
| a solution (e.g. vial of uranyl nitrate) is transferred by a university to another KMP in same LOF MBA (a laboratory that can use the material) | <ul style="list-style-type: none"> <li>• date of transfer</li> <li>• name of receiving location</li> <li>• batch-name and item number</li> <li>• composition</li> <li>• weight (+fissile weight if appropriate)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>no need to issue an ICR because it is a movement between two KMPs in the same (national) LOF MBA</p>                                                                                                                                                                                               |
| a solution (e.g. small vial of diluted uranium for analysis) becomes irrecoverable and is transferred to a national low level                   | <ul style="list-style-type: none"> <li>• date of measured discard</li> <li>• batch-name and batch data, item number</li> <li>• composition</li> <li>• weight (+fissile weight if appropriate)</li> <li>• information about the plan to transfer the terminated material to the repository</li> </ul>                                                                                                                                                                                                                                                                                                                                                                             | <p>LD is reported for the material in the next ICR for the KMP/MBA</p>                                                                                                                                                                                                                                |

|                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| waste repository                                                                                      |                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| a jar of material is found in one of the LOFs                                                         | <ul style="list-style-type: none"> <li>• date</li> <li>• name of location</li> <li>• type of element</li> <li>• weight of nuclear material (+ fissile weight, if appropriate)</li> <li>• composition of material</li> <li>• number of batches</li> <li>• number of items</li> <li>• Concise Note with explanation</li> </ul>                                            | <p>ICR with Concise Note of explanation, submitted not later than 30 days after the end of the month in which the change took place</p> <p><i>Note: Check first if the material was received from abroad – supplier’s papers, import authority, etc.</i></p> <p>‘GA’ to be reported</p>                                                                                                                                                                                                                                                        |
| a sample is taken by the IAEA inspectors                                                              | <ul style="list-style-type: none"> <li>• the portion of nuclear material that is used for the IAEA sample has to be reported</li> <li>• rebatching of the sample before shipment (RM for the original batch; RP for the remaining batch and the sample)</li> <li>• date when the action took place</li> <li>• information of sending the sample to the IAEA</li> </ul>  | <p>ICR not later than 30 days after the end of the month in which the change took place</p> <p>RM, RP and SF to be reported with Concise Note as needed</p>                                                                                                                                                                                                                                                                                                                                                                                    |
| Physical Inventory Taking (PIT) for each LOF KMP in an MBA (there may be several LOF KMPs in one MBA) | <ul style="list-style-type: none"> <li>• List of Inventory Items (LII) should be produced for each LOF KMP, which includes the following: <ul style="list-style-type: none"> <li>○ number of items</li> <li>○ number of batches</li> <li>○ weights (+fissile weights, if appropriate)</li> <li>○ composition of material</li> <li>○ element type</li> </ul> </li> </ul> | <p>The SRA produces a PIL and MBR that reflect all of the IILs submitted by the LOF KMPs in the MBA and updates the General Ledger to reflect the new physical ending inventory</p> <p>The PIL and MBR are to be submitted to the IAEA not later than 30 days after the day the PIT took place</p> <p>All LOF KMP locations in an MBA must be reported with the same PIT date</p> <p><i>Note: Check if batch names, numbers of batches and number of items, weights and KMP codes correspond to the previous reports sent to the IAEA.</i></p> |
| Physical Inventory Verification (PIV)                                                                 | <ul style="list-style-type: none"> <li>• Same as for PIT</li> </ul>                                                                                                                                                                                                                                                                                                     | <p>Same as for PIT but SRA gives General Ledger to IAEA.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## **Annex VI.**

### **ISSUES RELATED TO REPORTING DEPLETED URANIUM**

Depleted uranium's high density and shielding properties are beneficial for use in many industrial and medical applications, including shielding of radiation in shipping containers designed to transport high energy radioactive sources and substances, radiography cameras for weld joint inspections, and medical teletherapy heads used for treatment of cancer.

DU is nuclear material which must be declared by the original owner (usually the instrument supplier) in a State. Once the shield is manufactured into a finished device (e.g. a transport container, radiography camera or medical teletherapy head shield), the DU component should be reported as a one item batch and assigned with a unique batch name that stays with the DU during its lifetime. It is useful to reflect the manufacturer/owner model number and serial number of the equipment's shielded body in the batch name for the DU shield. The batch name stays with the DU throughout its use, and the weight and physical/chemical form are not expected to change.

Some examples of non-nuclear uses of DU are provided below.

DU-Shielded Transport Containers: There are often locations in a State that own transport containers which are fabricated with DU shielding permanently embedded within the package body, used to transport radioactive substances, both domestically and internationally. The manufacturer, importer or owner will usually exempt the DU in such containers based on non-nuclear use (i.e. as a shield). These containers may be shipped abroad (internationally) without de-exemption as long as the ownership of the container does not change, and such imports and exports need not be reported to the IAEA. The containers may also be transferred domestically, without reporting them to the IAEA, and without requesting de-exemption. However, it is necessary that the SRA maintain control over its inventory of exempted material.

Teletherapy Shields: Some States may have hospital and clinic licensees who possess medical teletherapy units fabricated with a DU shield to contain the radiation from the sources when not in use. These units may have been supplied by a domestic manufacturer or imported from a foreign supplier. The original manufacturer usually retains detailed records of each teletherapy headshield containing the DU, including serial number, DU mass, date of manufacture, customer name and address, shipping records and exemption records (for the units that remained in the State). Some manufacturers may accept return of the teletherapy unit at the end of its useful life and recycle the DU for future use or dispose of it in a radioactive waste disposal facility.

DU that is returned from customers to suppliers in a State for disposal **must first be de-exempted** before being introduced into a safeguarded recycle/disposal facility.

Radiography devices: Radiography cameras used in industry contain high activity gamma radioisotope sources for radiography of weld joints and metal for defects, etc. Similar to shipping containers discussed above, radiography units are often DU shielded for use in the field and as transport packages. These devices are commonly used by small companies and the cameras are often moved around in everyday use. For this reason, it is efficient to request exemption for the DU based on its non-nuclear use within an MBA in the State prior to delivery to the customer. Otherwise, each location to which the DU is transferred will need to be established as a LOF and all relevant obligations under a CSA and AP will apply.

In the case that an exempted DU container needs to be exported temporarily back to a foreign manufacturer for repair or reload, and returned to the owner, they can be treated as transport packages and the DU would not have to be de-exempted. However, if they are returned (exported) for final disposal, the DU must first be de-exempted, safeguards re-applied and then reported as an export. If the DU is shipped to a national waste site for disposal, then if the waste site contains nuclear material under safeguards, the DU should first be de-exempted.

*Example 1: A hospital needs to dispose of an old DU shielded teletherapy head. The hospital calls a waste or metal collection service company to retrieve the device. The hospital can identify the unit from original history and shipping records (e.g. original manufacturer, supplier country, quantity of DU, etc.) and the SRA can produce the relevant exemption records.*

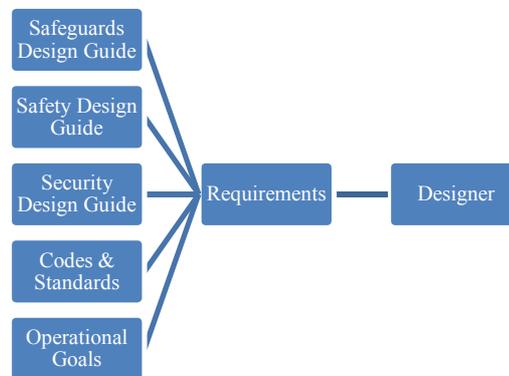
*Example 2: During an outreach event conducted by an SRA at a nuclear research centre, some DU was being used in instruments for non-destructive testing and radioactive source containers. Accounting data for this DU was not being kept by the LOF operator. Therefore, the LOF reported it to the SRA using an inventory change report with the 'accidental gain' (code GA).*

Counterweights (e.g. crane, aircraft): Counterweights are rarely encountered, as DU has gradually been replaced by tungsten and other dense materials in the past few decades. The DU in these historic applications was usually exempted based on non-nuclear use. Occasionally, a DU counterweight is found in a scrap yard or retrieved from a scrapped aircraft. In such cases, the DU can be added to the State's inventory through an ICR with the code for accidental gain (GA) and requested for exemption by the IAEA.

## Annex VII. CASE STUDIES ON SAFEGUARDS BY DESIGN

An effective and efficient design process is one which clearly defines the functional and performance requirements at the beginning of the project and enables the project to achieve a reasonable balance between competing requirements in a time and cost effective manner. An effective approach to safeguards by design (SBD) is to consider IAEA safeguards measures as a standard part of the design and licensing of nuclear facilities.

Specific considerations for each nuclear fuel cycle facility type are summarized in the IAEA's guidance series on SBD (found on [www.iaea.org/safeguards](http://www.iaea.org/safeguards)). Figure AVI-1 illustrates the inclusion of all relevant requirements in the early stages of the design.



*FIG. AVII-1. Inclusion of all relevant requirements in the early stages of the design.*

A research reactor project considered the implementation of SBD from early phases of design and construction of the reactor. The requirements considered in the design process included:

- Appropriate physical and visual access for inspectors to verify fresh fuel by item counting and measurement using NDA equipment;
- Provision for Cerenkov viewing in the core and spent fuel racks; and
- Provision for design information verification.

A project for long-term disposition of spent nuclear fuel in bedrock has actively pursued a SBD dialogue with the IAEA and relevant State and regional authorities. Access to the stored fuel for verification will be very limited, which creates unique requirements for safeguards in all parts of the process. All fuel has to be verified prior to placement in the repository and continuity of knowledge will need to be meticulously maintained. Technical and scientific discussions on how to safeguard the final repository have been going on in various forums for more than twenty years.

A very important milestone for SBD discussions is the preparation of early design information. This was based on building plans submitted by the operator to the State authorities when applying for a construction license. The design information was reviewed by

the IAEA and SRAs, and planning of safeguards activities in detail began. Several technical meetings were held with all of the stakeholders. The information exchanged during these meetings enabled the IAEA to plan activities to be as efficient and minimally disruptive to facility operations as possible. It also enabled the operator to plan for the safeguards equipment well in advance of any construction work. The encapsulation process is planned to continue for more than 100 years, so the design has to ensure smooth operation of the plant.

The most important design modifications to the encapsulation plant that have arisen from the SBD process are provisions for NDA measurements and camera surveillance in the hot cells at the encapsulation plant, as these include penetrations to the cell. These would have been very costly and difficult to add once the hot cell had been built. The maintenance and foreseen upgrades of the equipment have been taken into account when optimising the cabling and locations of the equipment. Without early operator involvement and a positive attitude of the operators, this process would not have been possible. Continued interaction is essential during construction and operation, particularly since the repository will change its shape and volume during its operation, and the IAEA equipment for containment and surveillance will likely need to be maintained and even relocated during the exceptionally long lifetime of the repository.

## **Annex VIII.**

### **ADJUSTMENTS TO ACCOUNTING ENTRIES**

#### **VIII.1 Overview of Accounting Entries**

Nuclear material accounting reports contain entries that report inventory changes (ICRs), inventory batches (PILs) and balances (MBRs). The basic structure of accounting reports and entries varies based on the Code 10 format (fixed or labelled), but the contents of both formats meet the needs of IAEA safeguards.

PILs, ICRs and MBRs contain common information (called a header) and nuclear material information (called an accounting entry or line entry). Depending on the Code 10 format, the header information is reported as a separate record (fixed format) or is contained within the line entry data fields (labelled format).

#### **VIII.2 Header Entries**

For each nuclear material accounting report the IAEA records general information pertaining to the relevant report. This information is specifically reported as a report “header” in fixed format Code 10. The primary reason for the use of header entries is because of the 80-column card format limitations of fixed format Code 10. Also, with the information processing technology when Code 10 was first developed, every effort was made to reduce the need for storage space. Labelled format Code 10 does not provide for separately reported header information.

##### **Header entries with fixed format Code 10:**

The header record for fixed format reporting contains information that applies to all line entries in the report, such as the MBA code and report number. The header information is recorded in the IAEA’s information system and also contains the number of accounting line entries in the report, which can be cross-checked with the actual number of entries reported.

##### **Header entries with labelled format Code 10:**

Labelled format Code 10 does not provide for separately reported header information; the IAEA retrieves header information from the lines entries in an accounting report. Even though a separate header record is not defined, the IAEA uses information from labelled format Code 10 accounting entries to generate an internal IAEA header record, which ensures consistency between the two Code 10 formats in the Agency information system.

#### **VIII.3 Accounting (line) entries**

Nuclear material accounting reports must contain at least one accounting line entry. For ICRs and PILs, each entry (or entries, depending on Code 10 format) represents a batch of nuclear material. In MBRs, each entry reports summarized nuclear material accounts, as reflected in the corresponding facility ledgers.

In the normal process of nuclear material accounting and reporting, situations will arise where an accounting entry or header information will need to be corrected. The following describes the processes and procedures to follow when modifying a nuclear material accounting report. Modifications include additions, corrections and deletions.

#### VIII.4 Addition of an accounting entry

A State has the option of reporting nuclear material accounting entries that are to be added to a previously submitted report. An MBA may only add lines to reports of the same type for that MBA; i.e. an MBA may not add lines to the reports of another MBA and only an ICR can add lines to another ICR, only an MBR can add lines to another MBR and only a PIL can add lines to another PIL.

The data elements indicating where an entry is to be added are the 'To Report Number' and the 'To Entry Number':

- The 'To Report Number' is the report number in which the entry is to be added;
- The 'To Entry Number' should be the next available entry number in the 'To Report Number'.

For fixed format Code 10, there is a limit of 99 entries in a report, and if a report already has that many lines (original entries plus all prior additions), it is not possible to add another entry. In this case, either a new report number needs to be used to report the addition without reference to an earlier report or the entry could be added to another report that has less than 99 lines (original entries plus all prior additions). With labelled format Code 10, the limit of line entries in a report is 999999 so there is essentially no problem with having enough entry numbers available for use as an addition to a report.

For adding inventory change entries, the date of the inventory change must be within the reporting period (date from/to) of the report to which the entry is added. The inventory change date is not required to be within the period of the report containing the addition entry. When PIL or MBR entries are added, they belong to the inventory date or material balance period, respectively, of the report to which the entry is added.

Figure AVIII-1 indicates the addition of two entries to a report.

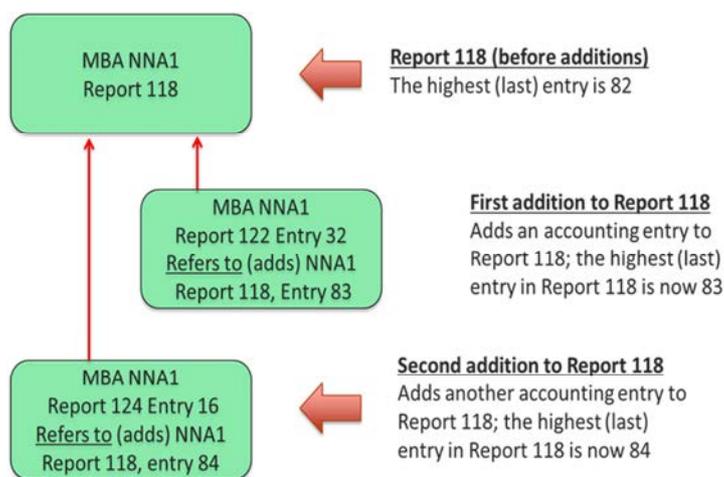


FIG. AVIII-1 Adding two entries to a report.

#### VIII.5 Correction of an accounting report header

It is not possible for a State to correct header information by means of reporting a correction and having the correction applied as it would be for a nuclear material accounting entry.

Corrections to header records can be made only by the Agency, on the basis of information provided by the State. As with all Agency-assisted corrections to State reports, changes can be made only with the written approval of and in cooperation with the reporting State. A common correction to the header is changing the reporting period (date from, date through, or both) of an inventory change report.

### **VIII.6 Correction of an accounting entry**

A State has the option of reporting corrections to previously reported nuclear material accounting entries. An MBA may correct entries only in reports of the same type for that MBA; i.e. an ICR can correct another ICR entry, an MBR can correct another MBR entry and a PIL can correct another PIL entry.

A correction may be needed to resolve the closing of a material balance period or it may cause a previously closed period to be opened. Therefore, there could also be the need to correct other corresponding nuclear material accounting reports. Changing the value of an inventory change entry may result in a previously closed material balance period being opened, thereby requiring changes to the associated PIL and MBR reports. It is also possible that a correction will provide the necessary values that are needed in order to close a material balance period.

Some States have changed from a fixed format Code 10 to a labelled format. In this case, if a labelled format Code 10 entry corrects an entry reported under fixed format Code 10, there are some considerations, depending on the entries reporting the batch.

- A single entry in labelled format may correct an accounting entry that, under fixed format, needed more than one line entry (e.g. a spent fuel batch, with one line entry for the plutonium and one for the uranium or an entry continued because of size limitations on a numeric field). In this case, delete all of the corresponding fixed format entries and report an addition entry to the corrected report.
- Problems may also arise with regard to continuation entries; what may have needed several entries to report a single weight under fixed format can be reported in one labelled format entry.

FIG AVIII-2 shows an entry that has been corrected twice. Taking an example, a SD of 100 kg is reported on 1 October 2016 in ICR number 126, entry 32. One month later it is realized that the entry was incorrect and should have been reported as 105 kg. To correct the weight, the State reports in another ICR (e.g. report 127, entry 1) the same batch data field content that was in report 126 entry 32, but the weight is reported in the new entry as 105 kg. The data fields 'To Report Number' and 'To Entry Number' are filled in for report 127 with the values 126 and 32, respectively. Once processed in the IAEA's information system, entry 1 in report 127 is used for providing information about the shipment instead of entry 32 in report 126.

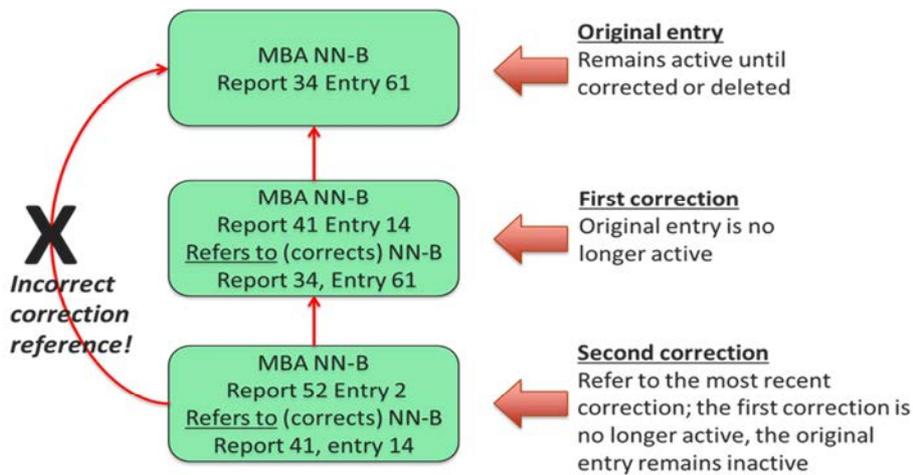


FIG. AVIII-2. Multiple corrections and appropriate references to entries.

### VIII.7 Deletion of an accounting entry

A State has the option to delete any previously reported nuclear material accounting entry. An MBA may delete entries only in reports of the same type for that MBA; i.e. an ICR can delete another ICR entry, an MBR can delete another MBR entry and a PIL can delete another PIL entry. A deletion may be needed to resolve the closing of a material balance period or it may cause a previously closed period to be opened. Therefore, there may also be the need to correct other corresponding nuclear material accounting reports. The procedure for indicating the deletion of a record differs according to the Code 10 format. However, in both cases, the record is not physically deleted in the IAEA information system but kept available for possible use — a similar approach is a good accounting practice for States as well. The reference data elements are the ‘To Report Number’ and ‘To Entry Number’.

- The ‘To Report Number’ is the report number containing the entry to be deleted;
- The ‘To Entry Number’ is the entry in the ‘To Report Number’ to be deleted.

Fixed format deletions are accomplished by reporting an invalid entry that refers to the entry that is to be deleted:

- ‘Continuation’ (position 3) contains an ‘A’;
- The ‘To report number’ and ‘To report entry’ fields contain the report and entry number to be deleted;
- The remainder of the line entry fields are not required.

Labelled format deletions are accomplished by reporting a deletion entry with a reference to the entry to be deleted:

- The first subfield of label 309 contains a ‘D’;
- The ‘To report number’ and ‘To report entry’ subfields of label 309 contain the report and its entry number to be deleted;
- The minimum fields needed for reporting a deletion are labels 001, 002, 003, 006, 010, 015, 207, 307, 309 and, optionally, 310.

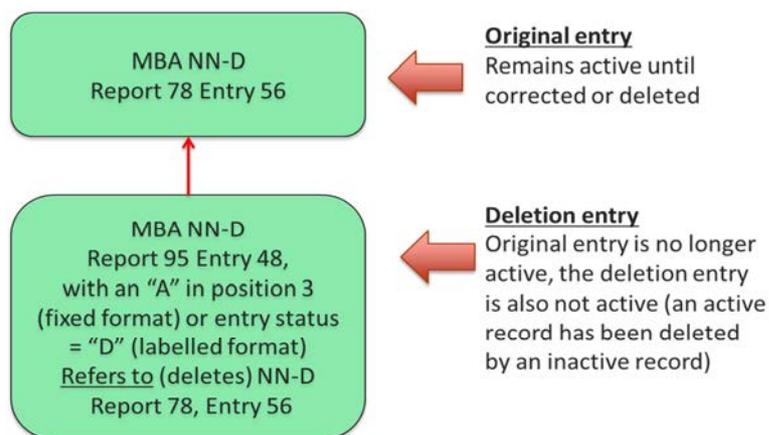


FIG. AVIII-3. Deletion of an entry.

*Example: a shipment foreign (SF) was accidentally reported twice by a State (with a fixed format Code 10) as entries 34 and 35 in ICR number 254. One of the line entries needs to be deleted. Upon noticing the mistake, the State decided to delete entry 35 in ICR 254. From a nuclear material accounting point of view, it does not matter which of the two entries is deleted.*

*In the next ICR sent to the IAEA for that MBA, an entry is reported with the letter 'A' in position three of the record and with a 'To Report' of 254 and a 'To Entry' of 35. The ICR entry that reports the deletion needs to contain only this information; other data fields may be reported if desired, but are not required.*

In the above example, depending on the effected material balance period, corrections to the associated MBR may be necessary, especially if the shipment was reported twice in the MBR entry total for all exports during the period.

*Example: Using a labelled format Code 10, a SF was reported twice by a State as entries 171 and 172 in ICR number 542. One of the line entries needs to be deleted. Upon noticing the mistake, the State decided to delete entry 172 in ICR 542. In the next ICR for that MBA that is sent to the IAEA, an entry is reported with the letter 'D' in the first subfield of label 309. The rest of the label 309 subfields should be completed to indicate a back reference to report 542, entry 172. In addition, the other subfields mentioned above should be reported.*

*Depending on the effected material balance period, corrections to the associated MBR may be necessary, especially if the shipment was double counted in the MBR entry total for all exports during the period.*

## Annex IX.

### STEPS FOR REQUESTING AND REPORTING EXEMPTION

The granting of exemption by the IAEA temporarily exempts the batch of nuclear material from full safeguards reporting requirements. Exemption is **temporary** and the material will eventually be de-exempted and returned to safeguards (e.g. prior to export or co-location with safeguarded material). Section 8.25 addresses exemption in more detail; this Annex offers an approach for an SRA to assist licensees in requesting exemptions, and for tracking exempted material. The SRA has the obligation to keep track of the exempted material in the whole State, e.g. to ensure that the amount of material exempted under paragraph 37 of INFCIRC/153 (Corr.) does not exceed the thresholds specified in that paragraph. It can be very helpful for the SIMS to track all exemptions/de-exemptions under the relevant paragraphs (36 and 37) to assist the State in meeting this obligation.

#### **Example of an Exemption Procedure established by an SRA**

A request for exemption may be initiated by the SRA or by the facility operator. The SRA will need to convey the request to the IAEA in either case. A request for exemption usually results from consultations between the facility or LOF operator and the SRA. The facility may initiate a request for exemption by informing the SRA which batches on its inventory are being requested for exemption. An example of a 'Request for Exemption' form is provided at the end of this Annex.

*Example: SRAs may require MBA operators to submit a "Request for Exemption" which provides specific batch information for the nuclear material being requested for exemption. The batch ID will convey all the necessary information for the SRA to complete the Code 6.2 form and submit to IAEA.*

The SRA then evaluates the request to ensure that the requesting MBA possesses the batches on its inventory that are being requested for exemption.

It is a good practice for the SRA to assign each exemption request a **reference number** used for tracking purposes. The reference number can be conveyed on the cover letter from the SRA to the IAEA, which may be attached to multiple Code 6.2 forms. This reference number may contain, e.g. the year and a sequential number (e.g. 2015/1). Once the exemption is granted, the reference number is included in the **Concise Notes in the ICR** that reports the exemption for each batch.

The SRA then submits a request to the IAEA on a Code 6.2 form (see Subsidiary Arrangements) using the data provided by the operator. The IAEA will assess the application from the State. Once the IAEA completes their review, and notifies the SRA that it has granted the exemption and the associated conditions/obligations, then the SRA informs the operator of the decision, again referencing the tracking identifier. (An example of a letter conveying information to the operator is provided at the end of this Annex). The operator must then submit an ICR to the SRA that includes the exemption (using inventory change

code 'EU' or 'EQ' as described in section 8.25), with the reference number mentioned in the concise notes. This information is conveyed to the IAEA in the next ICR for that MBA.

If EQ, the SRA reports its location annually (as of December 31st) under AP Article 2.a.(vii).

If EU, the SRA evaluates the use and quantity of the material to determine if a declaration is necessary under AP Article 2.a.(vii).

### **Example of a de-exemption procedure established by an SRA**

A request for de-exemption (also sometimes referred to as a request for re-application of safeguards) may be initiated by the SRA or by the facility operator. The SRA will need to convey the request to the IAEA in either case. A request for de-exemption is typically submitted following consultations between the LOF or facility operator and the SRA.

*Example: Similar to the Request for Exemption form, the SRA may request operators to submit a form, "Request for De-Exemption," which describes the nuclear material to be de-exempted and other information necessary to complete the Code 6.3 form. The information may include material and batch data, the batch name of the exempted material that was originally reported (e.g. EU or EQ batch), the tracking reference number, current location, intended disposition and location for transfer, if applicable.*

The SRA evaluates the request to check that the batch was already exempted in a prior ICR (either EU or EQ); that the de-exemption is requested using the same code (DU or DQ); that the requesting MBA is an active MBA; and the quantity in the batch does not exceed the quantity of exempted material in that MBA. (Material can be de-exempted in an MBA that is different from the one where the corresponding exemption occurred.) The SRA submits the Code 6.3 form (see Subsidiary Arrangements), including the reference tracking identifier described above.

Once IAEA notifies the SRA that it has granted the de-exemption, the SRA informs the operator of the decision, again referencing the tracking identifier. The operator then submits an ICR reflecting the de-exemption DU or DQ transaction and immediately removes any previously applied labels that identify it as exempted material. The SRA submits an ICR to report the de-exemption (DU or DQ as appropriate) to the IAEA.

If a large amount of nuclear material is to be de-exempted at one time, it is a good practice to inform the IAEA in advance and explain the circumstances. This is particularly true when information is notified in advance to the IAEA in an annual plan of activities for LOFs, for example.

*Example: In one State, a company that recycled nuclear material purchased the entire inventory of unused shielding containers from a storage repository at one time. This amounted to approximately 20 tonnes of depleted uranium being de-exempted at once. The SRA contacted the IAEA in advance and described this transaction, which was not foreseen at the beginning of the year.*

### **Disposing of exempted material when a company goes out of business**

In case a company which uses exempted nuclear material is going to go out of business, or is going to file for bankruptcy, it is necessary for the company and the SRA to work together on the disposal of the nuclear material.

To be prepared for such situations, it is a good practice for the SRA to include conditions in a license with regard to the disposition of the material in cases of death, bankruptcy or dissolution of a company. The State's nuclear law should also specify that nuclear material is to be handled using a separate process from other materials that may arise from criminal activities (e.g. smuggling, theft, etc.).

Some considerations include the process of liquidating the assets of the company, and how the nuclear material will be dealt with; the responsibilities of the liquidating agent or the executor of a deceased person's estate; and the payment for costs associated with disposal.

*Example Letter from SRA Conveying IAEA Exemption to a Licensee*

Reference # \_\_\_\_\_

<Date>

Contact Name

Position

MBA Organization Name.

Street Address

City, Province Postal Code

**SUBJECT: Exemption approval for Tracking Identifier: \_\_\_\_\_**

Dear Contact:

I am pleased to send you the attached exemption approval(s) received from the IAEA. Please note that the material is not exempted from safeguards until you report the exemption transaction to the <SRA> via an Inventory Change Document (ICD). Therefore, please ensure that the exemption transaction(s) for each material batch is/are implemented by:

- 1) reporting the exemption to the SRA via an ICD for each material exemption (please include the exemption tracking identifier in the reporting form);
- 2) entering the exemption transaction onto the General Ledger to decrease the quantity of safeguarded material on the ledger;
- 3) entering the exemption transaction into the Exempt Material Ledger to increase the quantity of exempt material on the ledger; and,
- 4) physically separating the newly exempted material from the safeguarded inventory, and updating both the safeguarded LII and the exempted LII.

Note that this exempted material may only be used or transferred within <State>, and <cite regulatory requirement> requires that you must use an ICD to notify the <SRA> of any transfer of exempted material to or from your MBA. If the exempted material is to be exported, irradiated, or stored or processed with safeguarded material, you must submit an application to de-exempt the material, and receive approval for the de-exemption, before doing so.

Attached is a sheet entitled "Guidelines for possession and transfer of Nuclear Material which has been exempted from safeguards in <State>" – please store a copy of this sheet with the exempted material or the container it is in, so that the sheet is accessible to anyone who may be working with the material. If you are transferring this material to another party, please include a copy of this sheet for their reference.

SRA Name

*Attachment: Guidelines for possession and transfer of nuclear material which has been exempted from safeguards.*

## Guidelines for Licensees holding Exempted Nuclear Material

Every SRA licensee shall “take all necessary measures to facilitate State’s compliance with any applicable safeguards agreement.” The nuclear material stored with this sheet has temporarily been exempted by the IAEA from some safeguards measures to reduce reporting and access requirements; however there remain several restrictions and controls, as follows:

- A ledger must be maintained for each type of exempted nuclear material on-site, showing any shipments or receipts and showing the total mass of each exempted material type present;
- If this material is to be shipped to another party, that party must be licensed by the SRA to possess the material in question, and Inventory Change Documents must be filed with the SRA by both the shipper (on shipment) and receiver (upon receipt);
- This material must be clearly labelled with a unique identifier, and it may not be processed or stored together with nuclear material which is not exempted from safeguards;
- This material may not be fissioned, used to breed fissile or fissionable substances, enriched, reprocessed, or converted into nuclear fuel, or used in research and development activities related to enrichment, reprocessing, or conversion into nuclear fuel;
- Safeguards can be reapplied on this material only by request, and only if the material is physically located in an MBA; and,
- Depending on the type of exemption, the IAEA may have the right to access this material with 24 hours notice, regardless of its location.

Please store this sheet with the exempted material, to ensure that anyone who accesses this material is aware of these restrictions. Information regarding the specific material you possess has been included below, to facilitate the eventual re-application of safeguards. If the material is to be divided, please keep a copy of this sheet with each portion, and manually update the mass information below as necessary. If the exempted material is to be transferred, please ensure that a copy of this sheet is given to the receiver with the material. If full safeguards are reapplied to the material (i.e. the material is de-exempted), this sheet can be discarded.

|                                                |  |
|------------------------------------------------|--|
| <b>Exemption Identifier:</b>                   |  |
| <b>Date of IAEA approval</b>                   |  |
| <b>Physical/chemical form and mass, units:</b> |  |
| <b>Exempting MBA:</b>                          |  |

## Annex X. EXAMPLE OF AN AP OUTREACH BROCHURE

### FACTS ABOUT THE ADDITIONAL PROTOCOL

1. The Philippines entered the AP into force in February 2010.
2. As of 21 May 2014, 144 countries have signed the AP. Of this number, 123 countries, including the Philippines, have entered the AP into force.
3. The Philippine Nuclear Research Institute (PNRI) is the agency responsible for implementing the AP.

### RESOURCES AND SERVICES PROVIDED BY PNRI

- Knowledge, expertise and resources to meet AP obligations
- Assistance in determining if an activity is reportable to PNRI and the IAEA under the AP
- Informational seminars for industry, research and development organizations and universities
- Guidance in preparing for possible complementary access by IAEA inspectors

*In 1968, the Philippine Congress enacted into law Republic Act No. 5207 which established a program of licensing and regulatory control of atomic energy materials and facilities, including nuclear power plants, nuclear fuel and other radioactive materials.*

*The authority to enforce the law, which is known as the Atomic Energy Regulatory and Liability Act of 1968, was vested in the Philippine Atomic Energy Commission (PAEC), now the PNRI.*

*As a signatory to the Nuclear Non-Proliferation Treaty (NPT), the Philippines, through PNRI, ensures compliance with the articles and provisions of the Treaty by the implementation and enforcement of its Safeguards Agreement with the IAEA together with the AP.*

NUCLEAR SAFEGUARDS AND SECURITY SECTION  
Nuclear Regulatory Division  
PHILIPPINE NUCLEAR RESEARCH INSTITUTE  
Commonwealth Avenue  
Diliman, Quezon City 1101  
Tele/Fax: +63 2 920 3214  
www.pnri.dost.gov.ph

May 2014



### IAEA Additional Protocol Reporting Requirements for the Philippines

*NEW Legal Obligations  
for Industry, Enterprises,  
R&D Organizations, and  
Universities Conducting  
Nuclear-Related Activities*

**PNRI Can Help You  
Meet These Obligations**

### WHAT IS THE ADDITIONAL PROTOCOL?

The Additional Protocol (AP) is a legal agreement between the International Atomic Energy Agency (IAEA) and an IAEA Member State, like the Philippines, that provides assurances to the international community that the country is in compliance with international nonproliferation agreements.

The AP:

- Strengthens the IAEA's ability to detect undeclared nuclear activities
- Provides the IAEA with a broader picture of a State's nuclear energy activities
- Requires a State to report nuclear-related information to the IAEA
- Allows the IAEA expanded inspector access to nuclear fuel cycle facilities, activities, and related locations

Find more information on the AP at:  
[www.iaea.org/Publications/Factsheets/English/sg\\_overview.html](http://www.iaea.org/Publications/Factsheets/English/sg_overview.html)

### WHY IS COMPLIANCE IMPORTANT TO THE PHILIPPINES?

Compliance with the AP is important because:

- It demonstrates the Philippines' commitment to nuclear nonproliferation
- It helps keep the Philippines from unintentionally contributing to illicit proliferation networks
- It enhances Southeast Asian regional security and confidence building
- It increases the Philippines' access to nuclear-related imports

### WHAT ACTIVITIES SHOULD BE REPORTED?

If you are involved in any of the following nuclear-related activities, you may have to report the activities to PNRI. PNRI will declare the activities to the IAEA. The IAEA may visit locations where the activities occur.

1. Nuclear fuel cycle-related research and development activities that do not involve nuclear material (source or special fissionable material). These are activities related to development of the following processes:
  - Chemical conversion of uranium
  - Enrichment of uranium
  - Reactor fuel fabrication

- Reactors
- Facilities for nuclear criticality experiments
- Reprocessing of reactor fuel
- Processing of intermediate- or high-level waste containing plutonium, highly enriched uranium, or U-233

However, the following do not need to be reported: basic or theoretical scientific research; industrial radioisotope applications; medical, hydrological, or agricultural applications; health and environmental effects; and improved maintenance.

2. Buildings on a nuclear site, such as the Philippine Research Reactor-1 and the Batasan Nuclear Power Plant.
3. Information about manufacture, import, and export of certain nuclear-related equipment and materials

If you are involved in any of the activities listed above, or for information on other reportable activities, contact:

JULETTA E. SEGUS, Head  
NUCLEAR SAFEGUARDS AND SECURITY SECTION  
Nuclear Regulatory Division  
PHILIPPINE NUCLEAR RESEARCH INSTITUTE  
Tele/Fax No. +63 2 920 3214  
Email: [jsegusi@pnri.dost.gov.ph](mailto:jsegusi@pnri.dost.gov.ph)

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## Annex XI.

### EXAMPLE OF STATE DECLARATIONS OF PLANNED FACILITIES – FROM 2.A(X) PLANS TO DESIGN INFORMATION

A key aspect of safeguards implementation is the transmission of relevant information about facilities from the SRA to the IAEA in accordance with INFCIRC/153 (Corr.), particularly paragraphs 8 and 42 to 45. Knowledge of relevant information concerning facilities enables the implementation of effective and efficient safeguards approaches, which benefits the operator, the State and the IAEA. Provision of information about planned facilities is submitted with gradually increasing granularity, and begins very early, under an AP article 2.a.(x) declaration (for States with an AP in force).

This declaration is based on a 10-year evaluation, so the information may be very limited and basic. However, some key elements can already be included, for example the type of facility, the targeted power and flow capacity, the potential operator, the cooperation with other States or companies and the licensing process.

Below are examples of 2.a.(x) declarations for a hypothetical planned nuclear power plant construction project, showing how more detailed information is progressively provided until the submission of early design information.

Name of State (or Party): Ruritania  
 Safeguards agreement INFCIRC: 000 Protocol article: 2.a.(x)  
 Declaration number: 1 Declaration date: 2010-05-15  
 Declaration period: 2009-05-15 to 2010-05-15  
 Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle                                                                                                                                                                                    | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments |
|-------|------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------|
| 1     |      |                  |                                                                                                                                                                                                                                            |                                                                                  |          |
| 2     |      | Reactors         | Ruritania plan to construct a nuclear power station of 3 PWRs of 900 MWe. 3 candidate sites will be selected for the NPP and a public consultation and feasibility studies will determine the site, design and the vendor of the reactors. |                                                                                  |          |
| 3     |      |                  |                                                                                                                                                                                                                                            |                                                                                  |          |

Name of State (or Party): Ruritania  
 Safeguards agreement INFCIRC: 000 Protocol article: 2.a.(x)  
 Declaration number: 2 Declaration date: 2011-05-15  
 Declaration period: 2010-05-15 to 2011-05-15  
 Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle                                                                                                                                                                                                                                                 | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments |
|-------|------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------|
| 1     |      |                  |                                                                                                                                                                                                                                                                                                         |                                                                                  |          |
| 2     |      |                  |                                                                                                                                                                                                                                                                                                         |                                                                                  |          |
| 3     |      |                  |                                                                                                                                                                                                                                                                                                         |                                                                                  |          |
| 4     | 1-2  | Reactors         | <p>Ruritania plan to construct a nuclear power station of 3 PWRs of 900 MWe.</p> <p>2 sites could already be chosen for the NPP. RURITANUC will provide the reactor design, which will be evaluated by the National regulatory Authority.</p> <p>RURITELEC will operate all the facilities on-site.</p> |                                                                                  |          |
| 5     |      |                  |                                                                                                                                                                                                                                                                                                         |                                                                                  |          |

Name of State (or Party): Ruritania  
Safeguards agreement INFCIRC: 000 Protocol article:2.a.(x)  
Declaration number: 3 Declaration date: 2012-05-15  
Declaration period: 2011-05-15 to 2012-05-15  
Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments |
|-------|------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------|
| 1     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                  |          |
| 2     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                  |          |
| 3     | 2-4  | Reactors         | <p>Ruritania plan to construct a nuclear power station of 3 PWRs of 900 MWe.</p> <p>The site of the NPP is Easternia. RURITANUC will provide the reactor design, which will be evaluated by the National regulatory Authority. The NRA made available its first safety evaluations.</p> <p>RURITECH will construct the structural part of the reactors. Some equipment will be imported in 2016 such as steam generators and vessel. The licensing procedures have begun.</p> <p>RURITELEC will operate all the facilities on-site.</p> |                                                                                  |          |
| 4     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                  |          |

Name of State (or Party): Ruritania  
Safeguards agreement INFCIRC: 000 Protocol article:2.a.(x)  
Declaration number: 5 Declaration date: 2014-05-15  
Declaration period: 2013-05-15 to 2014-05-15

Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments                                                                                   |
|-------|------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |                                                                                            |
| 2     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |                                                                                            |
| 3     | 4-3  | Reactors         | <p>Ruritania plan to construct a nuclear power station of 3 PWRs of 900 MWe. The site of the NPP is Easternia.</p> <p>The RURITANUC reactor design has been validated by the National regulatory Authority. The construction of the first reactor will begin in January 2017 and the two other units in November 2017.</p> <p>RURITECH will construct the structural part of the reactors. Some equipment will be imported in 2016 such as steam generators and vessel. All licences requirement have been obtained.</p> <p>RURITELEC will operate all the facilities on-site.</p> |                                                                                  | Reactors controls rod will be manufactured in Ruritania (see article 2.a.(iv) declaration) |
| 4     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                  |                                                                                            |

Name of State (or Party): Ruritania  
Safeguards agreement INFCIRC: 000 Protocol article:2.a.(x)  
Declaration number: 6 Declaration date: 2015-05-15  
Declaration period: 2014-05-15 to 2015-05-15

Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments                                                                                   |
|-------|------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1     | 5-3  | Reactors         | <p>Ruritania plan to construct a nuclear power station of 3 PWRs of 900 MWe. The site of the NPP is Easternia.</p> <p>The RURITANUC reactor design has been validated by the National regulatory Authority. The construction of the first reactor will begin in January 2017 and the two other units in November 2017.</p> <p>RURITECH will construct the structural part of the reactors. Some equipment will be imported in 2016 such as steam generators and vessel. All licences requirement have been obtained.</p> <p>RURITELEC will operate all the facilities</p> |                                                                                  | Reactors controls rod will be manufactured in Ruritania (see article 2.a.(iv) declaration) |

|   |  |  |                                                                                                                                                                                                                                                                                       |  |  |
|---|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
|   |  |  | <p>on-site.</p> <p>A first DIQ draft has been sent to the Agency by the national SRA. A meeting between the SRA, the SSAC, RURITECH and RURITELEC regarding national and international legal framework and safeguards implementation will be hosted in Easternia in October 2016.</p> |  |  |
| 2 |  |  |                                                                                                                                                                                                                                                                                       |  |  |

Name of State (or Party): Ruritania  
Safeguards agreement INFCIRC: 000 Protocol article:2.a.(x)  
Declaration number: 7 Declaration date: 2016-05-15  
Declaration period: 2015-05-15 to 2016-05-15

Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments |
|-------|------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------|
| 1     | 6-1  | Reactors         | <p>Ruritania currently constructs a nuclear power station of 3 PWRs of 900 MWe. The site of the NPP is Easternia. The RURITANUC reactor design has been validated by the National regulatory Authority. The construction of the first reactor will begin in January 2017 and the two other units in November 2017. RURITECH constructs the structural part of the reactors.</p> <p>The steam generator, the pressure vessel and the pressurizer will arrive on-site from Pointsmoria in November 2016. RURITELEC will operate all the facilities on-site.</p> <p>The first DIQ has been sent to the Agency by the national SRA. The MBA code for the first unit will be sent in July.</p> <p>A meeting between the SRA and RURITELEC regarding national and international legal framework and safeguards implementation will be hosted in Easternia in August 2017.</p> |                                                                                  |          |
| 2     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                  |          |

Name of State (or Party): Ruritania  
Safeguards agreement INFCIRC: 000 Protocol article:2.a.(x)  
Declaration number: 8 Declaration date: 2017-05-15  
Declaration period: 2016-05-15 to 2017-05-15

Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments |
|-------|------|------------------|---------------------------------------------------------|----------------------------------------------------------------------------------|----------|
|       |      |                  |                                                         |                                                                                  |          |

|   |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                                                     |
|---|-----|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------|
| 1 | 7-1 | Reactors | <p>Ruritania currently constructs a nuclear power station of 3 PWRs of 900 MWe. The site of the NPP is Easternia.</p> <p>The RURITANUC reactor design has been validated by the National regulatory Authority. The construction of the first reactor will begin in January 2017 and the two other units in November 2017.</p> <p>Due to technical delays, the construction began in March 2017 for the first unit.</p> <p>RURITECH constructs the structural part of the reactors. The steam generator, the pressure vessel and the pressurizer arrived on-site directly from Pointsmoria in November 2016.</p> <p>RURITELEC will operate all the facilities on-site. The first DIQs for the other units have been sent to the Agency by the SRA. The MBA code for the second and third unit will be sent in June.</p> |  | Last declaration for Unit 1 in Article 2.a.(x) due to the allocation of facility status (MBA RNP1). |
| 2 |     |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                                                     |

Name of State (or Party): Ruritania  
Safeguards agreement INFCIRC: 000 Protocol article:2.a.(x)  
Declaration number: 9 Declaration date: 2018-05-15  
Declaration period: 2017-05-15 to 2018-05-15  
Comment:

| Entry | Ref. | Fuel Cycle Stage | General Plans for development of the Nuclear Fuel Cycle                                                                                                                                                                                                                                                                                                                                         | General Plans for Nuclear Fuel Cycle-Related Research and Development Activities | Comments                                                                                                            |
|-------|------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1     | 8-1  | Reactors         | <p>Ruritania currently constructs a nuclear power station of 3 PWRs of 900 MWe. The site of the NPP is Easternia.</p> <p>The construction of all reactors will end in 2018. Construction of units 2 and 3 began in January. RURITELEC operates all the facilities on-site. The first DIVs for all units have been sent to the Agency by the national SRA and MBA codes have been allocated.</p> |                                                                                  | Last declaration of the NPPs in Article 2.a.(x) due to the allocation of facility status (MBA RNP1, RNP2 and RNP3). |
| 2     |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                  |                                                                                                                     |

Early provision of design information is required when the decision is taken to construct, or to authorize construction, of the facility, whichever is earlier. When early provision of design information occurs, the declarations of the planned facility under 2.a.(x) will cease.

Early provision of design information helps to:

- Identify any technical issues sufficiently early to incorporate into final facility design;
- Highlight operating and design concerns that may impact the safeguards approach (radiological hazards, black-box processes, personnel radiation protection requirements, access limitations);
- Discuss and prepare elements of the FA; and
- Provide the basis for the IAEA to develop the safeguards approach and plan for the verification effort.

After the initial early provision of design information, the SRA needs to submit updates and revisions as more details become known. For many cases such as large-scale facilities, the national legal requirements and the technical design aspects will set the schedule for producing design information very early in the process.

As the DIQ is updated, new information will be added, related to choices of equipment, measurement points, operating schemes or records systems. All relevant elements, including those related to measurement uncertainties and material held up in process (both important aspects of the safeguards approach) should be submitted as soon as they are known. The results of calibrations and tests can also be presented to the IAEA to enable evaluation of performance with respect to international target values and standards, and support the design/selection of verification equipment and related material.

The licensing process for a new facility is quite variable from State to State. The SRA should inform the IAEA of the different steps, ensuring a correct understanding of the design option timing.

**Annex XII.**  
**EXAMPLE FORM FOR ANNUAL REPORTING ON NEPTUNIUM AND AMERICIUM**

|                               |  |
|-------------------------------|--|
| <b>Reporting Organization</b> |  |
|-------------------------------|--|

**A - Neptunium**

**1 – Inventory as of 1 January 20XX** (in grams, to the nearest tenth of a gram<sup>8</sup>):

Please also provide a brief of summary of the nature of this inventory (e.g. oxide in powder form, sealed sources etc.) – and an explanation for any differences from the information provided as of 31 December of the prior year (Use separate sheet as necessary).

**2 – Receipts and Exports during 20XX**

| Date | Issue or Receipt <sup>9</sup> | Weight (g) | Origin or Destination | Designation, description and intended use |
|------|-------------------------------|------------|-----------------------|-------------------------------------------|
|      |                               |            |                       |                                           |
|      |                               |            |                       |                                           |

**3 – Inventory as of 31 December 20XX** (in grams, to the nearest tenth of a gram<sup>10</sup>):

Please also provide a brief of summary of the nature of this inventory (e.g. oxide in powder form, sealed sources etc.).

Signed \_\_\_\_\_ Company Position \_\_\_\_\_

Print Name \_\_\_\_\_ Dated \_\_\_\_\_

---

<sup>8</sup> only inventories comprising 1 gram or more of ‘previously separated’ neptunium need be reported

<sup>9</sup> only receipts or issues of 1 gram or more of ‘previously separated’ neptunium need be reported.

<sup>10</sup> only inventories comprising 1 gram or more of ‘previously separated’ neptunium need be reported

## B - Americium

### 1 – Inventory as of 1 January 20XX (in grams, to the nearest gram<sup>11</sup>):

Please also provide a brief of summary of the nature of this inventory (e.g. oxide in powder form, sealed sources etc.) – and an explanation for any differences from the information provided as of 31 December of the prior year (Use separate sheet as necessary)

### 2 – Receipts and Exports during 20XX

| Date | Issue or Receipt <sup>12</sup> | Weight (g) | Isotope(s) <sup>13</sup> | Origin or Destination | Designation, description and intended use |
|------|--------------------------------|------------|--------------------------|-----------------------|-------------------------------------------|
|      |                                |            |                          |                       |                                           |
|      |                                |            |                          |                       |                                           |

### 3 – Inventory as of 31 December 20XX (in grams, to the nearest tenth of a gram<sup>14</sup>):

Please also provide a brief of summary of the nature of this inventory (e.g. neptunium oxide in powder form, sealed sources etc.).

Signed \_\_\_\_\_ Company, Position \_\_\_\_\_

Print Name \_\_\_\_\_ Dated \_\_\_\_\_

---

<sup>11</sup> only inventories totalling 10 grams or more of ‘previously separated’ americium-241, 242m and/or-243 need be reported

<sup>12</sup> only receipts or issues of 10 grams or more of ‘previously separated’ americium need be reported.

<sup>13</sup> whether americium-241, 242m and/or-243

<sup>14</sup> only inventories totalling 10 grams or more of ‘previously separated’ americium-241, 242m and/or-243 need be reported

**Annex XIII.**  
**EXAMPLE OF STATE’S GUIDANCE ON**  
**NUCLEAR MATERIAL ACCOUNTING AND CONTROL TRAINING**

A State has produced national guidance on safeguards and nuclear material accountancy systems for its nuclear facilities and LOFs. The guidance is made available on the SRA’s website, and contains specific information about training for facility operators in nuclear material accounting and control. The guidance resulted from extensive consultation with and input from those involved in nuclear material accountancy at nuclear facilities. It reflects a broad consensus on how best to satisfy safeguards and nuclear material accountancy requirements and includes numerous examples of good practice as identified by the industry.

The document also contains information on relevant international and national legal obligations, and other undertakings to which organizations may subscribe voluntarily, such as typical site/organizational roles in a nuclear material accountancy system and safeguards and nuclear material accountancy terms and definitions. The guidance is designed to complement related regional regulations on the implementation of a nuclear material accountancy and control system by operators of nuclear installations.

**SRA training**

The SRA has developed a set of competency areas to ensure safeguards staff are suitably trained and qualified in their relevant area of responsibility:

**Safeguards – Skills and Expertise Framework**

Knowledge and Experience

| <b>Specialism</b>                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b> – Knowledge of the legal framework for the application of safeguards in the State                                                                                               |
| <b>2</b> – Knowledge of SRA’s safeguards remit and legal powers                                                                                                                          |
| <b>3</b> - Appreciation of the regional and global non-proliferation basis and context for the application of regional and IAEA safeguards in the State and more widely                  |
| <b>4</b> – Knowledge and experience of arrangements for nuclear materials and accountancy at nuclear facilities                                                                          |
| <b>5</b> – Knowledge of safeguards tools and techniques                                                                                                                                  |
| <b>6</b> – Knowledge and experience of tools and techniques for destructive and non-destructive measurement of nuclear materials and the nature of the associated uncertainties          |
| <b>7</b> - Understanding of regional safeguards application for nuclear material at locations outside nuclear licensed sites                                                             |
| <b>8</b> - General appreciation of the civil nuclear industry, and awareness of plants/processes of safeguards relevance                                                                 |
| <b>9</b> - Understanding of the sensitivity of safeguards and nuclear materials and accountancy-related information, including requirements for its security classification and handling |

|           |                                                                                                                                                                                              |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>10</b> | – Understanding of the origins, objectives and specific requirements of the State’s reporting obligations under the AP to the State’s Safeguards Agreement for which the SRA is responsible  |
| <b>11</b> | – Understanding of the origins, objectives and specific requirements of other State reporting obligations to the IAEA for which SRA is responsible, and experience of the processes involved |
| <b>12</b> | – Understanding of the policies and experience of the processes for State responses to requests for the approval of new regional and IAEA safeguards inspectors                              |
| <b>13</b> | – Knowledge and experience of State safeguards-related reporting obligations arising from nuclear co-operation/transfer agreements with other States                                         |
| <b>14</b> | – Knowledge and experience of State reporting and publication of information on inventories of civil plutonium and uranium                                                                   |
| <b>15</b> | – Knowledge and experience of the publication of nuclear materials balance information for sites processing nuclear material                                                                 |

### Rating Scheme for Technical Skills and Knowledge Management Process

|   |                                                                                                                                                                                                                                                                                                           |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Limited <ul style="list-style-type: none"> <li>– limited experience and/or knowledge of the area</li> <li>– some technical oversight may be appropriate over and above normal due process</li> </ul>                                                                                                      |
| 2 | Capable <ul style="list-style-type: none"> <li>– can work in this area routinely</li> <li>– able to act as <i>intelligent customer</i> for routine work commissioned in this area</li> </ul>                                                                                                              |
| 3 | Lead <ul style="list-style-type: none"> <li>– a “go to” person for advice or work on this area</li> <li>– capable of supervising or training others &amp; representing SRA at international level</li> <li>– able to act as <i>intelligent customer</i> for all work commissioned in this area</li> </ul> |

### **National Occupational Standards and Training Standards**

SRA produced a set of occupational and training standards related to Nuclear Material Accountancy, Control and Safeguards (NMAAS). National Occupational Standards (NOS) describe what an individual needs to do, know and understand in order to carry out a particular role or function, together with specifications of the underpinning knowledge and understanding. NOS are a suite of standards which cover the activities carried out by individuals working within and on behalf of nuclear site licensed companies to meet NMAAS requirements.

For example, the NOS covering compilation of NMA and safeguards reporting requires that a nuclear licensed site ensure that nuclear materials are accounted for, controlled and safeguarded in order to demonstrate good governance arrangements; meeting international safeguards commitments; and complying with legal requirements and voluntary undertakings. It describes the standards expected of individuals who are responsible for producing and reporting nuclear material accounts in the NMAAS system and applies primarily to the Nuclear Material Accountants and their NMAAS Managers within nuclear site license companies who are responsible for managing compliance with NMAAS requirements for nuclear material accounting and reporting at a site or an organizational level. The main outcome of this activity is correctly maintained and compiled system of nuclear material accounts and safeguards reporting.

The Safeguards Awareness Training Standard is shown below.

| Title                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Awareness of International Safeguards |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Details                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                       |
| Learning outcomes                                                                                | Assessment Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |
| The learner will:                                                                                | The learner can:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                       |
| LO2.1 Understand the purpose and objectives of nuclear safeguards                                | <ol style="list-style-type: none"> <li>1. Explain the meaning, intent and objectives of nuclear safeguards.</li> <li>2. Explain the importance of nuclear safeguards to the nuclear non-proliferation regime, to your stakeholders, to your organization and to your job context</li> <li>3. Distinguish between safeguards , security, and safety and explain their fundamental commonalities and differences</li> <li>4. Explain the scope of nuclear safeguards – (materials, plant and equipment, etc).</li> <li>5. Explain the inspector’s rights of inspection</li> <li>6. Explain the IAEA strengthened safeguards and AP measures relevant to your organization or job context</li> <li>7. Explain the differences between IAEA and regional safeguards</li> </ol>                                                                                                                                                                                                                                                                                                                    |                                       |
| LO2.2 Understand the legal and regulatory framework for nuclear safeguards                       | <ol style="list-style-type: none"> <li>8. Understand the IAEA safeguards agreement and related State laws.</li> <li>9. Understand the regional safeguards requirements, powers, and sanctions, and how these are enacted in State law.</li> <li>10. Explain the roles of the regional institutions associated with safeguards</li> <li>11. Understand the requirements for meeting the obligations of international nuclear co-operation agreements</li> <li>12. Explain State government policy and oversight arrangements for safeguards</li> <li>13. Understand the security and safety requirements for regional inspectors and information exchange</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |
| LO2.3 Know the technical basis of safeguards                                                     | <ol style="list-style-type: none"> <li>14. Describe the safeguards diversion concerns and detection goals and their relevance for your nuclear fuel cycle activities and your job context</li> <li>15. Describe the types of inspections</li> <li>16. Understand what material tracking and independent measurement techniques are deployed by the safeguards inspectorates</li> <li>17. Explain the requirements for providing information on plant technical characteristics (design) and for its verification</li> <li>18. Explain the requirements for advance notification and special reports</li> <li>19. Understand the importance of operating and accountancy records and the difference between them</li> <li>20. Understand the concepts of material balance, physical inventory taking, Material Unaccounted For and its testing for significance</li> <li>21. Understand the effects on operations of safeguards verification and for re-verification.</li> </ol>                                                                                                               |                                       |
| LO2.4 Know the appropriate arrangements to follow when interacting with safeguards inspectorates | <ol style="list-style-type: none"> <li>22. Understand the personnel security requirements for escorting inspectors and protective marking requirements for sensitive information exchanges.</li> <li>23. Understand the protocols for inspectorate’s safety and radiation protection on nuclear licensed sites</li> <li>24. Explain the points of contact and channels of communication with the inspectorates</li> <li>25. Explain safeguards by design and the importance of early engagement with the safeguards inspectorate on new plants and major modifications</li> <li>26. Explain the principle of safeguards in-depth and utilization of operator’s systems by the safeguards inspectorate</li> <li>27. Understand the logistical arrangements to support safeguards inspections</li> <li>28. Explain the arrangements to formalize agreed safeguards approaches and actions.</li> <li>29. Explain the process for dealing with inspection findings, letters and requests.</li> <li>30. Understand the safeguards reporting requirements and the communication channels</li> </ol> |                                       |
| LO2.5 Understand the organization                                                                | <ol style="list-style-type: none"> <li>31. Describe the roles and responsibilities for managing safeguards compliance, performance and resourcing at a site or organizational level and governance</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                       |

|                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| and governance structures that exist for the management of safeguards | at an executive level<br>32. Understand the main safeguards performance measures and expectations and the systems for deficiencies<br>33. Understand the arrangements for safeguards awareness<br>34. Explain what constitutes a good safeguards culture<br>35. Understand safeguards emergency response and risk management arrangements                                                                                                                                                                                                                                                                                                                     |
| Aim & Purpose                                                         | Aimed at those who interact with safeguards inspectorates or provide systems and features important to safeguards compliance. This would include all those handling nuclear material whether site employees or contractors and those involved in design, construction and commissioning of plants which will handle nuclear materials.<br><br>Provides an awareness and development of knowledge of requirements of international safeguards within their working environment and an overview of the regulatory and inspections measures in place to provide positive, independent safeguards assurance of peaceful nuclear use and good material management. |
| Assessment methodology                                                | The purpose of assessment is to ensure that effective learning has taken place. Assessment of the candidates' performance will be against the stated learning outcomes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Other Details                                                         | This training standard has been developed against the suite of national occupational standards for nuclear material accountancy and safeguards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### **State's 'Nuclear Passport'**

NMAS is included in the State's 'Nuclear Skills Passport', which is a system which offers all nuclear organizations instant secure web access to information on the nuclear skills base, offering a detailed overview of the training completed by their workforce as well as contracting organizations. The Nuclear Skills Passport was designed by nuclear employers, specifically for the requirements of the nuclear sector. It is an effective vehicle for the introduction of industry agreed standards and inter-site recognition of internal and external skills development training, which reduces duplication of training common to nuclear sites.

#### **The Nuclear Passport comprises five key elements:**

1. A web based accessible learner database that provides a registry of training records for individual passport holders and facilities and generates a skills passport card.
2. Dataset repository for Job Contexts, which are agreed common job roles across industry with which associated competencies are aligned.
3. Benchmarking tool that supports and enables up-skilling and workforce mobility across the sector – enables existing employee's skills to be recognized and mapped against defined standard industry Job Context roles, highlighting gaps in skills and/or training.
4. Training sign-posting tool which supports up-skilling by sign-posting learners to Skills Academy Quality Assured training provision (courses/programmes/qualifications) to meet any identified Skills Gaps. This offers a simple modular approach to closing skills gaps through continuous learning and development, with accreditation against national industry standards.
5. A reporting suite that generates statistics at industry, regional and corporate levels.

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