

TECHNICAL GUIDELINES

GUIDELINES OF NUCLEAR MATERIAL ACCOUNTANCY FOR FACILITY/LOF



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1.0 INTRODUCTION

1.1 BACKGROUND

The Treaty on the Non-Proliferation of Nuclear Weapons (NPT), INFCIRC/140 specifies and provides the legal basis for the conclusion of safeguards agreements between the International Atomic Energy Agency (IAEA) and Malaysia for the implementation of safeguards. Under these safeguards agreement, Malaysia is required to establish and maintain a state system of accounting for and control of nuclear material (SSAC) subject to safeguards under the agreement. A cornerstone of both safeguards and the SSAC is nuclear material accountancy of which nuclear material accounting is a key component and includes the corresponding reports from the domestic potential parties that are required to be submitted to the Department of Atomic Energy Malaysia (Atom Malaysia) as the State Regulatory Authority that Responsible for Safeguards Implementation (SRA) for further submission to the IAEA.

In INFCIRC/182, Article 7 specifies that the Safeguards Agreement between the IAEA and Malaysia stipulates that Malaysia shall establish and maintain a system of accounting for and control of all nuclear material subject to safeguards under the agreement, and that such safeguards shall be applied in such a manner as to enable the IAEA to verify, in ascertaining that there has been no diversion of nuclear material from peaceful uses to nuclear weapons or other nuclear explosive devices. In order to fulfill this obligation, the Nuclear Material Accounting (NMA) system need to be developed at each facility/LOFs.

1.2 OBJECTIVE

The objective of this guideline is to guide licensee on how to establish, develop and maintain nuclear material accounting in accordance with safeguards principle which uses and possess nuclear material in nature of work. The guidance also developed to ensure the licensee are aware of the objectives and significant of NMA. Domestic NMA system is aims to detect misuse/unauthorized use of even smaller quantities in grams of material immediately as well as provide routine assurances that nuclear materials are being used for their intended purposes.

NMA uses control measures in conjunction with accounting measures to enhance the timeliness and effective detection of potential nuclear material's diversion and to ensure that nuclear material is not used without proper approval and accounting.

2.0 PRINCIPLES OF ESTABLISHING STATE SYSTEM OF ACCOUNTING FOR AND CONTROL (SSAC)

2.1 STATE SYSTEM OF ACCOUNTING FOR AND CONTROL (SSAC)

The SSAC shall function at the state level as well as at the facility/LOFs level, which will allow a state to achieve:

- a) a national objective to account for and control of nuclear material in the State (Malaysia) and to contribute to the detection of possible losses or unauthorized use or removal of nuclear material; and
- b) an international objective to provide the essential basis for the application of IAEA safeguards pursuant to the provisions of an agreement between Malaysia and the IAEA.

In INFCIRC/182, Article 31 specifies that the SSAC shall be based on a structure of material balance area (MBA) and shall provide for the establishment of a measurement system, a records and reports system, procedures for taking a physical inventory and provisions to ensure that accounting procedures and arrangements are correctly operated.

2.2 NUCLEAR MATERIAL ACCOUNTING AND ACCOUNTANCY

Nuclear material accounting refers to “activities carried out to establish the quantities of nuclear material present within defined areas and the changes in those quantities within defined periods”. Nuclear material accountancy is defined as “the practice of nuclear material accounting as implemented by the licensee and the SSAC, inter alia, to satisfy the requirements in the safeguards agreement between the IAEA and Malaysia; and as implemented by the IAEA, inter alia, to independently verify the correctness of the nuclear material accounting information in the facility/LOFs records and the reports provided by the SSAC to the IAEA”. In this Guideline, the emphasis is placed on establishing and maintaining an accounting system at the facility/LOFs level, which enables the licensee

not only to account for the nuclear material, but also to submit the necessary accounting reports to the Atom Malaysia.

2.3 LEGAL BASIS FOR PROVISION OF NUCLEAR MATERIAL ACCOUNTING DATA

With the ratification of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), INFCIRC/140 Article iii.1 required Malaysia to concluded a safeguards agreement with the IAEA, The Text of the Agreement Between Malaysia and The Agency for the Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapon, INFCIRC/182. This Safeguards Agreement specifies various types of information that must be reported to the IAEA. In addition, INFCIRC/182 also specifies and provide information regarding accounting reports, the starting point of safeguards, nuclear material customarily used outside facilities and exports and imports of nuclear material must also be reported and declared.

In national context, Atomic Energy Licensing Act 1984 (Act 304) was gazette on 1 February 1985 which provide for the regulation and control of atomic energy. Section 8(d) of the Act 304, indicate the functions of the Board to perform or provide for the performance of the obligations arising from agreements, conventions or treaties relating to nuclear matters or atomic energy to which Malaysia is a party where such agreements, conventions or treaties relate to the purposes of this Act. Thus, it is a requirement for the licensee to establish, develop and maintain nuclear material accounting in accordance with safeguards principle.

2.4 NUCLEAR MATERIAL ACCOUNTING COMPONENTS

Below are the components which are important that need to be recognised and carried out in order to establish nuclear material accounting.

2.4.1 Facility and Locations Outside Facilities (LOF)

Facility means a reactor, a critical facility, a conversion plant, a fabrication plant, a reprocessing plant, an isotope separation plant or a separate storage installation or any location where nuclear material in amounts greater than one effective kilogram is customarily used.

Locations Outside Facilities (LOFs), are any installation which is not a facility, where nuclear material is customarily used in amounts of one effective kilogram¹ or less. The licensee that use and possess nuclear material of Class B license for the purpose of nuclear activity; or non-nuclear activity as shielding (e.g: Radiography Industry); or others purpose such as research and development (e.g: universities and hospitals) are also categorize as LOFs.

2.4.2 Material Balance Area (MBA):

MBA is an area in or outside of a facility/LOFs such that:

- a) The quantity of nuclear material in each transfer into or out of each MBA can be determined; and
- b) 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 reports made to the Atom Malaysia. Material crossing the boundary of an MBA must be reported to the Atom Malaysia 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 Atom Malaysia but should be recorded within the facility/LOFs as to ensure there is no undeclared nuclear material and keep track the inventory changes.

2.4.3. Key Measurement Points (KMP)

¹ An effective kilogram is a special unit used in safeguards, and is defined in Article 97, INFCIRC/182

A KMP is a location where nuclear material appears in such a form that it may be measured to determine material flow or inventory. KMPs thus includes, but are not limited to, the inputs and outputs and storage areas in MBAs. The facility/LOFs arrangements for a given facility/LOFs clearly specifies the flow and inventory of KMPs agreed between the facility/LOFs and Atom Malaysia. There are two categories of KMP which are Flow KMP and Inventory KMP. Normally numbers are used for flow KMPs and letters are used for inventory KMPs.

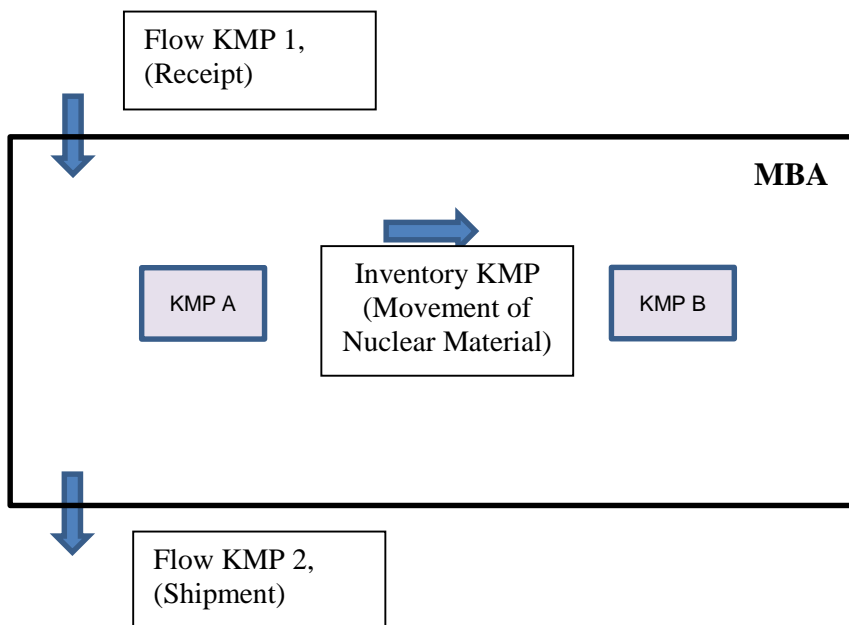


Figure 1: Diagram of Material Balance Area

2.4.4 System of Records

The licensee must maintain an accounting and operating records for each KMP. The accounting and operating records system shall reflect:

- a) all inventory changes, so as to permit a determination of the book inventory at any time;
- b) all measurement results that are used for determination of the physical inventory (including laboratory analyses and source documents); and
- c) all adjustments and corrections that have been made in respect of inventory changes, book inventories and physical inventories.

2.4.5 Reporting system

The licensee needs to prepare accounting reports based on MBA accounting records. This report should be prepared or updated at least once a year or whenever there is changes to inventory and submit that report to the Atom Malaysia as soon as possible but not later than 7 days after the changes occur through official communication via email or letter.

2.4.6 Inventory Change Report (ICR)

ICR is an accounting report submitted by Malaysia to the IAEA that provide information about changes in the inventory of nuclear material. Inventory change means an increase or decrease, in terms of batches, of nuclear material in a material balance area, such a change should involve one of the following:

- a) Increases:
 - i. Import;
 - ii. Domestic receipt: receipts from other material balance areas, or receipts at the starting point of safeguards;
 - iii. Nuclear production: production of special fissionable material in a reactor; and
 - iv. De-exemption: re-application of safeguards on nuclear material previously exempted therefrom on account of its use or quantity.

- b) Decreases:
 - i. Export;
 - ii. Domestic shipment: shipments to other material balance areas;
 - iii. Nuclear loss: loss of nuclear material due to its transformation into other element(s) or isotope(s) as a result of nuclear reactions;

- iv. Measured discard: nuclear material which has been measured, or estimated on the basis of measurements, and disposed of in such a way that it is not suitable for further nuclear use;
- v. Retained waste: nuclear material generated from processing or from an operational accident, which is deemed to be unrecoverable for the time being but which is stored;
- vi. Exemption: exemption of nuclear material from safeguards on account of its use or quantity; and
- vii. Other loss: for example, accidental loss (that is, irretrievable and inadvertent loss of nuclear material as the result of an operational accident) or theft.
- viii. Category changes as the increases and decreases in nuclear material accounts which is the result of uranium changing from one category (enriched, natural or depleted) to another.

2.4.7 Physical Inventory Taking (PIT)

The licensee should conduct PIT at least once a year as to ensure there is no undeclared nuclear material and keep track on nuclear material inventory. The PIT also should be conduct to determine periodically quantities of nuclear material present within each facility/LOFs. The licensee should notify Atom Malaysia on PIT plan as early as possible not less than 30 days that PIT conducted.

2.4.8 Material Balance Period (MBP)

MBP can be defines as the time between two PITs which 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 MBP.

2.4.9 Physical Inventory Listings (PIL)

PIL is an accounting report submitted by Malaysia to the IAEA. It is the sum of all the measured or derived estimates of batch quantities of nuclear material physically present

at a given time within an MBA, obtained by licensee in accordance with their procedures. Each MBA contains an inventory of nuclear material that must be reported to the Atom Malaysia as soon as possible within 7 days after the PIT conducted.

2.4.10 Material Balance Report (MBR)

The MBR is defined as an accounting report submitted by Malaysia to the IAEA to present the actual material balance based on a physical inventory of nuclear material in the MBA. MBR provide a summary of the material balance in the MBA reflecting all inventory changes in MBP. Licensee have to submit MBR as soon as possible within 7 days after the PIT have conducted in facility/LOFs. While this provision is not applicable for LOFs.

Establishing a material balance is the process of comparing a book inventory with the corresponding physical inventory for each type of nuclear material after conduct PIT. There are few processes to establish a nuclear material balance of nuclear material in MBA. They are:

- a) Taking a physical inventory;
- b) Identifying and summarizing all inventory changes since the previous physical inventory taking;
- c) Determining the amount of material that should be in the MBA by accounting for all increases and decreases since the previous physical inventory taking;
- d) Adjusting for rounding and shipper/receiver differences; and
- e) Comparing the amount that should be in the MBA to that which is physically present.

2.4.11 Design Inventory Verification (DIV)

DIV is continuous validation of the safeguards approach that will be conducted at a facility/LOFs to verify the correctness and completeness of the design information.

2.4.12 Design Information Questionnaire (DIQ)

DIQ has to be prepared to determine material balance areas and key measurement points by licensee in facility. DIQ consists of five main sections which detailed out facility identification, general arrangement of the facility, description of facility, and procedures for nuclear material accounting.

2.4.13 LOF Information Questionnaire

LOF Information Questionnaire is the almost similar document as DIQ but specifically only for licensee in LOFs. The document has to be prepared by the licensee itself that consists of the use of the nuclear material, its geographic location and the licensee's name, address existing and proposed procedures for nuclear material accountancy, including organizational responsibility.

3.0 ORGANIZATIONAL STRUCTURE OF FACILITY/LOCATION OUTSIDE FACILITY

3.1 INTRODUCTION

A management framework allows licensee to sustain and manage nuclear material information. In order to implement safeguards obligations and NMA system, its organizational structure shall be developed for each facility/LOFs as to facilitate and ensure the information and submission of nuclear material accounting reports are collected, validated, correct and complete provided to the Atom Malaysia.

3.2 NUCLEAR MATERIAL ACCOUNTING (NMA) ORGANIZATIONAL STRUCTURE

NMA system should adopted a system where accounting for and control of nuclear material should be the responsibility of an NMA unit, consisting of a Nuclear Material Officer (NMO) that responsible for safeguards implementation at facility/LOFs level and at least one nuclear material custodian and handler. NMO can be the same person as Radiation Protection Officer (RPO) or any other personnel within the organization. It is further suggested that these functions be separated from operational and overall facility/LOFs management.

The example of organizational structure as below:

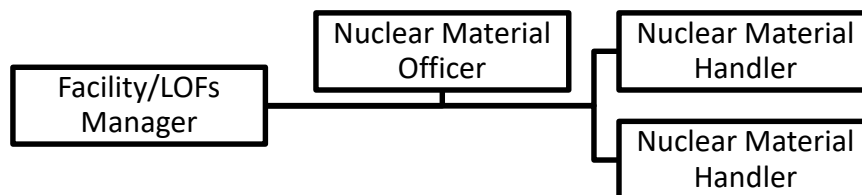


Figure 2: NMA Organizational Structure

3.3 FUNCTION AND RESPONSIBILITY

The NMA unit should have clearly defined responsibilities and sufficient authority to carry them out. Each position in organizational structure will be able to secure the declared nuclear material information within the his or her responsibility level as well as will determine the information to be provided to the unit. A system of notifications should exist to enable the unit to plan ahead. Each position as shown in Figure 2 plays an important role and should be able to control the flow of information from the points of origin to where it is needed, irrespective of the system used, whether manual or computerized until the submission to Atom Malaysia. Below are the function and responsibilities of each personnel within the NMA unit.

a) Facility/LOFs Manager

- i. Appoint NMO and oversees overall the safeguards implementation at facility/LOFs.
- ii. Oversees any changes to the nuclear material accounting report such as GL, PIL, MBR, ICD, Concise Note for any KMP; and
- iii. Oversees the required physical inventory operations.

b) Nuclear Material Officer (NMO)

Approves any changes to the nuclear material accounting report such as GL, PIL, MBR, ICD, Concise Note for any KMP, maintain and submit to Atom Malaysia.

- i. Oversees daily operation related to Safeguards including PIT activity;
- ii. Develop all NMA procedures of the KMP such as Preparation of Accounting Reports (PIL and MBR for Facility) and (GL for LOFs) Preparation of Inventory Document, Preparation of Internal Material Transfer Form, Measurement system and PIV;
- iii. Plan and ensures that NMA staff undergo Safeguards training; and
- iv. Facilitate any inspection conducted by Atom Malaysia or IAEA.

c) Nuclear Material Handler

- i. Conduct Physical Inventory Taking (PIT);
- ii. Handle the nuclear materials within KMP and receive instructions from NMO;
- iii. Responsible for keeping all information on nuclear materials are up to date for all transactions;
- iv. Completing all records such as Internal Material Transfer and submit to NMO for approval; and
- v. Implements all NMA procedures within KMP.

4.0 NUCLEAR MATERIAL ACCOUNTING IMPLEMENTATION AT FACILITY/LOFS LEVEL

4.1 GENERAL

This section describes the key elements required for the fulfilment of accounting and reporting of nuclear material at the facility/LOFs level. This element includes organizational structure, measurement program, record and report, PIT, material balance closing and material verification.

4.2 ORGANIZATION AND MANAGEMENT OF NUCLEAR MATERIAL

As stated in Chapter 3, facility/LOFs management should appoint an NMO and assign that person responsibility for accounting and control of the facility/LOFs nuclear material. An organization chart should be developed that clearly defines the relation between NMA and other facility/LOFs organizational units.

The NMO should be aware of and provide oversight, as appropriate, of activities involving nuclear material and related information, including those conducted by other departments and contractors who are not employees of the facility/LOFs. The NMO also should have authority to communicate directly with the highest-level manager of the facility/LOFs, who has ultimate responsibility for the whole facility/LOFs, including the nuclear material.

The roles and responsibilities of the NMO and NMA unit staff should be clearly defined and documented. Sufficient resources should be provided to ensure an effective NMA system. All facility/LOFs personnel involved with nuclear material should be aware that their actions contribute to the effectiveness of the NMA system.

4.3 ESTABLISHING MEASUREMENT SYSTEM

Measurement system is a combination of various measure such as established measurement points, measurement methods, measurement and calculation procedures, sampling procedures, calibration methods and procedures, standards or reference

material and measurement quality control. The objective of a measurement system is to ensure that the measurement methods selected for use are capable (as related to random and systematic errors) of measuring the material in question to the desired levels of precision and accuracy. In addition, the measurement system is important:

- a) To determining quantities of nuclear material received, produced, shipped, lost or otherwise removed from inventory;
- b) To determining inventory quantities; and
- c) To ensure there is no present of undeclared nuclear material

4.3.1 Measurement system

The activities require to establish the measurement system should be appropriate to the complexity of the safeguards activities. They are as below where applicable:

- a) Approved measurement equipment for establishing weights (calibration, standards);
- b) A sampling system;
- c) Document verification method (birth certificate); and
- d) Visual Observation (as it may be seen for qualitative and/or quantitative).

Selection of appropriate measurement method is important to ensure correct measurement of inventories as well as determination of nuclear material received, produced, shipped, lost or otherwise removed from inventory.

Licensee should keep all records to the same decimal significance to minimize rounding adjustments. Quantities of natural uranium, depleted uranium and thorium be reported in kilograms or grams, and those of plutonium, enriched uranium and other compound (solution) be reported in grams.

4.3.2 Documentation of measurement results

All measurement results should be properly recorded in approved forms. The forms should include provisions for at least the following information:

- a) Identity of nuclear material;
- b) Type Nuclear Material;
- c) Date and time of measurement;
- d) Method of Measurement;
- e) Material or Equipment of measurement used;
- f) Measurement procedures used;
- g) Measurement result; and
- h) Signatures of persons performing or reviewing the measurements.

Example of the form as mentioned above can be referred in **Appendix 3**. The record should be documented and available for submission, upon request by the Atom Malaysia reflecting measurement quality.

4.4 ESTABLISHING A RECORD AND A REPORT SYSTEM

Records and reports are primary component to the nuclear material accounting. The records and reports should always have related to each other as a report is always based on a record which originated in the nuclear material operating activities of the facility/LOFs.

Facility/LOFs records and reports should be complete, accurate and timely, as such it will provide sufficient information to resolve irregularities as well as provide complete and clear picture of the material inventory and allow Atom Malaysia to easily construct national report for onward submission.

Records should include accounting records, operating records and any other records that are important to nuclear material accounting. Traceability of all records should be maintained for at least 5 years as required by Atom Malaysia.

4.4.1 Accounting Records and Reports

Accounting records consist of the set of documents kept at a facility/LOFs which show the quantity of each type of nuclear material present at the facility/LOFs, the distribution in the facility/LOFs and all corresponding changes. All activities involving nuclear material should be recorded, including movements (shipments, receipts, transfers and relocations), physical inventory takings, measurements and adjustments to records.

The quantities and locations of all nuclear material listed in the accounting records should be correct and verifiable. The records should meet the requirements of showing the nuclear material inventory and all inventory changes affecting it, and accurate enough to facilitate verification. Accounting records could consist the following:

4.4.1.1 LOF Information Form

Licensee is required to submit first declaration of nuclear material Inventory at their LOFs to Atom Malaysia using the LOF Information form. The LOF Information form has been developed in aspect of safeguards for LOFs to collect the information of nuclear material and assist in verification process before declaration to IAEA. Example of the form as mentioned above can be referred in **Appendix 1**.

4.4.1.2 General Ledgers

A ledger has a starting point which is at the beginning of the MBP, an entry is made equal to the physical inventory at the end of the previous MBP. Entries following represent all known inventory changes, such as receipts and shipments. Thus, at any point in time the ledger shows the book inventory, indicates the quantity of nuclear material that should be present at the facility/LOFs. Below are the following steps to prepare a general ledger:

- a) Licensee has to inform Atom Malaysia planned date for Physical Inventory Taking (PIT) not less than 30 days from the date of PIT;
- b) Licensee has to prepare General Ledger after conduct the PIT;

- c) General Ledger has to be submit to Atom Malaysia as soon as possible but not later than 7 days after PIT; and
- d) Licensee has to file the General Ledgers for a proper record management.

Example of the General Ledgers can be referred in **Appendix 4**.

4.4.1.3 Inventory Journals

Inventory journals are chronological records indicating various types of inventory changes that have occurred at a facility or LOFs. Periodical entries are made from this document to the ledger. In the case of computerized accounting systems, journals might be unnecessary. Journals in turn are supported by source documents originating where nuclear material is received, shipped and discarded e.g. shipping document and purchase order.

4.4.1.4 Internal Material Transfer

Internal Material Transfer form is aim to record all the movement and transfer of nuclear material at the facility/LOFs level. This also can be describing as the chronological records of the nuclear material at the facility/LOFs.

There is no specific requirement of information in the internal material transfer form as long as it provide information as below:

- a) Date;
- b) Time;
- c) Transfer from;
- d) Transfer to; and
- e) Person in charge.

Example of the Internal Material Transfer Forms can be referred in **Appendix 2**.

4.4.1.5 Inventory Change Document (ICD)

ICD provide information about any changes of nuclear material inventory whether transfer out/in between MBA and/or movement out/in to Malaysia. ICD report has been developed for LOFs in simplified version from inventory change record template to meet safeguards reporting requirement to IAEA. While, for facility, they need to provide inventory change record (ICR) to Atom Malaysia. Below are the following steps to prepare ICD:

- a) Licensee has to prepare ICD if any changes occur in nuclear material inventory;
- b) ICD has to be submit to Atom Malaysia as soon as possible but not later than 7 days after changes occur; and
- c) Licensee has to file ICD for a proper record management.

Example of the ICD can be referred in **Appendix 5**.

4.4.1.6 Inventory Change Report (ICR)

ICR is one of accounting report provided by Atom Malaysia to IAEA to state any changes occur in nuclear material inventory. ICR is prepare using the fixed template and safeguards reporting format provided by IAEA. Facility need to submit ICR as soon as possible but not later than 7 days after changes occur. Example of the ICR can be referred in **Appendix 8**.

4.4.1.7 Physical Inventory Listings (PIL)

PIL provide information of all nuclear material inventory as specify nuclear material identification at each KMP. PIL is accounting report that need to provide to IAEA after the PIT activity. Facility has to submit PIL to Atom Malaysia but not later than 7 days after PIT. Example of the PIL can be referred in **Appendix 6**.

4.4.1.8 Material Balance Report

MBR provide summary of the nuclear material in MBA reflecting all inventory changes in a MBP. MBR need to provide to IAEA after the PIT activity. Facility has to submit MBR to Atom Malaysia but not later than 7 days after PIT. Example of the MBR can be referred in **Appendix 7**.

4.4.2 Accounting Reports

The accounting reports need to be submit to Atom Malaysia every year after the PIT activity. Atom Malaysia will responsible to consolidate information on nuclear material and ensure the information provided is correct and complete for reports submission to IAEA. Atom Malaysia has clearly stated and differentiate the accounting reports that need to be submit between facility and LOFs as below:

Facility	LOFs
a) General Ledger (GL)	a) General Ledger (GL)
b) Inventory Change Report (ICR)	b) Inventory Change Document (ICD)
c) Physical Inventory Listing (PIL)	
d) Material Balance Reports (MBR)	

Table 1: Accounting Reports for Facility/LOFs

4.5 ESTABLISHING A PHYSICAL INVENTORY TAKING (PIT) SYSTEM

PIT is a nuclear material accounting activity which can be described as the bench mark of nuclear material accounting and control. Licensee should notify Atom Malaysia 30 days in advance when physical inventories taking will be taken.

Licensee should develop procedures at facility/LOFs level to ensure the efficiency and effectiveness of PIT activity. The procedures shall specify the accounting documentation

associated with the PIT to ensure that no significant losses or discrepancies have gone undetected. This procedure should be able to address 'what shall be done' and 'how shall it be done' questions relating to a PIT.

Procedures and instructions for different facility/LOFs can vary and depending upon the facility/LOFs type and particularly on the types, forms and quantities of nuclear material. Below are generic content of this procedure:

- a) movement of nuclear material in a location to assembly positions facilitating measurement and inventory taking;
- b) step for identification of item for example attaching a label of different colour showing that it was inventoried; and
- c) techniques used in measurement performance.

4.6 PHYSICAL INVENTORY VERIFICATION ACTIVITY

On the basis of communication with licensee, Atom Malaysia agree on the annual PIV schedule which is carried out only by designated IAEA Inspectors and procedures to be applied at relevant facilities/LOFs. On receiving the schedule from the Atom Malaysia, the NMO shall plan the PIV in collaboration with the licensee. The objectives of PIV as following:

- a) Verify that declared nuclear material is not diverted;
- b) Verify that reports are consistent with records;
- c) Verify location, identity, quantity and composition of all nuclear material subject to safeguards under the Agreement;
- d) Verify information on the possible causes of shipper/receiver differences (SRD), and uncertainties in the book inventory; and
- e) Verify facilities or LOFs are not misused as to confirm that safeguards relevant operations are as declared

This PIV activity also include:

- a) Examination of records
 - i. Examination of nuclear material accounting records;
 - ii. Examination of safeguards relevant operating records;
 - iii. Comparison of records and State reports (ICR/MBR/PIL); and
 - iv. Requirements for record keeping/reports.

- b) Verifications at strategic points
 - i. Verification of inventory / DIV; and
 - ii. Verification of inventory changes/flow;

Tools or means of verifications: item counting, tag/serial number checks, non-destructive assay measurements, environmental sampling, containment and surveillance service and checking licensee's measurement system

5.0 MAINTAINING NUCLEAR MATERIAL ACCOUNTING AT FACILITY LEVEL

5.1 GENERAL

This section describes necessary elements for maintaining nuclear material accounting at the facility/LOFs level, which forms the structure to effectively meet the Atom Malaysia requirements discussed in the previous section.

5.2 PROCEDURES

Licensee should develop and establish clear procedures for controlling and reporting nuclear material inventory, flow, storage, use and for keeping good accounting records. The objectives of procedures are to ensure the continuity of knowledge of safeguards and control of each NMA staff over nuclear material. The procedures should be reviewed periodically and when operational changes are made. Below is the list of procedures that is highly recommended to be develop and maintain:

- a) Preparation of Accounting Reports (PIL and MBR);
- b) PIT;
- c) Preparation of Inventory Change Document;
- d) Preparation of Internal Material Transfer Form;
- e) Preparation of General Ledger;
- f) Measurement system; and
- g) PIV

5.3 TRAINING AND TECHNICAL SUPPORT

5.3.1 NMA Staff Training

Training of personnel responsible for accounting and control of nuclear material at State and facility/LOFs levels is critical and should be continuing activity for the successful operation of an SSAC. Licensee should identify training needs for personnel performing measurements to determine the quantities of nuclear material. The relevant staff should

have relevant education, training and experience. 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 staff performing the measurement. In order to ensure the objectives are achieved, licensee should develop the NMA staff training program and ensure the training implementation are recorded.

5.3.2 Technical Support

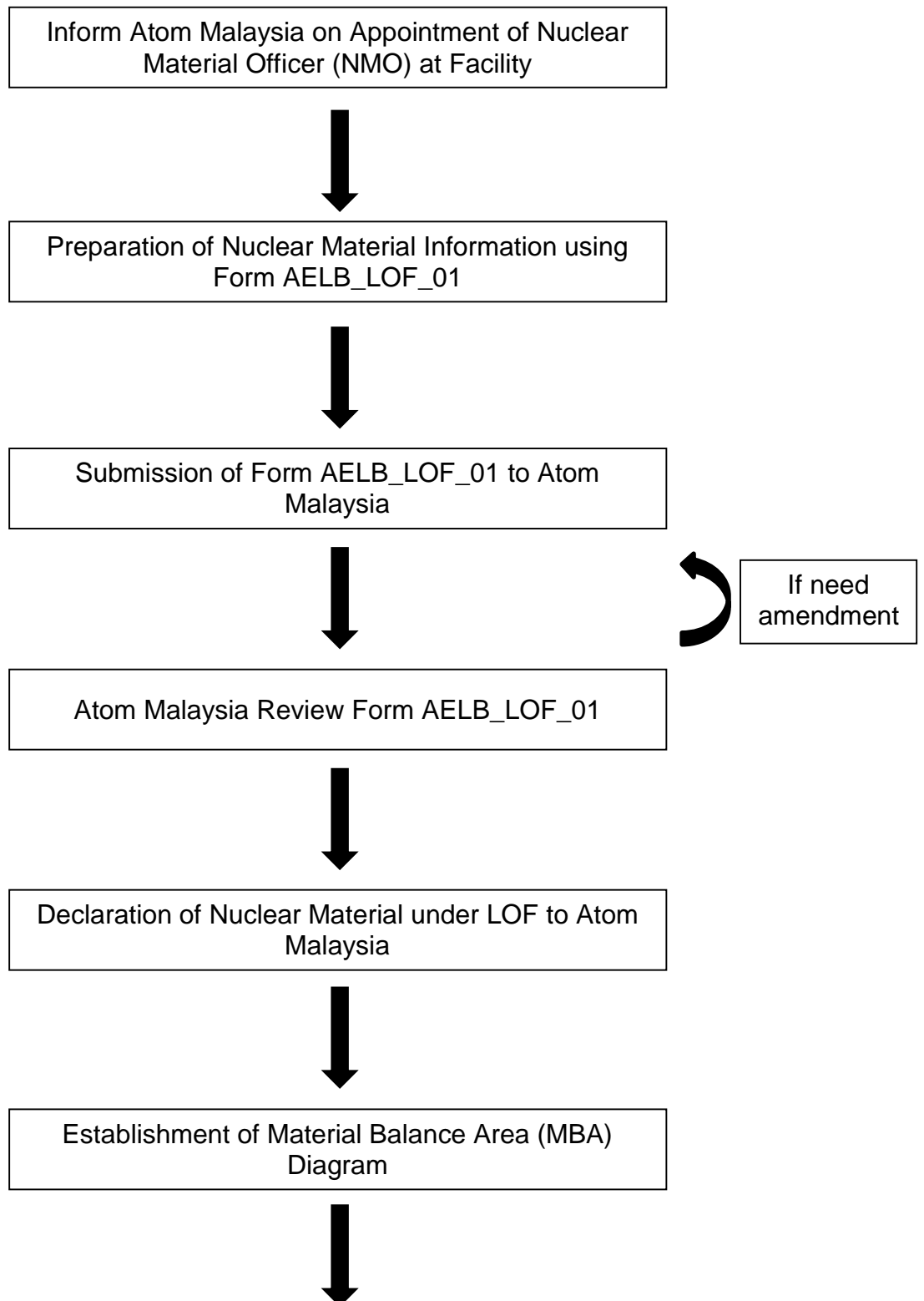
In order to enable the licensee to fulfil requirements for nuclear material accounting and control, they could contact Atom Malaysia and request for assistance from external sources, for example assistance in establishing adequate record and measurement systems which may incorporate data processing and analysis procedures.

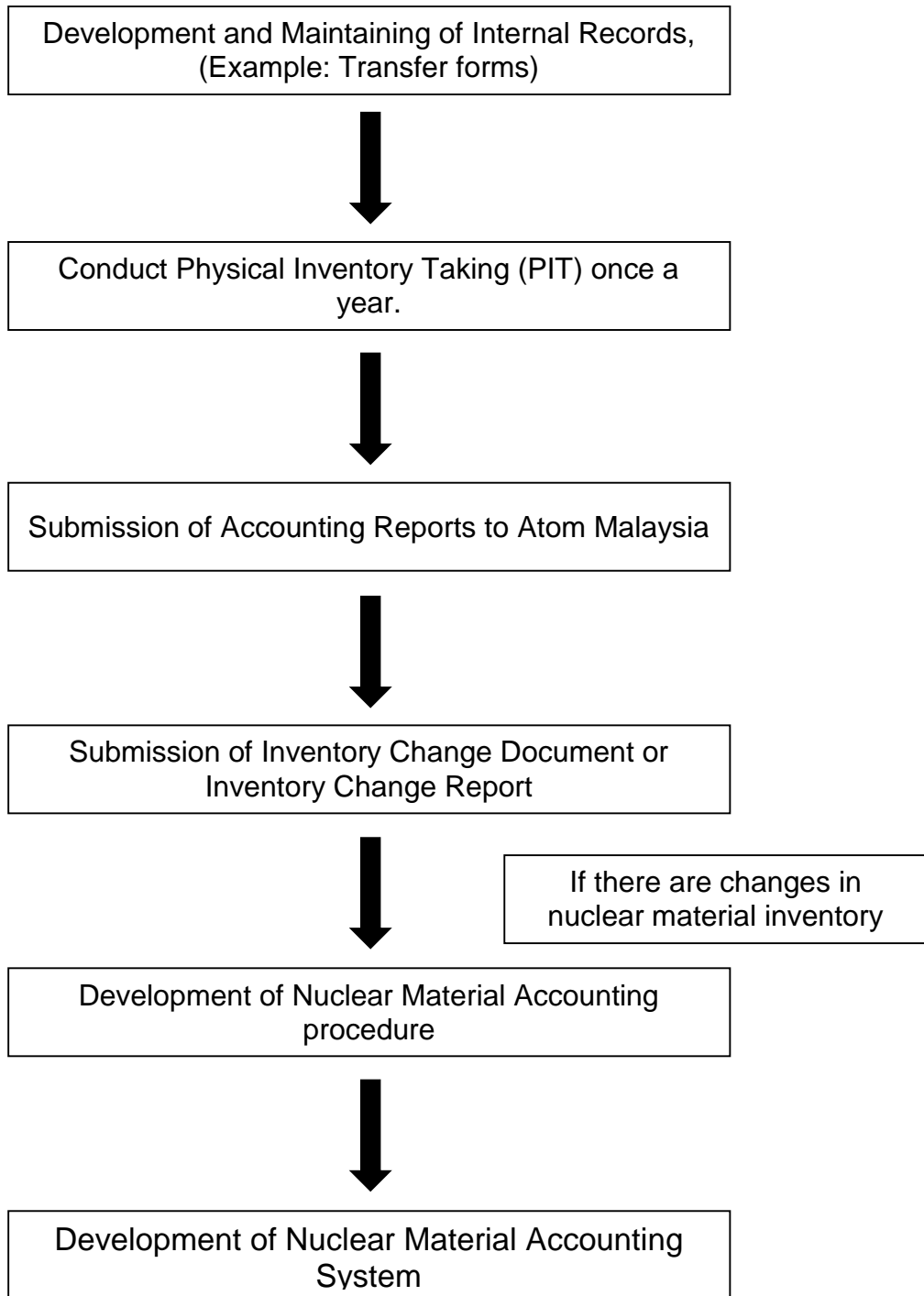
ABBREVIATION

Some of the terms that usually use for the purpose of Nuclear Material Accountancy:

Atom Malaysia	Department of Atomic Energy Malaysia
DIV	Design Information Verification
DIQ	Design Information Questionnaire
GL	General Ledger
IAEA	International Atomic Energy Agency
ICD	Inventory Change Document
ICR	Inventory Change Report
KMP	Key Measurement Point
LOF	Locations Outside Facility
MBA	Material Balance Area
MBP	Material Balance Period
MBR	Material Balance Report
NMA	Nuclear Material Accounting
NMO	Nuclear Material Officer
NPT	Non-Proliferation Treaty
PIL	Physical Inventory Listing
PIT	Physical Inventory Taking
PIV	Physical Inventory Verification
SRA	State Regulatory Authority that Responsible for Safeguards Implementation
SSAC	State System of Accounting for and Control

FLOW CHART DEVELOPMENT OF NUCLEAR MATERIAL ACCOUNTING





APPENDIX 1

LOCATION OUTSIDE FACILITY INFORMATION FORM

AELB_LOF_01

NO	SOURCE ID	NUCLEAR MATERIAL	CHEMICAL FORMULA	WEIGHT OF ELEMENT/ COMPOUND, (g/kg)	WEIGHT OF URANIUM (g/kg) (CALCULATED BY ATOM MALAYSIA)	PROCURED DATE	SPECIFIC USAGE	PHYSICAL FORM	MATERIAL DESCRIPTION CODE (MDC)	LOCATION	STATUS	ATTACHMENT (IMAGE)
1	ID material, Example: 38926-1	Which Nuclear material: Example: Depleted/ Uranium/ Natural/ Uranyl Nitrate	Chemical formula nuclear material stated, Example UO ₂	Weight of nuclear material stated: Example: 100 g	if weight of uranium will be calculated by Atom Malaysia	Date or year of procured: Example: February 1992	Usage of Nuclear material, Example: Lab Experiment	Physical form of nuclear material, Example: Solid, Liquid or Gas	Generated manually by Atom Malaysia	Location of nuclear material	State Current status of nuclear material, in used, stored or disposed	Image of Nuclear Material

*Subject to changes

APPENDIX 5

INVENTORY CHANGE DOCUMENT

AELB_ICD_01

SHIPPER NAME AND ADDRESS:				DATE:		RECEIVER NAME AND ADDRESS:		
				PAGE NO.:				
MBA:		DATE RECEIVED:		MBA:				
KMP:				KMP:				
REPORT NO.:								
SHIPPERS DATA								
NO	NUCLEAR MATERIAL ID	NUCLEAR MATERIAL	ELEMENT CODE	NUMBER OF ITEMS	WEIGHT OF NUCLEAR MATERIAL	UNIT (KG/G)	WEIGHT OF U-235	UNIT (KG/G)
DATE OF INVENTORY CHANGE:				NAME AND SIGNATURE OF AUTHORIZED:				
				OFFICIAL AND DATE SIGNED:				
RECEIVER'S DATA				RECEIVER'S REPORT NO:				
NO	NUCLEAR MATERIAL ID	NUCLEAR MATERIAL	ELEMENT CODE	NUMBER OF ITEMS	WEIGHT OF NUCLEAR MATERIAL	UNIT (KG/G)	WEIGHT OF U-235	UNIT (KG/G)
FOR AUTHORITY'S USE ONLY (SHIPPER'S DATA)				FOR AUTHORITY'S USE ONLY (RECEIVER'S DATA)				
IAEA REPORT NO.:				IAEA REPORT NO.:				

CONCLUSION

For further questions regarding the matters related to this document, kindly please contact Atom Malaysia at the following contact details:

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23 December 2022	Amend.1	1. Ridha Roslan 2. Erma Hafiza Ibrahim@Abd. Aziz

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