

**U.S. Department of Energy
Washington, DC**

ORDER

DOE O 474.2A

Approved: 02-07-2023
Chg 1 4-16-2024

SUBJECT: NUCLEAR MATERIAL CONTROL AND ACCOUNTABILITY

1. PURPOSE. This Order establishes requirements for developing, implementing, and maintaining a nuclear material control and accountability (MC&A) program within the U.S. Department of Energy (DOE), including the National Nuclear Security Administration (NNSA), and for DOE-owned materials at other facilities that are exempt from licensing by the Nuclear Regulatory Commission (NRC). This Order only addresses the safeguards and security of accountable nuclear materials. Attachment 2, Chapter I contains requirements for special nuclear material. Attachment 2, Chapter II contains requirements for other accountable nuclear material. Nuclear Safety requirements may be found in 10 Code of Federal Regulations (CFR) 830, 10 CFR 835 and Safety related DOE Directives. Sealed source requirements may be found in DOE O 231.1, *Environment, Safety and Health Reporting*, current version. Additionally, requirements for special nuclear material covered under the provisions of the Voluntary Offer Safeguards Agreement and the Additional Protocol between the United States and the International Atomic Energy Agency (IAEA) may be found in DOE M 142.2-1, *Manual for Implementation of the Voluntary Offer Safeguards Agreement and Additional Protocol with the International Atomic Energy Agency*, current version (DOE O 142.2A).
2. CANCELS/SUPERSEDES. This Order cancels DOE O 474.2 Chg 4 (PgChg), *Nuclear Material Control and Accountability*, dated 9-13-16.

NOTE: Basic Requirements for Nuclear Materials Management and Safeguards System Reporting and Data Submission, has been incorporated into the *Nuclear Materials Management and Safeguards System (NMMSS) User Guide*. The NMMSS User Guide can be obtained by sending an email request to nmmss@nnsa.doe.gov.

Cancellation of a directive does not, by itself, modify or otherwise affect any contractual or regulatory obligation to comply with the directive. Contractor Requirements Documents (CRDs) that have been incorporated into a contract remain in effect throughout the term of the contract unless and until the contract or regulatory commitment is modified to either eliminate requirements that are no longer applicable or substitute a new set of requirements.

3. APPLICABILITY.
 - a. Departmental Applicability. This Order applies to DOE elements that have oversight of site and facility management, operations and offices that administer contracts for DOE MC&A programs, including those created after this Order is issued.

The Administrator of the National Nuclear Security Administration (NNSA) must ensure that NNSA employees comply with their responsibilities under this

directive. Nothing in this directive will be construed to interfere with the NNSA Administrator's authority under section 3212(d) of Public Law (P.L.) 106-65 to establish Administration-specific policies, unless disapproved by the Secretary.

- b. DOE Contractors. Except for the equivalencies/exemptions in paragraph 3.c., the Contractor Requirements Document (CRD) sets forth requirements of this Order that will apply to contracts that include the CRD (see Attachment 1).
- (1) The CRD must be included in contracts requiring the access, use, oversight, management and/or operation of accountable nuclear materials at a DOE-owned or -leased facility.
 - (2) The CRD must be included in all radioactive waste management contracts involving transfers of waste containing reportable quantities of nuclear material, including transfers to DOE radioactive waste land disposal sites designated by a "V" Reporting Identification Symbol (V-RIS). The only requirement of this Order applicable to such V-RIS sites is to report to NMMS the transfer of accountable nuclear material on DOE/NRC Form 741.
 - (3) The CRD must be included in all contracts for management and/or operation of DOE facilities that involve nuclear materials and contain DOE Acquisition Regulation (DEAR) clause, Title 48 CFR 952.204-2, *Security Requirements*.
- c. Equivalencies/Exemptions for DOE O 474.2A. Existing equivalencies and exemptions must be reviewed to determine applicability under DOE O 474.2A. If applicable, the site must document the review was completed and the equivalency or exemption remains valid through the site management and Officially Designated Federal Security Authority (ODFSA).
- (1) Equivalencies and exemptions from the requirements of this Order are processed in accordance with DOE O 251.1, *Departmental Directive Program*, current version.
 - (2) When conditions warrant, equivalencies or exemptions from the requirements in this Order, requests must be supported by a Security Risk Assessment (SRA) or Vulnerability Assessment (VA) when required by the assets being protected, or by sufficient analysis to form the basis for an informed risk management decision, the analysis must identify compensatory measures, if applicable, or alternative controls to be implemented. SRA/VA is in accordance with DOE O 470.3, *Design Basis Threat (DBT) Order*, current version.
 - (3) Equivalencies and exemptions from safeguards and security requirements within DOE O 474.2A require formal consultation with the Office of Security. The Office of Security will respond to consultation requests within 30 business days from the receipt of the request.

- (4) All approved equivalencies and exemptions under this Order must be entered in the Safeguards and Security Information Management System (SSIMS) database. Approved equivalencies and exemptions become a valid basis for operation when they have been entered in SSIMS and documented in the appropriate security plan, MC&A plan, and they must be incorporated into site procedures at that time.
 - (5) Many DOE Safeguards and Security (S&S) Program requirements are found in or based on regulations issued by Federal agencies, and codified in the CFR or other authorities, such as Executive Orders or Presidential Directives. In such cases, the process for deviating from those requirements found in the primary document must be applied. If the primary document does not include a deviation process, the DOE Office of the General Counsel, or NNSA Office of General Counsel if an NNSA element is involved, must be consulted to determine whether deviation from the source can be legally pursued.
 - (6) Exemptions. This Order does not apply to the following:
 - (a) Activities regulated by the Nuclear Regulatory Commission (NRC) or a state under an agreement with NRC, including activities certified by NRC under section 1701 of the Atomic Energy Act.
 - (b) In accordance with the responsibilities and authorities assigned by Executive Order 12344, codified at 50 USC sections 2406 and 2511 and to ensure consistency throughout the joint Navy and DOE organization of the Naval Nuclear Propulsion Program, the Deputy Administrator for Naval Reactors (Director) will implement and oversee all requirements and practices pertaining to this DOE Order for activities under the Director's cognizance, as deemed appropriate.
 - (c) Manufactured Items that Contain Depleted Uranium or Thorium. Depleted Uranium or Thorium in manufactured items including, but not limited to; crane weights, ballast, thoriated lenses, and shielded containers used for transport or storage (e.g., shielded drums, pigs) are excluded from the requirements of this Order to account and report.
4. REQUIREMENTS. Any change in the policy requirements of this Order do not affect requirements in other Orders. The following are essential to a valid and successful MC&A program.
- a. Physical Protection Requirements.
 - (1) Physical protection requirements are found in DOE O 473.1, *Physical Protection Program*, current version.

- (2) In addition to SNM category determination, physical protection requirements are determined by:
 - (a) Results of a Material Risk Review Committee (MRRC) review as required for the conditions defined in DOE O 470.3, current version, as appropriate.
 - (b) Results of a roll-up analysis conducted in accordance with DOE O 470.3, current version, as appropriate.
- b. DOE Oversight Requirements for SNM and OANM.
 - (1) The Field Elements must ensure and assess the performance of DOE MC&A program meeting requirements in the CRD and Attachment 2, Chapter I and Chapter II.
 - (2) The Field Element must ensure that the contractor reports to the national system of accounting, Nuclear Materials Management and Safeguards System (NMMSS), as required by Public Law (P.L.) 83-703, the Atomic Energy Act of 1954, as amended.
- c. DOE Program Planning and Administration for SNM and OANM.
 - (1) For sites/facilities possessing SNM or material controlled and accounted for as SNM, a comprehensive MC&A Plan developed and implemented by the site/facility operator that defines the program at the site, must be reviewed and approved by the ODFSA. The MC&A Plan documents the safeguards authorization basis for the site/facility operator to possess accountable nuclear materials and must specify how those materials are accounted for and controlled on a graded safeguards basis (Table IV, Graded Safeguards Table). The MC&A Plan must include all fundamental commitments that define the bounds within which the MC&A program will function and the detailed level of performance.
 - (2) For sites/facilities possessing OANM, a comprehensive OANM Plan developed and implemented by the site/facility operator that defines the program at the site, must be reviewed and approved by the ODFSA. The OANM Plan documents how these materials are accounted for and reported. The OANM Plan may be included in the MC&A Plan.
- d. Program Integration. The MC&A oversight program must be integrated with other oversight programs such as Safeguards and Security program planning and management, physical protection, Protective Force, information security, personnel security and response personnel.^{FAQ-1}
- e. DOE to Department of Defense (DoD) SNM Transfers. For DOE to DoD weapons transfers, SNM in weapons must not be transferred to DoD under 42

U.S.C. §2121(b), Material for Department of Defense Use, until DOE has received direction from the President.

- (1) Require that DOE line management not transfer nuclear material to DoD, or authorize contractor facilities to make such transfers, until it has received written authorization for specific transfers.
- (2) Require that DOE line management and the contractor retain written authorization on file.
- (3) Maintain memorandum inventory accounts and current inventory records for all transfers of accountable SNM in weapons to DoD by the Office of Defense Programs (or successor office).
- (4) Include inventory records for all quantities shipped to DoD, all quantities returned to DOE (based on the receiver's measured quantities), all quantities determined to have been consumed or lost, and inventory and loss data for reports of composition of ending inventory.

f. Implementation.

- (1) Compliance with the requirements within this Order, including the Attachments, must be complete within one (1) year of the issuance date.
- (2) If compliance cannot be accomplished within one (1) year, an implementation schedule must be submitted to the appropriate Program Secretarial Officer (or their designee), prior to the deadline stated in 4.f.(1) above. The documentation must include timelines and resources needed to fully implement this Order.

g. Contracting Officer (CO) Requirements.

- (1) The Head of the Departmental Element, or his or her designee, must notify the CO and other appropriate subject matter experts in the organization that the directive applies to an existing contract or to a solicitation for a future contract.
- (2) For existing contracts, the Head of Departmental Element must designate appropriate representatives (Federal and/or contractor) to work with the CO to develop an appropriately tailored set of standards, practice, and controls.
- (3) For existing management and operating (M&O) contracts, after being notified by the Head of the Departmental Element or his or her designee, the CO must provide the contractor the opportunity to:
 - (a) Assess the effect of incorporating the CRD on contract cost, funding, schedule, and technical performance; and

- (b) Provide input on the appropriately tailored set of requirements for the contract. All associated activities will be accomplished in a timely manner and, if applicable, in accordance with the timelines established in DEAR 970.5204-2. The CO will incorporate the CRD without alteration unless the directive permits alteration and the appropriate process is followed.
 - (4) For existing non-M&O contracts, after being notified by the Head of the Departmental Element or his or her designee, the CO shall provide the contractor the opportunity to:
 - (a) Assess the effect of incorporating the CRD on contract cost, funding, schedule, and technical performance; and
 - (b) Provide input on the appropriately tailored set of requirements for the contract. The CO shall incorporate the CRD without alteration unless the CRD or directive permits alteration and the appropriate process is followed.
- 5. RESPONSIBILITIES. The responsibility for management and implementation of safeguards and security programs resides with the appropriate Under Secretary. The Under Secretary serves as DOE Line Management and has the authority to commit security resources, direct the allocation of security personnel, and approve security implementation plans and procedures in the accomplishment of specific work activities. Delegations must be documented and disseminated to concerned parties in a manner determined by the Under Secretary.
 - a. Secretarial Program Offices, including NNSA.
 - (1) Serve as DOE Line Management for programs, operations, and facilities under their jurisdiction. This authority may be delegated to Field Office management with documentation of the approval authority.
 - (2) Ensure that MC&A programs are operating within the limits of approved MC&A plans and establish programs for periodic assessment of program effectiveness.
 - (3) Ensure resources are available and allocated to accomplish Federal oversight and allow for contractor implementation of Departmental MC&A requirements.
 - b. NNSA Nuclear Materials Integration Division. Manages the development and maintenance of NMMSS by:
 - (1) collecting data relative to nuclear materials including those for which the United States has a safeguards interest both domestically and abroad;
 - (2) processing the data; and

- (3) issuing reports to support the safeguards and management needs of DOE, NRC, and other government organizations, including those associated with international treaties and agreements (e.g., IAEA).
- c. NNSA Defense Programs Office of Tritium and Domestic Uranium Enrichment. Review and approve Programmatic Value Determinations (PVDs) for Defense Programs, NonProliferation and site stakeholders.
- d. Heads of Headquarters Departmental Elements. Ensure COs of affected contracts include the CRD into the contract.
- e. Heads of Field Elements. Field elements that are responsible for oversight of a site/facility possessing nuclear material have the following responsibilities.
 - (1) Confirm site compliance with the approved plans and periodically assess the effectiveness of the operators' programs.
 - (2) Through contracting officers, require that the entire CRD associated with this Order be included in all contracts with license-exempt contractors holding DOE-owned nuclear material. (See section 3.b.(1))
 - (3) Ensure COs of other affected contracts include the CRD into the contract, if applicable.
- f. Officially Designated Federal Security Authority (ODFSA).
 - (1) Fulfill requirements and responsibilities as defined in this Order, that are delegated to them from DOE/NNSA.
 - (2) As the risk accepting official, makes final attractiveness level determination when disagreements occur.
 - (3) Approves changes to the categorization of SNM. ^{FAQ-2}
- g. Federal Staff at Government-Owned, Government-Operated Sites. Federal staff that are responsible for the operation of a site/facility possessing accountable nuclear materials must develop, implement, and maintain MC&A programs that conform to this Order and follow the requirements in Attachment 2, Chapter I and Chapter II.
- h. Office of Environment, Health, Safety and Security.
 - (1) Develops, after coordination with Secretarial Offices and field organizations, MC&A policies, standards and guidance affecting field organizations, DOE license-exempt contractors and subcontractors.
 - (2) Provides technical advice, analyses, and recommendations in developing international safeguards policies and procedures. In connection with

international agreements, recommends corrective action to ensure compliance with overall safeguards policies, procedures, and standards.

i. Contracting Officers.

- (1) Upon notification of its applicability, incorporate the CRD into affected contracts via the appropriate process.
- (2) Assist originators of procurement requests who want to incorporate the requirements of this Order in new non-site/facility management contracts, as applicable.

6. INVOKED STANDARDS. This Order does not invoke any DOE technical standards or industry standards as required methods. Any technical standard or industry standard that is mentioned in or referenced by this Order is not invoked by this Order. Note: DOE O 251.1D, Appendix J provides a definition for “invoked technical standard.”

7. REFERENCES.

- a. DOE Orders referenced in this Order are located on the DOE Directives webpage, <https://www.directives.doe.gov/>.
- b. DOE Technical Standards referenced in this Order are located on the DOE Technical Standards webpage, <https://www.standards.doe.gov/>.
- c. All other referenced materials are located on the EHSS Policy Information Resource (PIR) website, <https://pir.doe.gov/>.

8. DEFINITIONS AND ACRONYMS. Definitions of commonly used terms and Acronyms are provided in Attachment 3. Terms used in the DOE safeguards and security programs are defined and located on the Policy Information Resource website, <http://pir.doe.gov>.

9. CONTACT. Questions concerning this Order should be directed to the Office of Security Policy, Office of Environment, Health, Safety and Security, email address Security.Directives@hq.doe.gov. Formal clarification requests should be submitted to the Director, Office of Security through the respective Program Office.

BY ORDER OF THE SECRETARY OF ENERGY:



DAVID M. TURK
Deputy Secretary

ATTACHMENT 1
CONTRACTOR REQUIREMENTS DOCUMENT
DOE O 474.2A, *NUCLEAR MATERIAL CONTROL AND ACCOUNTABILITY*

This Contractor Requirements Document (CRD) establishes Nuclear Material Control and Accountability (MC&A) requirements for Department of Energy (DOE) contractors, including National Nuclear Security Administration (NNSA) contractors.

Regardless of the performer of the work, site/facility contractors with the CRD incorporated into their contracts are responsible for compliance with the CRD. The contractor is responsible for flowing down the requirements of the CRD to subcontracts at any tier to the extent necessary to ensure compliance with the requirements.

In addition to the CRD, contractors are responsible for complying with Attachment 2, Chapter I and Chapter II, to DOE O 474.2A, which provide program requirements and/or information applicable to contracts in which this CRD is inserted. Chapter I contains requirements for SNM. Chapter II contains requirements for OANM. Any change in the policy requirements of this Order do not affect requirements in other DOE Orders.

ATTACHMENT 2
CHAPTER I. SPECIAL NUCLEAR MATERIAL (SNM)

1. PROGRAM MANAGEMENT.

- a. Objectives. Federal and Contractor personnel responsible for the management and/or operation of a facility possessing SNM, material treated as SNM or credible substitution material, must develop, document, implement, and maintain an MC&A program that conforms to DOE policy. The MC&A program must:
 - (1) Document and maintain a comprehensive and effective program to control and account for SNM, material treated as SNM and credible substitution material;
 - (2) Define MC&A program elements;
 - (3) Be graded based on the consequence of loss;
 - (4) Establish and maintain an evaluation program that monitors the effectiveness of the MC&A system;
 - (5) Respond to nuclear material loss indicators, anomalous conditions, and significant degradations in individual program element or total system performance; and
 - (6) Integrate MC&A with Safeguards & Security and other site programs.^{FAQ-3}
- b. General Program Requirements. The program management element of MC&A focuses on the scope and effectiveness of management relative to program planning, policy implementation, and program review to ensure that a graded, cost-effective MC&A program is implemented.
 - (1) The level of resources and personnel necessary to maintain an effective MC&A program are identified and are available to implement and maintain the program.
 - (2) The MC&A program is sufficiently independent of operations. For Category I and II facilities, the MC&A organization must not be subordinate to the operations organization. This is not applicable to Federal oversight functions provided by field elements.^{FAQ-4}
 - (3) Internal review and assessment and performance testing programs are defined that have elements of schedule, comprehensiveness, conduct, evaluation, reporting, and issues management.
 - (4) Performance goals are established for each defined program element that demonstrate program objectives are met.

- (5) Performance testing of system elements is addressed. System elements are defined at each facility based upon mission, operations, and nuclear material.

c. Program Administration.

- (1) Roles and Responsibilities. Each facility is required to define the MC&A program management structure and assignment of duties and authorities.
 - (a) Persons responsible for each MC&A function must have authority to implement their responsibilities.
 - (b) A management official responsible for the control and accountability of nuclear materials must be designated for each facility. For Category I and II facilities, this official must be organizationally independent from operations.
 - (c) A Nuclear Materials Representative responsible for nuclear materials reporting and data submission to the Nuclear Materials Management and Safeguards System must be designated for each facility having a Reporting Identification Symbol.
 - (d) An individual does not have sole authority to oversee, evaluate performance, or audit information for which they are responsible.
 - (e) MC&A personnel validate key Security Risk Assessment (SRA) or Vulnerability assessments (VA) parameters affecting MC&A implementation.
- (2) Training. Each facility is required to have an MC&A organization with trained and qualified personnel who administer and oversee MC&A functions at the facility.
 - (a) Requirements for MC&A training are established to meet Department requirements (DOE O 470.4, *Safeguards and Security Program*, current version) and ensure that personnel with MC&A functions are trained and knowledgeable of their duties and responsibilities.
 - (b) Job Task Analyses or equivalent must be performed for each MC&A function. ^{FAQ-5}
 - (c) The MC&A training plan must define required initial training and re-qualification or re-training needs and schedules required for each MC&A function based on job task analyses or equivalent.
 - (d) The MC&A training plan must be reviewed annually and updated as necessary.

- (3) MC&A Plan. Each facility must develop, implement and maintain a DOE-approved MC&A plan that describes the MC&A program. The MC&A Plan must be reviewed biennially and updated as necessary.
 - (a) The MC&A Plan provides the safeguards authorization basis for the facility operator and must be approved by the Officially Designated Federal Security Authority.
 - (b) The MC&A Plan must describe how MC&A Program elements are implemented such that they work together to deter and detect theft and diversion of SNM.
 - (c) All credible substitution materials must be identified in the MC&A plan, by material form and type.^{FAQ-6}
 - (d) All SNM not amenable to measurement must be identified in the MC&A plan, by material form and type.^{FAQ-7}
- (4) Implementing Plans and Procedures.
 - (a) Each facility must develop, implement and maintain plans and procedures for MC&A program elements. These plans and procedures must be referenced in the MC&A plan.
 - (b) MC&A personnel must review facility-level procedures to ensure consistency with MC&A plans and procedures.
 - (c) MC&A personnel must review changes to facility operations and procedures for impact to MC&A programs prior to implementation.
- d. Graded Safeguards. The graded safeguards concept is used to provide the greatest relative amount of control and accountability for the types and quantities of SNM that can be most effectively used in a nuclear explosive device. When other nuclear materials are potentially credible substitution materials for Category I, Category II, and Category III (Attractiveness Levels B and C) SNM, are collocated with SNM, and there is a credible substitution scenario, the items must be under the same MC&A requirements as the SNM, with the exception of reporting credible substitution material to NMMSS, if otherwise not reportable.
 - (1) Special Nuclear Materials. SNM in Table I must be controlled and accounted for as required by Attachment 2, Chapter I of this Order.

Table I. Special Nuclear Materials

Material Type	Accountable Quantity	Weight Field Used for Element	Weight Field Used for Isotope	Material Type Code
Enriched Uranium (U-235)	1 gram	total U	U-235	20
Uranium-233 ³	1 gram	total U	U-233	70
Plutonium-242 ¹ (Pu)	1 gram	total Pu	Pu-242	40
Plutonium-239-241	1 gram	total Pu	Pu-239 + Pu-241	50
Plutonium-238 ²	1/10 of a gram	total Pu	Pu-238	83
Uranium in Cascades	1 gram	total U	U-235	89

¹Account as Pu-242 (MT 40) if the contained Pu-242 is 20 percent or greater of total plutonium by weight; otherwise, account as Pu-239-241 (MT 50).

²Account as Pu-238 (MT 83) if the contained Pu-238 is 10 percent or greater of total plutonium by weight; otherwise, account as Pu-239-241 (MT 50).

³Account as U-233 (MT 70) if the contained U-233 is 10 percent or greater of total uranium by weight; otherwise, account as U235 (MT 10, 20, or 81).

- (2) Controlled and Accounted for as SNM in Table II: When separated, Am and Np must be controlled and accounted for as required by Attachment 2, Chapter I of this Order.

Table II. Controlled and Accounted for as Special Nuclear Materials

Material Type	Accountable Quantity	Weight Field Used for Element	Weight Field Used for Isotope	Material Type Code
Americium-241**(Am)	1 gram	total Am	Am-241	44
Americium-243**	1 gram	total Am	Am-243	45
Neptunium-237** (Np)	1 gram	total Np	-	82

**Americium and Np-237 contained in SNM are not required to be accounted for until separated. If separated, these materials must be controlled and accounted for as SNM.

- (3) Categorization and Use of the Graded Safeguards Table.
- (a) The Graded Safeguards Table must be used when determining the attractiveness level and categorization of SNM. MC&A requirements must be applied to SNM according to the category derived from Attachment 2, Chapter I, Table IV, the Graded

Safeguards Table in this Order. If roll-up to the derived category has been demonstrated to not be credible per DOE O 470.3, *Design Basis Threat (DBT) Order*, current version, MC&A requirements must be applied to the SNM based on the highest credible roll-up category.

- (b) Determination of category involves grouping materials by type, attractiveness level, and quantity. Material quantities are element weights for plutonium, americium, and neptunium and isotope weights for uranium-235 (U-235) and uranium-233 (U-233). For the purposes of category determination, quantities of plutonium Material Type Code 40 and Material Type Code 50 are combined and considered as one material type. For the purposes of category determination, quantities of americium Material Type Code 44 and Material Type Code 45 are combined and considered as one material type. The Material Types can be found in Tables I and II.
- (4) Less Than Accountable (LTA) quantities of SNM.
 - (a) If the less than accountable quantities of SNM are containerized or put in a single shipment that exceeds an accountable quantity, then the total combined quantity must be within the boundaries of a material balance area (MBA) and be included on the facility's nuclear material inventory.
 - (b) If similar less than accountable items within a location, such as an identified room or building, can cumulatively become an accountable quantity of SNM then an MC&A program must be established. ^{FAQ-8} Sites that possess LTA quantities of SNM must document the technical basis of how this requirement is met in their MC&A plan, if applicable, or alternate document approved by the ODFSA.
- (5) Rounding for Reporting to NMMSS.
 - (a) Both element and isotope weights are reported if they round to a reportable unit. In cases where the element is a reportable unit, but the isotope is not a reportable unit, the material is still to be reported, but for the isotope, enter 0 (zero). See Table III for Rounding, below.

- (b) Quantities reported as shown in Table III for Rounding, below with fractions of one-half or greater of a reporting unit are rounded upwards and fractions of less than one-half of a reporting unit are reported as the number zero (0). Any item that contains nuclear material that rounds to a reportable unit for that nuclear material is accountable.

NOTE: When performing general calculations, do the calculation first before rounding. For software development purposes, sites or facilities may use more significant digits than provided in the tables.

Table III. Rounding

Quantity	Action
Equal to or greater than one-half of the reporting unit ¹	Report to the nearest whole reporting unit
Less than one-half of the reporting unit	Report as 0 (zero) -round down

¹ See NMMSS User Guide for NMMSS reporting units.

Table IV. Graded Safeguards Table

	Attractiveness Level	Pu/U-233 ² Category (kg)				Contained U-235/Separated Np-237/Separated Am-241 and Am-243 Category (kg)			
		I	II	III	IV ¹	I	II	III	IV ¹
WEAPONS Assembled weapons and test devices	A	All	N/A	N/A	N/A	All	N/A	N/A	N/A
PURE PRODUCTS Pits, major components, button ingots, recastable metal, directly convertible materials	B	≥2	≥0.4<2	≥0.2<0.4	<0.2	≥5	≥1<5	≥0.4<1	<0.4
HIGH-GRADE MATERIALS Carbides, oxides, nitrates, solutions (≥25g/L) etc.; fuel elements and assemblies; alloys and mixtures; UF ₄ or UF ₆ (≥50% enriched)	C	≥6	≥2<6	≥0.4<2	<0.4	≥20	≥6<20	≥2<6	<2
LOW-GRADE MATERIALS UF ₄ or UF ₆ (≥ 20% < 50% enriched); Solutions (1 to 25 g/L); process residues requiring extensive reprocessing; Pu-238 (except waste)	D	N/A	≥16	≥3<16	<3	N/A	≥50	≥8<50	<8

	Attractiveness Level	Pu/U-233 ² Category (kg)				Contained U-235/Separated Np-237/Separated Am-241 and Am-243 Category (kg)			
		I	II	III	IV ¹	I	II	III	IV ¹
ALL OTHER MATERIALS Highly irradiated forms, solutions (<1g/L), compounds; uranium containing <20% U-235 or <10% U-233(any form, any quantity)	E	N/A	N/A	N/A	Reportable Quantities	N/A	N/A	N/A	Reportable Quantities

¹The lower limit for Category IV is equal to reportable quantities in this Order.

²In items that contain U-233 and U-235, if the contained U-233 is 10 percent or greater of total uranium by weight, then the effective quantity of U-233 = (Contained U-233 + Contained U-235). The category is then determined by using the effective quantity of U-233 compared with the Pu/U-233 side of the table.

- (6) Directions for determining the material category when multiple material types and attractiveness levels must be considered:
- (a) One Material Type, One Attractiveness Level. Sum the material in the attractiveness level and determine the category from Attachment 2, Chapter I, Table IV, Graded Safeguards Table.
 - (b) One Material Type, Multiple Attractiveness Levels (where a Category III or greater quantity of Attractiveness Level B material is included).
 - 1 Determine the amounts of SNM for materials in each of Attractiveness Levels B, C, and D.
 - 2 Calculate the effective quantity for Attractiveness Levels B and C by multiplying the quantity in Attractiveness Levels B and C by the appropriate factors in Attachment 2, Chapter I, Table V, Factors for Calculating Effective Quantities.
 - 3 Sum the effective amounts in Attractiveness Levels B and C.
 - 4 Compare the total effective amount, as calculated in section 1.d.(6)(b)3 above, to the amounts in Attractiveness Level B from Attachment 2, Chapter I, Table IV, Graded Safeguards Table.
 - 5 Compare the amount of Attractiveness Level D to Attachment 2, Chapter I, Table IV, Graded Safeguards Table.

- 6 The material category is the highest category determined using the procedures in sections 1.d.(6)(b)1 through 1.d.(6)(b)4 or in section 1.d.(6)(b)5 (above).
- (c) One Material Type, Multiple Attractiveness Levels (where less than a Category III quantity of Attractiveness Level B material is included).
 - 1 Determine the amounts of SNM for all attractiveness levels.
 - 2 Compare the total amounts in each attractiveness level to those in Attachment 2, Chapter I, Table IV, Graded Safeguards Table.
 - 3 The material category is the highest category determined using the procedures in sections 1.d.(6)(c)1 and 1.d.(6)(c)2 (above).
- (d) Multiple Material Types.
 - 1 Determine the category for each material type following the above procedures.
 - 2 The final category is the category determined for the individual material type that requires the highest level of protection.

Table V. Factors for Calculating Effective Quantities

Attractiveness Level	Pu/U-233 Factor	Contained U-235/Separated Np-237/Separated Am-241 and Am-243 Factor
B	1	1
C	1/3	1/4

e. Performance Assurance.

- (1) Program Objectives. The MC&A performance assurance program must:
 - (a) Identify MC&A elements and establish monitoring and testing activities to ensure that MC&A program elements are operational and functioning as intended to detect and deter theft or diversion of SNM.
 - (b) Describe all elements of the MC&A performance assurance program in the approved MC&A Plan.

- (2) System Effectiveness. The overall MC&A system effectiveness is evaluated at least annually, or as defined in the MC&A Plan approved by the ODFSA, using a methodology that considers each MC&A program element, its importance to overall system effectiveness, performance, and its interaction with other program elements.
- (3) Internal Review and Assessment (IRA) Program. The IRA program must:
 - (a) Provide assurance that MC&A assets and activities are protected at the required levels through surveys, self-assessments, and program reviews.
 - (b) Provide DOE Federal and contractor line management with information necessary to make informed decisions regarding the allocation of resources, acceptance of risk, and mitigation of MC&A vulnerabilities.
- (4) Performance Testing. Each facility must establish and implement a documented performance testing program per DOE 470.4B, *Safeguards and Security Program*, to verify MC&A system elements are functioning as intended.
 - (a) Each facility must identify MC&A system elements which correspond to those components of the MC&A system that provide the greatest effectiveness against theft and diversion. These elements for testing must be used in the determination of the overall MC&A system effectiveness as applicable.
 - (b) MC&A system elements that must be performance tested are defined in the MC&A Plan. ^{FAQ-9}
 - (c) Each site/facility must define MC&A programmatic Essential Elements in accordance with DOE Performance Assurance Program policy.
 - (d) The MC&A Plan must document the MC&A performance testing program.
 - (e) The MC&A performance testing program must include establishing testing frequency for each system element.
 - (f) Performance test plans must include the system elements tested, type of test (operability or effectiveness), test description/scenario, and clear pass/fail criteria.
 - (g) The results of each test must be documented in accordance with DOE O 470.4, current version.

- (h) Category I and II SNM sites must execute an integrated Safeguards and Security performance test utilizing a scenario which includes MC&A, Protective Force, and Physical Security System elements at least once every 12 months.
- f. Final Disposition of SNM. The site/facility must ensure that SNM transferred for final disposition meets the following conditions:
 - (1) The SNM must have a no programmatic value determination (PVD) approved by the NNSA Defense Programs Office of Tritium and Domestic Uranium Enrichment (for Defense Program material) and Nuclear Materials Integration Division (NMID); or
 - (2) The SNM must not exceed any of the provisions of a NMID approved Site Discard Limit PVD; or
 - (3) The SNM is contained in Normal Operating Losses, which are approved by the ODFSA. For this condition, no PVD is required; or
 - (4) Must be 0.1 percent or less concentration of the SNM in the material form containing it for solids or 1 gram per liter or less concentration for liquids. For this condition, no PVD is required.
 - (5) The SNM meeting the approved discard limit or with no programmatic value must have a measured value and evidence that the nuclear material has remained in a condition that ensures it has not been tampered with (e.g., an intact TID, storage in a location considered to provide assurance of tamper detection, etc.).
 - (6) Prior to final disposition, the SNM meeting the approved discard limit or with no programmatic value may be transferred to a Material Balance Area (MBA) within the site/facility RIS that has been established for predisposition purposes (e.g., predisposition MBA) as described in the Material Accounting section 2.d.(6).
- g. Termination of Safeguards for a Nuclear Material Facility. When the site/facility operator requests termination of safeguards for an SNM facility, the following must be done:
 - (1) The ODFSA must verify that all accountable SNM has been removed from the facility.
 - (2) Ensure that the only remaining SNM is waste or residual holdup that meets the definition of Attractiveness Level E.
 - (3) Ensure that SNM has been written off the accounting record system as a transfer to a waste management RIS or permanent disposal RIS.

h. Anomaly Resolution.

- (1) The MC&A Plan must have documented processes and procedures for identifying and responding to SNM loss indicators, anomalous conditions, failures of performance tests and degradation of system performance.
- (2) Potential or actual incidents or events of MC&A concern are reported to all affected organizations, federal oversight, and the ODFSA in accordance with MC&A Plan and site procedures.

2. MATERIAL ACCOUNTING.

a. Objectives.

- (1) Accounting records are maintained that reflect quantities of SNM inventory. All changes in the inventory are supported by source documentation. Transactions are entered within timeframes documented in the MC&A plan or implementing procedures.
- (2) The accounting system:
 - (a) Provides data and reports on nuclear material to support local, national, and international commitments.
 - (b) Reflects the nuclear material inventory and has controls to ensure data integrity.
 - (c) Provides data for reporting on accountable nuclear material to NMMSS and Nuclear Materials Inventory Assessment (NMIA).
 - (d) Utilizes MBAs as the basis of the accounting structure with key measurement points established to localize and identify IDs.
 - (e) Provides a complete audit trail for all SNM from receipt or production through disposition.
 - (f) Provides the capability to reconcile accounting records to physical inventories.

b. General Requirements.

- (1) Each facility must have a system that provides for tracking SNM inventories, documenting SNM transactions, issuing periodic reports, and assisting with the detection of unauthorized system access, data falsification, and SNM gains or losses.
- (2) The facility must maintain documentation describing the structure and operation of the SNM accounting system.

- (3) The facility must ensure shipments, receipts, transfers, changes in physical form, chemical/isotopic composition, location, and adjustments of the facility SNM inventory are approved and recorded and entered into the accounting system within a defined timeframe approved by the ODFSA.
- (4) The accounting system provides continuity of knowledge for SNM from receipt or production through disposition by maintaining an audit trail that includes documentation of all accounting system entries, including transfers; adjustments, to include technically justifiable estimates; accountability values; the identity of individuals making changes to the accounting system; and the date and time such changes are made.
- (5) Each facility must ensure that only authorized persons have the ability to enter, change, or access material control and accountability data and information.
- (6) SNM in transit at the end of a reporting period is included in the receiver's inventory documentation.

c. Accounting System.

- (1) The Generally Accepted Accounting Principles must be used in the design and operations of the SNM accounting system unless otherwise directed by DOE directives.
- (2) The facility must maintain documentation describing the accounting system, including:
 - (a) Management and operation of the accounting system;
 - (b) Procedures for updating the accounting data and reconciling the accounting data with the results of physical inventories;
 - (c) Description of the required data elements for each applicable material type.
- (3) Data fields used in the SNM accounting system are consistent with Tables I and II and provide information to comply with national and international reporting objectives.
- (4) The accounting system must include checks and balances to deter unauthorized changes to the accounting system.
- (5) Accounting system data is accurate and timely to confirm that a planned movement of SNM would not exceed the approved category and roll-up limits.

- (6) Accounting information is sufficient for calculating shipper/receiver and inventory differences, evaluating their significance, and investigating and resolving significant differences.
- (7) Data integrity is ensured by backing up accountability data at a specified frequency and periodically testing disaster recovery capability.
- (8) The accounting system provides detection capability for data falsification and unauthorized access to the accounting system and source documents.

d. Account Structure.

- (1) At least one RIS is established for the site with an assigned nuclear material representative who is responsible for reporting data to NMMSS.
- (2) A facility must consist of one or more RIS(s) containing one or more Material Balance Areas (MBAs).
- (3) All accountable quantities of SNM at the facility are assigned to an MBA, unless previously terminated in accordance with the DOE policy in place at the time of termination.
- (4) The Material Balance Area account structure:
 - (a) Must provide the capability to localize inventory differences.
 - (b) Must provide a system of checks and balances for verifying the accuracy of the accountability data and records.
 - (c) Must not cross a Material Access Area (MAA) boundary unless measures are in place, supported by a risk assessment approved by the ODFSA, that a Category I quantity remains in the MAA.
 - (d) Must conform to the single geographical area concept unless approved by the ODFSA.
 - (e) Must consist of an integral operation of similar SNM types, processes, or functions.
- (5) Each MBA has an assigned MBA custodian who is responsible for ensuring that material control and accountability policies are implemented in that MBA and key measurement points are defined.
- (6) Sites/facilities may establish Predisposition MBAs for SNM prior to final disposition.^{FAQ-10}

SNM transferred into Predisposition MBAs must meet the following requirements:

- (a) The SNM must have a no programmatic value determination (PVD) consistent with section 1.f.
 - (b) The SNM is accounted for and protected in accordance with waste management policies and all physical protection requirements pursuant to DOE directives.
 - (c) Accountability values for SNM in Predisposition MBAs is maintained and updated in the accounting system to support shipments and reporting to NMMSS.
 - (7) An accountable quantity of SNM recovered during deactivation, decommissioning, or decontamination must be returned to the local MC&A inventory. Accountability values for SNM being returned to the inventory of the site/facility will be established using one of the following methods:
 - (a) Perform an accountability measurement on the SNM and use the value obtained as the accountability value, or
 - (b) Perform research to establish the history associated with the SNM.
 - 1 Verify the accountability value for the SNM at the time of the transfer.
 - 2 Verify that the SNM has remained in a condition that ensures it has not been tampered with (e.g., an intact TID, storage in a location considered to provide assurance of tamper detection, etc.).
 - 3 Return the SNM to the inventory using the value obtained from the historical research.
- e. Records and Reports.
- (1) MC&A SNM records in the accounting system must be updated only by authorized personnel, and the records system must provide an audit trail for all transactions affecting the SNM accounting system.
 - (2) All SNM transactions are supported by source documentation, i.e., records and reports (hard copy or electronic equivalent) that provide a complete audit trail of all inventory transactions and adjustments
 - (3) Accounting system and/or source documentation include the following information for reportable SNM: item identification, material type, form, quantity, measurement method, total measurement uncertainty, attractiveness, location, gross weight, net weight, isotope weight, elements weight and enrichment as defined in the MC&A plan. ^{FAQ-11}

- (4) To meet emergency and special needs, the accounting system is capable of generating a book inventory for SNM within 3 hours.

f. Inventory Adjustments.

- (1) The facility operator must review all inventory adjustments entered in the accounting system.
- (2) Inventory adjustments must be supported by measured values or other technically justifiable basis.

g. Shipper/Receiver Differences.

- (1) Each facility must document the process for evaluating shipper/receiver differences and for investigating and reporting significant shipper/receiver differences.
- (2) Shipper/receiver differences must be resolved according to the terms and provisions of the shipper/receiver agreement if one exists.
- (3) Reported transactions with unresolved or statistically significant shipper/receiver differences for further investigation must be reported to respective ODFSAs and Federal MC&A Program Managers.
- (4) Discrepancies in item count, gross weight, TID integrity and identification must be investigated.
- (5) Shipper/receiver differences must be evaluated using statistical techniques.
- (6) Shipper/receiver difference data must be subjected to trend analysis to detect measurement bias and/or material loss for the same material type between the same facilities.
- (7) The receiving facility must not process SNM contained in a shipment involving an unresolved statistically significant shipper/receiver difference unless a shipper/receiver agreement allowing processing has been approved by the shipping and receiving facilities.
- (8) Resolution of statistically significant shipper/receiver differences must be achieved through one of the following protocols:
 - (a) If either the shipper or receiver agrees to accept the other's value, then the shipper or receiver must prepare a corrected copy of the DOE/NRC Form 741 using the other's data; or
 - (b) If both shipper's and receiver's ODFSAs obtain adequate assurance that the measurements and limits of error are valid, and

the investigation indicates that theft or diversion has not occurred, then each facility may record its own quantitative values; or

- (c) If either the shipper or receiver does not agree to accept the other's value, the issue must be referred to the cognizant ODFSAs for resolution. ^{FAQ-12}

h. Nuclear Materials Management and Safeguards System (NMMSS) Reporting.

- (1) Facilities must report data to the national database, Nuclear Materials Management and Safeguards System (NMMSS). The NMMSS User Guide can be obtained by sending an email request to nmmss@nnsa.doe.gov.
- (2) The facility must maintain procedures for recording, reporting, and submission of data to NMMSS.
- (3) Facilities must ensure that when a reportable quantity of SNM is recovered during deactivation, decommissioning, or decontamination, the recovered SNM will be reported to NMMSS.

3. MATERIAL CONTROL.

a. Objectives. The Material Control program must:

- (1) Detect, assess and deter unauthorized access to SNM.
- (2) Provide loss detection capability for SNM and, when SNM is not in its authorized location, be able to provide accurate information needed to assist in locating the SNM in a timely manner.
- (3) In conjunction with other security program elements, detect, assess, communicate alarms, and respond to unauthorized access or use of SNM and anomalous conditions/events.
- (4) In coordination with security organizations, ensure that protection and controls are applied to SNM according to the attractiveness and quantity of the material.

b. General Requirements. The facility must implement a Material Control program consistent with the graded safeguards concept to ensure that SNM is not removed from an authorized location without approval or timely detection of an unauthorized removal.

- (1) Losses and inventory differences must be localized to an MBA.
- (2) Control measures are in place for SNM in use and in storage that deter, detect, assess and report loss, diversion, or unauthorized activities.

- (3) Transfers of SNM are monitored to prevent exceeding authorized MC&A limits from occurring and exceeding the categorization of the receiving MBA.
 - (4) Item losses or gains must be investigated. If process monitoring is implemented, then process differences that exceed identified thresholds are detected and resolved.^{FAQ-13}
- c. Access Controls. Each facility must have a graded and documented program for controlling personnel access to SNM, MC&A data, equipment and computer systems.^{FAQ-14}
 - (1) SNM Access. Each facility must have a graded program to ensure that access to SNM is limited to authorized individuals performing authorized activities.
 - (2) Information Systems Access. Each facility must have a graded program to ensure that only authorized persons have access to classified and unclassified information systems that contain MC&A data.
 - (3) Data Access. Each facility must have a graded program to ensure that only authorized personnel have the ability to enter, change, or access MC&A data.
 - (a) The facility operator must identify persons that can enter, change, or access MC&A information and data.
 - (b) Procedures are in place to deter and detect personnel with authorized access from performing unauthorized activities, including data falsification or manipulation.
 - (c) Access controls are in place to deter unauthorized personnel from gaining access to MC&A data.
 - (4) Equipment Access. Each facility must have a graded program to control personnel access to data-generating and recording devices, measurement equipment, tamper-indicating devices, and other types of equipment used in MC&A activities and/or provide assurance that the integrity of equipment is maintained.^{FAQ-15}
- d. Material Surveillance. Each facility must establish a graded surveillance program for monitoring SNM, including detecting unauthorized activities or anomalous conditions and for reporting SNM and facility status.
 - (1) Methods. Specific material surveillance methodologies may include:
 - (a) Automated capabilities to detect anomalies and to report alarm conditions.^{FAQ-16}

- (b) Visual surveillance/direct observation to provide assurance that only authorized activities occur and to assess SNM movements or inventory status. ^{FAQ-17}
 - (c) Process logs, inventory records, or other information to indicate anomalies and trigger investigatory actions.
- (2) Category I and II Facilities. The material surveillance program for Category I and II quantities of SNM must ensure that:

- (a) Unauthorized SNM flows and transfers across Material Access Area (MAA) and Protected Area (PA) boundaries are detected.
- (b) Unauthorized SNM flows and transfers across Category I and II MBA boundaries are detected.
- (c) Only authorized and knowledgeable personnel (i.e., individuals who are capable of detecting incorrect or unauthorized actions) must be assigned responsibility for surveillance of SNM.

Ensure that two-person rules or equivalent surveillance is in effect when material is not in secured storage.

- (d) The site/facility must ensure active surveillance of all persons and/or SNM ^{FAQ-18} in secure storage locations at any time the location is not locked and is not protected by an active alarm system.
- (e) Material surveillance must be in place for SNM in use or process.

- (3) Category III and IV Facilities. The material surveillance program for Category III and IV quantities must ensure that when materials are not in locked storage, they are attended, are in authorized locations, and are not accessed by unauthorized persons.

e. Material Containment. Each facility must have a documented program to provide controls for SNM.

- (1) Material Balance Area (MBA). Each facility must have controls to ensure that SNM is used, processed, or stored within an MBA.

Description. The containment program for each MBA must be formally documented and must include the following information:

- (a) Geographical boundaries and functions of each MBA.
- (b) SNM types, forms, and quantities authorized in each MBA.

- (c) Administrative controls for each MBA.
 - (d) MBA Custodian responsibilities for SNM contained within each MBA.
 - (e) Authorized SNM locations consistent with Site Security Plans and SRA/VAs.
 - (f) Personnel authorized to transfer and/or ship / receive SNM.
 - (g) SNM flows into and out of each MBA.
- (2) Category I and II Facilities.
- (a) The containment program for Category I and II MBAs must be documented and describe:
 - 1 Containment controls for normal and emergency conditions.
 - 2 Loss detection capability.^{FAQ-19}
 - (b) Category I MBAs are located within an MAA enclosed within a PA with ingress and egress restricted to defined portals and pathways subject to SNM and personnel controls.
 - (c) Category I MBA boundaries must not cross an MAA boundary unless alternative measures are described in the MC&A Plan.
 - (d) Category II MBAs are located within a PA with ingress and egress restricted to defined portals and pathways subject to material and personnel controls.
 - (e) Category I and II facilities must ensure that two-person rules or equivalent surveillance as approved by the ODFSA is in effect when opening and closing storage areas.
- (3) Category III and IV Facilities.
- (a) Category III MBAs must be located in a Limited Area or higher security area.
 - (b) Category IV MBAs must be located in a Property Protection Area or higher security area.
- (4) Secure Storage and Processing Areas. The facility must have controls for SNM held in secure storage and use/processing areas consistent with the graded safeguards concept and protected in accordance with DOE O 473.1, *Physical Protection Program*, current version.

- (a) The controls for these areas must address:
 - 1 activities and locations for storing SNM
 - 2 control procedures for operating conditions
 - 3 procedures for moving material into or out of the area
 - 4 components used to detect unauthorized activities or conditions
- (b) When not in use or not in process, SNM is stored in an approved secure storage area.
- (c) Containment for secure storage and processing areas in a secure mode must use a combination of barriers, intrusion detection systems, Protective Force checks, and/or administrative controls consistent with the MBA category.
- (d) Secure storage and processing areas for Category I and II SNM must have a records system documenting the individuals who open and secure the area.
- (5) Transfer Controls. The facility must have controls for transferring SNM across MBA boundaries.
 - (a) SNM transferred across MBA boundaries are moved only via authorized pathways and are subject to transfer and confirmation/verification procedures.
 - (b) An MBA custodian must not be responsible for multiple MBAs when transfers of SNM occur between those MBAs unless alternative measures are described in the MC&A Plan.
 - (c) SNM items transferred across an MBA boundary are either tamper-indicating, intrinsically tamper-indicating, or have other approved measures in place to ensure the integrity of the item.

When transferring SNM, an accountability value (either measured value or technically justifiable estimate) is established prior to transfer outside the current security area.
 - (d) Immediately after receipt, shipments must be subjected to a transfer check. Transfer checks must include item count, ^{FAQ-20} TID and container integrity verification and identification. If applicable as described in the MC&A Plan, transfer checks also include confirmation/verification measurements. Transfers involving SNM items that have been produced to program

specifications and are intrinsically tamper-indicating do not require confirmation/verification measurements if approved by the ODFSA.^{FAQ-21} The receiver's measurements for transfers, when required by the ODFSA, must be performed in accordance with the requirements in Table VI, Shipper/Receiver Measurement Requirements.

Table VI. Shipper/Receiver Measurement Requirements

Material Category and Attractiveness Level	Material Confirmation	Verification/Accountability Measurements
IA	3 working days	Shipper's value
IB	5 working days	30 calendar days*
IC, II	10 working days	30 calendar days*
III	10 working days	Shipper's value or verification/accountability measurement
IV	20 working days	Shipper's value or verification/accountability measurement

*30 calendar days or in an alternate timeline documented in the S/R Agreement approved by both the shipping and receiving ODFSA.

- (e) For external transfers, the shipper obtains verification that the intended receiver is authorized to accept the SNM before it is transferred (i.e., Authorization to Ship documentation).
 - (f) Internal transfers of SNM must be independently checked to ensure that the transfer is authorized and that the material being transferred agrees with the transfer documentation and does not exceed the category and roll-up limits of the receiving MBA.
- f. Detection and Assessment. Each facility must have the capability to detect and assess the unauthorized removal of SNM.
 - (1) Tamper-Indicating Devices (TIDs).
 - (a) Facilities must utilize TIDs to the extent practical to detect tampering of containers.^{FAQ-22}
 - (b) TIDs must be maintained under an effective material surveillance program to ensure they are effective indicators of container tampering.
 - (c) Program Elements. The TID control program must have an appointed TID Administrator and implement the following elements:

- 1 Identify personnel responsible for use and control of TIDs and document completion of training requirements (i.e. TID Applicators or TID Custodians).
 - 2 Require TID acquisition and procurement procedures to provide assurance from vendors that TID identifiers are unique and are not duplicated for another customer. ^{FAQ-23}
 - 3 Document types of TIDs and containers on which they are utilized.
 - 4 Document containers or items considered intrinsically tamper-indicating.
 - 5 Maintain chain of custody documentation for each transfer of TIDs upon receipt by the TID Administrator. ^{FAQ-24}
Unused TIDs must be stored in a locked cabinet.
 - 6 Maintain application procedures for each TID type used by the facility for SNM containers.
 - 7 Maintain application records identifying who applied the TID, date of application, who witnessed the application, and the container/item to which it was applied.
 - 8 Maintain the removal and destruction procedures which specify how to render TIDs ineffective and prevent their reuse.
 - 9 Maintain destruction records identifying who removed the TID, date of removal, who witnessed the removal, and the container/item from which it was removed.
- (2) Portal Monitoring. Facilities must conduct routine searches and inspections of all personnel, vehicles, and all hand carried items exiting MAA and PA boundaries to detect the unauthorized removal of metal, SNM, and shielded SNM.
- (a) The systems used for portal monitoring must meet the requirements outlined in DOE O 473.1, current version.
 - (b) The SNM and metal detectors in combination must detect unshielded and shielded test sources per standards approved by the ODFSA.
 - 1 The detection level of the monitors must be based upon detection of a representative SNM in the area and the credible number of removals associated with theft.

- 2 Radiation and SNM detectors must be calibrated using certified reference materials or secondary standards traceable to the national measurement base and revalidated, as necessary.
- 3 All detectors and related calibration standards must be maintained and controlled to ensure that portal monitors are capable of meeting detection requirements.

(3) Process Waste Stream Monitoring.

- (a) All liquid, solid, and gaseous process waste streams leaving an MAA must be monitored for SNM to detect theft or diversion. This does not include sanitary waste streams.
- (b) The detection level of the process waste stream monitors and/or equipment must be based on the detection of the representative SNM product in the area and the credible number of removals associated with theft of a Category I quantity of SNM.

- (4) Daily Administrative Checks. Category I MBAs (or multiple MBAs where roll-up to a Category I quantity of SNM is credible) must implement a facility-specific Daily Administrative Checks (DAC) program documented in the MC&A Plan. The DAC must consist of a general walkthrough of the MBA to detect gross abnormalities.

4. MEASUREMENTS.

a. Objectives.

- (1) The measurements program must provide measured values with uncertainties sufficient to detect theft or diversion of SNM.
- (2) The measurement control program must ensure the quality of measurements made for MC&A purposes.

- b. Program. All facilities possessing SNM must implement measurement and measurement control programs. Measurement programs used to determine Category III or IV inventories of SNM must address the topics set forth in paragraphs 4.c. through 4.f. below, but the specific measurement and measurement control requirements are to be approved by the ODFSA.

- (1) Measurement and measurement control programs must be documented in the MC&A plan.
- (2) The measurement and measurement control programs must have checks and balances to ensure their independence from operations including

separation of responsibilities and duties, used to identify irregularities and detect tampering with nuclear materials. ^{FAQ-25}

- (3) Key Measurement points must be established and documented.
 - (4) Measurement results and measurement uncertainties are determined and reported for each measured value using technically valid methodologies documented in the MC&A plan or flow-down procedures.
 - (5) Documentation of measurement data must be maintained to provide an audit trail from source data to accounting records.
 - (6) Individuals responsible for performing measurements of SNM must be trained and knowledgeable.
 - (a) Each facility will have a documented plan for the training of measurement personnel. The measurement training plan must be reviewed on a frequency identified in the MC&A plan and updated as necessary to reflect changes in measurement technology. The measurement training plan must specify training qualification and requalification requirements for each measurement method.
 - (b) Each facility will have a documented qualification program to ensure that measurement personnel demonstrate acceptable levels of proficiency before performing measurements and that measurement personnel are requalified in accordance with the requirements in the training plan.
 - (c) Personnel that perform measurements of SNM must demonstrate proficiency on a frequency identified in the MC&A plan for each method.
 - (7) MC&A personnel must verify that measurements conducted for accountability purposes, including measurements performed by external entities, comply with MC&A requirements.
- c. Measurement Types. Three types of measurements are used for accountability purposes:
- (1) Accountability measurements must be used to establish initial values for SNM and to replace existing values with more accurate measured values. These measurements must be of sufficient quality consistent with the graded safeguards concept for the highest potential material attractiveness level, and the contribution of the uncertainty of the accountability measurement to the limit of error of the inventory difference (LEID).
 - (2) Verification measurements must be used to validate the accounting system values when necessary, e.g., at time of physical inventory for non-tamper-

indicating items or in response to a security anomaly that could have resulted in a theft or diversion of SNM. Verification measurements used to adjust accounting values must have accuracy and precision comparable to, or better than the original measurement method.

- (3) Confirmation measurements must be used to validate the presence of SNM for transfers, and to determine SNM presence under anomalous conditions. In order to validate SNM presence, a characteristic of the SNM, not just the item, must be measured. However, when an item has been stored under TID protection under a material surveillance program, an item gross weight may be used as a confirmation measurement.

d. Measurement Methods. Each facility must develop, document, and maintain measurement methods for all SNM in inventory, excluding SNM not amenable to measurement ^{FAQ 26}

- (1) Measurement methods must be selected in a manner that the uncertainty of the inventory difference provides the capability to detect both theft and diversion as approved in the MC&A plan
 - (a) All measurement systems used for accountability must be qualified and documented in the MC&A plan or flow-down documents.
 - (b) The methodology for selecting and qualifying a measurement system for accountability use will be documented.
- (2) Qualification. Prior to being used for MC&A measurements, measurement methods must be capable of measuring the material type and form to the required precision and accuracy levels.
 - (a) The measurement program identifies target uncertainties for each MC&A measurement method, referencing national and international sources as applicable.
 - (b) The measurement program defines the methodology, including frequency, by which uncertainties are compared to the target uncertainties and performance is assessed.
 - (c) Each measurement method used for MC&A accountability measurements must be documented in the MC&A plan or flow-down documents.
- (3) Calibration. All measurement methods must be calibrated using certified reference material or secondary standards traceable to the national measurement base and revalidated as necessary.
 - (a) All calibration and working standards must be traceable to the national measurement base using certified reference material and

must have smaller uncertainties associated with their reference values than the uncertainties of the measurement method in which they are used.

- (b) Working standards used for calibration must be representative of the type and composition of the material being measured when the material matrix affects the measured values.
 - (c) Measurement equipment and instrumentation must meet precision and accuracy requirements under normal operating conditions.
- e. Measurement Control. Each facility must develop and implement measurement control programs for all measurement systems used for accountability purposes and obtain random and systematic (accuracy and precision) uncertainties for use in determination of inventory difference control limits and shipper/receiver difference limits of error.

A measurement control program must include the following elements:

- (1) Scales and Balances Program. All scales and balances used for accountability purposes must be maintained in good working condition, recalibrated according to an established schedule, and checked for accuracy and linearity on each day that the scale or balance is used for accountability purposes. ^{FAQ-27}
- (2) Analytical Quality Control. Data from process measurements must be analyzed statistically to ensure each measurement method meets accuracy and precision targets under normal operating conditions.
- (3) Sampling Variability. The uncertainty associated with each sampling method, or combination of sampling and measurement method must be determined and maintained on a current basis and validated periodically. The periodicity of this validation should be documented in the MC&A Plan. ^{FAQ-28}
- (4) Physical Measurements. The uncertainty of volume, temperature, pressure, and density measurements must be determined and validated periodically, as defined in the MC&A Plan.
- (5) Measurement Control Procedures. Each facility must develop documented measurement control procedures for all measurement methods used for accountability. A program must be in place to ensure that measurement control procedures are followed. For measurement control purposes the range of standards must bracket the SNM being measured.
 - (a) For destructive analysis, nondestructive assay, and physical measurements of SNM, performance must be demonstrated on a frequency identified in the MC&A plan.

- (b) Working standards used in a measurement control program must be representative of the type and composition of the material being measured when the material matrix affects the measured values.
- (6) Statistical Controls. For each measurement method used for accountability purposes control limits must be calculated and monitored and documentation must exist that details how to identify and respond to out-of-control conditions.
 - (a) Control limits must be established at the two-Sigma level (warning limits) and three-Sigma level (alarm limits). If two out of three consecutive data points exceed the two-Sigma level, the measurement system in question must not be used for an accountability measurement until the measurement system has been demonstrated to be within statistical control. If a single data point exceeds the three-Sigma level, the measurement system in question must not be used for an accountability measurement until the measurement system has been demonstrated to be within statistical control.
 - (b) For measurement methods relying substantially on operator technique, control limits must include operator-related uncertainties.
 - (c) Statistical control limits must be monitored to ensure that they are consistent with target uncertainties documented in the MC&A plan or flow-down documents.
 - (d) Sources of measurement uncertainties that are the largest contributors to the LEID for a material balance period are identified.
 - (e) Valid and verifiable statistical techniques must be utilized to determine the total random and systematic uncertainties for each measurement system or sampling/measurement system and to determine control limits, rejection limits, and outlier criteria.
- f. Bulk Sampling. For each bulk processing operation, a sampling plan must identify where accountability samples are taken.
 - (1) The sampling plan must be based on technical and statistical principles and must account for material type, measurement requirements, and any special process or operational considerations.
 - (2) For each sampling point, the methodology must be qualified by a documented study that evaluates mixing and sampling techniques to ensure that the sample represents the process material.

- (3) The sampling plan must specify the sampling procedure, number of samples required, size of samples, mixing times and procedure (when applicable), provisions for retaining MC&A archive samples, and estimates of uncertainties associated with the sampling method.
- (4) Sampling procedures must be documented and reviewed on a frequency documented in the MC&A plan or flow-down documents, or whenever changes are made to the sampling process or in material type or composition of the material being sampled.

5. PHYSICAL INVENTORY.

a. Objectives.

- (1) The physical inventory, in conjunction with other MC&A elements, ensures that SNM is in authorized locations.
- (2) The physical inventory program ensures that discrepancies between the physical inventory and the accounting records system are detected and resolved.

b. General Requirements. The facility must implement a physical inventory program for SNM to provide assurance that materials are present in their stated quantities and in authorized locations to detect unauthorized removals or discrepancies.

- (1) The physical inventory program must be documented in the MC&A Plan and/or associated plans and procedures.
- (2) The physical inventory process includes planning/preparation, conduct, and reconciliation.
- (3) The facility must develop, maintain, and adhere to procedures to ensure physical inventories are performed. The procedures must define responsibilities for performing inventories and specify criteria for conducting, verifying, and reconciling inventories of SNM.
- (4) Inventories must be based on measured values except for materials identified as “not amenable to measurement” which may be based on technically justifiable estimates.
- (5) When other nuclear materials are credible substitution materials for SNM and are collocated with SNM, facilities must inventory substitution materials with the same frequency as the SNM and use inventory measurement methods that can distinguish between SNM and other nuclear material. ^{FAQ-29}
- (6) Physical inventories of SNM must be conducted at frequencies commensurate with the category and operations conducted in each MBA

in accordance with Table VII, Physical Inventory Periods or as documented in the MC&A plan. The ODFSA can specify a less or more frequent inventory, based on the scope and nature of processing conducted in MBAs.

Table VII. Physical Inventory Periods ^{FAQ-30}

Category	Processing MBA	Storage MBA
I	2 months	6 months
II	2 months	6 months
III	6 months	2 years
IV	2 years	2 years

- (7) Inventory periods for Category I and II storage MBAs may be extended using alternative measures specified in Table VIII and documented in the MC&A plan.

Table VIII. Inventory Periods Based on Alternative Measures for Category I and II Storage Locations

Alternative Inventory Control Measures ¹	Inventory Period
Formidable barriers	1 year
Hazardous environment	1 year
Bulk containment	1 year
Vault enhancement above baseline requirements	9 months
Continuous monitoring of physical or mechanical parameters	1 year
General (area-wide) confirmatory measurements	1 year
Continuous item observation ² (e.g., video/image, laser surveillance)	2 years
Continuous item monitoring ² (e.g., monitoring of serial number, TIDs, movement)	2 years
Mass ² (load cell)	2 years
Confirmatory measurements ² on individual items (e.g., thermal, gamma, or neutron emission)	3 years
Quantitative measurements on individual items	May qualify as a continuous inventory ²

¹When multiple measures are used for storage MBAs, the inventory periods are additive as long as the alternative measures function independently.

²If the measurements are both item- and material-specific and there is a level of confidence that the measurements are correct, the monitoring may qualify as a continuous physical inventory. To be considered a continuous physical inventory, automated measurements must be made on all items on a second-to-second basis.

- (8) In processing areas where process controls provide equivalent levels of theft and diversion detection, physical inventories may be performed upon completion of the material campaign. In such cases, the ODFSA must approve the campaign plan.
- (9) For Category I and Category II processing locations where MC&A Plan approved process monitoring and item monitoring programs independent of operations are in place, the inventory period can be extended to six months. ^{FAQ-31}

c. Periodic Physical Inventories.

- (1) Planning and Preparation. The facility must ensure that the following requirements are met before the physical inventory is conducted:
 - (a) Physical inventory procedures are documented.
 - (b) SNM quantities entered in the book inventory (accountability values) are based on measured values except for materials identified as “not amenable to measurement” which may be based on technically justifiable estimates.
 - (c) The facility is prepared for a physical inventory per the MC&A Plan and/or associated documentation:
 - 1 Bulk materials undergoing processing operations are placed in measurable forms, configurations, and locations.
 - 2 Holdup locations are identified.
 - 3 Materials identified as “not amenable to measurement” may be based on the shipper’s values or technically justifiable estimates.
 - 4 Credible substitution materials collocated with SNM are identified.
 - 5 Statistical sampling plans, if used, are documented in the MC&A plan or flow-down documents. If statistical sampling plans are used for both item identification/ location and verification measurements, the statistical sampling plans must be independent.
 - 6 A physical inventory cutoff time has been established after which there is no SNM movement into or out of the MBA

unless otherwise documented in the MC&A plan or flow-down documents.^{FAQ-32}

- (2) Conduct. Physical inventories are performed at the end of a designated inventory period to determine whether or not SNM recorded in the accounting system are present.^{FAQ 33} All areas in the MBA are assessed to ensure that there are no materials present that are not reflected in the book inventory.

The facility must ensure that the following requirements are met during the conduct of the physical inventory:

- (a) The physical inventory must comprise a comparison of materials physically present in the MBA to the accounting system (book inventory).
- 1 The physical inventory procedure must utilize trained and qualified two-person inventory teams for conduct of physical inventory. For Category IV MBAs an alternative method can be approved in the MC&A Plan by the ODFSA.
 - 2 The physical inventory procedure must be based on a validation between the book inventory and the physical inventory. This can be accomplished by utilizing a book inventory list generated by the accounting system which is compared to the physical inventory or the physical inventory can be documented during the inventory and then compared to the accountability records.
 - 3 The physical inventory procedure must verify, at a minimum:
 - a Item/container identification numbers and locations
 - b Item/container integrity, where applicable
 - c TID serial numbers and locations, where applicable
 - d TID integrity, where applicable
- (b) The physical inventory procedure must include performance of a systematic inspection of the entire MBA to ensure all materials are identified. The systematic walk through must include potential storage areas.
- (c) Verification measurements must be performed on all items that are not intrinsically tamper-indicating or sealed with a TID. For sites

that deal with a large number of SNM items without a TID applied, threshold quantities may be established with ODFSA approval and documented in the MC&A Plan.

- (d) The ODFSA may approve confirmation measurements of two material attributes for SNM items that are not tamper-indicating and not amenable to verification measurement.
- (e) Holdup inventory must be measured and entered into the accounting system, where feasible, or estimated on the basis of throughput, process data, modeling, engineering estimates, or other technically justifiable factors during periodic physical inventories for facilities with Category I, II, and III quantities of SNM. The method, justification, and supporting documentation must be included in the MC&A Plan and/or associated documents.
- (f) In lieu of a 100 percent item inventory, a statistical sampling plan may be defined by the facility and approved by the ODFSA.
 - 1 The plan must use the confidence levels and minimum detectable defects as defined in Table IX, Minimum Sampling Parameters for Physical Inventories, unless justified in the MC&A plan and approved by the ODFSA.
 - 2 The population of items in each MBA is stratified as defined in the sampling plan.
 - 3 Acceptance/rejection criteria are established and documented in the MC&A Plan and/or associated documents for both item inventories and measurements.
 - 4 The statistical sampling plan must state how inventories or measurements that fail the criteria are resolved.

Table IX. Minimum Sampling Parameters for Physical Inventories

Category	Confidence Level	Minimum Detectable Defect
I	95%	3%
II	95%	5%
III & IV	95%	10%

- (3) Reconciliation. The physical inventory reconciliation program provides assurance that all SNM has been accounted for and that the facility's record system reflects the physical inventory. The facility must ensure that the following requirements are met during the reconciliation of the physical inventory with the following activities:

- (a) Comparison of Accounting System data with physical inventory observed data, as documented in the MC&A Plan.
- (b) Verification that all receipts and shipments were properly documented and reflected in the Accounting System.
- (c) Calculation of the Inventory Difference (ID) and uncertainty of the inventory difference for SNM material types by MBA. To detect protracted theft or diversion, an ID trend analysis of cumulative IDs over multiple inventory periods must be conducted following each periodic physical inventory.
 - 1 The facility must establish Inventory Difference Control Limits.
 - 2 Control limits for inventory differences must be based on variance propagation using current data. The data should reflect operating conditions for the material balance period of the inventory. Alternatively, other statistically valid techniques may be used but must be justified on the basis of factors such as limited data, low transfer rates, categories, and major process variations. Alternative methodologies must be documented in the MC&A Plan and approved by the ODFSA. ^{FAQ-34}
 - 3 Warning limits must be set at plus or minus two standard deviations. The Limit of Error of the Inventory Difference (LEID) is defined as two times the standard deviation of the inventory difference.
 - 4 Alarm limits must be set at 3 times the standard deviation.
 - 5 The ODFSA must establish an LEID performance metric for Category I and II facilities.
 - 6 Assessments of inventory differences must include statistical tests (e.g., tests of trends and biases), and must be applied, as appropriate, to the actual inventory difference on an individual and cumulative basis for each processing Material Balance Area by SNM material type.
 - 7 IDs must be evaluated for trends over time using a documented and approved statistical methodology to determine if trend limits were exceeded. Trends exceeding limits must be documented, reported to the Field Element and investigated.

- (d) The steps for evaluation and resolution of all SNM inventory differences exceeding control limits, including those involving missing items, are documented in the MC&A Plan.

All inventory differences exceeding warning or alarm limits must be documented, reported to the Field Element, and investigated unless the ODFSA approves a threshold limit. Establishment of such threshold limits must be based on facility specific characteristics. ^{FAQ-35}

- (e) Inventory reconciliation is completed after the inventory taking is complete, and following receipt of all inventory information, measurement data, and sample analyses.

- 1 Unless approved by the ODFSA, MBA operations must not resume until reconciliation is complete and the inventory difference is within approved control limits.

- 2 The ODFSA may approve a protocol for release of subsets of the inventory prior to reconciliation of the entire MBA subject to the following controls:

- a Subsets of inventory subject to release must be formally defined and must belong to a single Subsidiary MBA (sub MBA).

- b Process Monitoring program must be established and approved by the ODFSA for each subset of inventory subject to release, including all transfers between subsets as applicable.

- c Release must be contingent upon the fact that process monitoring data for the inventory period does not indicate any unresolved anomalies.

- d SNM released prior to MBA reconciliation must always remain in a configuration which facilitates analysis and remeasurement until the MBA reconciliation is complete.

- e Process controls (physical or administrative) must be established to prevent inadvertent release of SNM prior to verification of these release controls.

- f SNM which are released must remain in their original MBA until reconciliation is complete.

- g Additional SNM may not be introduced into the MBA until reconciliation is complete.

- d. Special Inventories. At each facility, management must establish and implement procedures for conducting special inventories. These inventories differ from periodic inventories in that they are performed to address objectives that may not include all elements of periodic inventories. Based on the scope, the ODFSA may approve the special inventory to serve as the periodic scheduled physical inventory.

Special Inventories may be conducted to support:

- (1) Routine disassembly of critical assemblies
 - (2) Turnover of primary MBA Custodian duties from one individual to another
 - (3) Resolution of Inventory Differences exceeding established control limits, including missing items
 - (4) Anomaly resolution
 - (5) Request of authorized personnel
 - (6) Transition of contractor responsibility
 - (7) Performance Testing during assessments and surveys
- e. International Atomic Energy Agency Inventories. Physical inventories performed during International Atomic Energy Agency Physical Inventory Verification may, with the concurrence of the ODFSA, serve in place of a scheduled physical inventory.

ATTACHMENT 2
CHAPTER II. OTHER ACCOUNTABLE NUCLEAR MATERIAL (OANM)

1. PROGRAM MANAGEMENT.

a. Objectives. The program:

- (1) Ensures that documentation is sufficient to maintain a comprehensive, effective, and cost-efficient program to account for and report OANM; this is included in the MC&A Plan or in an OANM Plan if the site does not possess SNM. Nuclear materials that are to be controlled and accounted for as SNM (see Attachment 2, Chapter I, Table II) must be in the MC&A Plan.
 - (a) Federal and Contractor Site/Facility Operators responsible for the management and/or operation of a site/facility possessing OANM must comply with the following requirements.
 - 1 Ensures that documentation is sufficient to maintain a comprehensive and effective accounting and reporting system.
 - 2 Develop, implement and maintain an ODFSA approved MC&A Plan or OANM Plan (for facilities without SNM) that includes provisions for accurate OANM inventory information and any additional direction provided by the ODFSA.
 - 3 Identify MC&A responsibilities and authorities for each relevant organization at the site/facility:
 - a Persons responsible for each MC&A function must have authority to implement their responsibilities.
 - b A management official responsible for the control and accountability of nuclear materials must be designated for each facility.
 - c A Nuclear Materials Representative responsible for nuclear material reporting and data submission to the Nuclear Materials Management and Safeguards System must be designated for each facility having a Reporting Identification Symbol.
- (2) Training. Each facility is required to have an organization with trained and qualified personnel who administer and oversee MC&A functions at the facility.

- (a) Requirements for MC&A training are established to meet Department requirements (DOE O 470.4, current version) and ensure that personnel with MC&A functions are trained and knowledgeable of their duties and responsibilities.
 - (b) Job Task Analyses or equivalent must be performed for each MC&A function. ^{FAQ-5}
 - (c) The MC&A training plan must define required initial training and re-qualification or re-training needs and schedules required for each MC&A function based on job task analyses or equivalent.
 - (d) The MC&A training plan must be reviewed annually and updated as necessary.
- (3) Final Disposition of Other Accountable Nuclear Material (OANM). Prior to final disposition of OANM, the site/facility must ensure a no programmatic value determination (PVD) is approved by the Nuclear Materials Integration Division (NMID) for the applicable OANM or ensure approved discard limit per NMID for applicable materials.
- b. Other Accountable Nuclear Material. Other Accountable Nuclear Material in Table X below must be accounted for and reported in accordance with Chapter II of this Order.
 - (1) Depleted Uranium (DU) is required to be accounted for and reported at the 1 kilogram level if it is:
 - (a) foreign obligated;
 - (b) owned by the weapons program (unless for developmental purposes see footnote 1 of Table X);
 - (c) has been imported; or
 - (d) has been exported.
 - (2) If DU does not meet the conditions in 1.b.(1)(a-d) above, then the DU is not accountable. If DU is considered as a credible substitution material for SNM, then see Attachment 2, Chapter I, Sections: 1. Program Management, and 1.d. Graded Safeguards, for requirements.

Table X. Other Accountable Nuclear Material ^{FAQ-36}

Material Type	Reportable/Accountable Quantity	Weight Field Used for Element	Weight Field Used for Isotope	Material Type Code
Depleted Uranium (DU)	1 kilogram ¹	total U	U-235	10
Normal Uranium (NU)	1 kilogram	total U	-	81
Curium (Cm)	1 gram	total Cm	Cm- 246	46
Deuterium ^{2,4} (D)	100 kilograms ³	D ₂ O	D ₂	86
Enriched Lithium (Li)	1 kilogram	total Li	Li-6	60
Thorium (Th)	1 kilogram	total Th	-	88
Tritium ⁵ (H-3)	1 gram	total H-3	-	87

¹ For process development with DU, the accountable quantity is at value of 50 kilograms.

² For deuterium in the form of heavy water, both the element and isotope weight fields will be used; for deuterium gas, report isotope weight only.

³ For weapon components with Deuterium the accountable quantity is 1/10 kilogram.

⁴ Deuterium and deuterium compounds are subject to export control requirements in 10 CFR 110.24 and 10 CFR 110.54 (a)(1).

⁵ Tritium contained in water (H₂O or D₂O) used as a moderator in a nuclear reactor is not an accountable material.

(3) Rounding for Reporting to NMMSS.

- (a) Both element and isotope weights are reported if they round to a reportable unit. In cases where the element is a reportable unit but the isotope is not a reportable unit, the material is still to be reported, but for the isotope, enter 0 (zero). See Table XI for Rounding, below.
- (b) Quantities reported as shown in Table XI for Rounding, below with fractions of one-half or greater of a reporting unit are rounded upwards and fractions of less than one-half of a reporting unit are reported as the number zero (0). Any item that contains nuclear material that rounds to a reportable unit for that nuclear material is accountable.

NOTE: When performing general calculations, do the calculation first before rounding. For software development purposes, sites or facilities may use more significant digits than provided in the tables.

Table XI. Rounding

Quantity	Action
Equal to or greater than one-half of the reporting unit ¹	Report to the nearest whole reporting unit
Less than one-half of the reporting unit	Report as 0 (zero) -round down

See NMMSS User Guide for NMMSS reporting units.

2. MATERIAL ACCOUNTING. Objectives:

- a. Accurate records of OANM inventory are maintained and transactions and adjustments are made on a RIS level in a timely manner, as identified in the OANM or MC&A plan. ^{FAQ 37}
- b. The accounting system:
 - (1) Provides data for reporting on OANM at the RIS level sufficient to support local, national, and international commitments.
 - (2) Must accurately reflect the OANM inventory and have sufficient controls to ensure data integrity.
 - (3) Provides data and reports on OANM to NMMSS and Nuclear Material Inventory Assessment (NMIA); and
 - (4) Provide a complete audit trail for all OANM from receipt through disposition. ^{FAQ -38}

3. REPORTING TO NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM (NMMSS).

- a. Facilities must report data to the national database, NMMSS. The NMMSS User Guide can be obtained by sending an email request to nmmss@nnsa.doe.gov.
- b. The facility must maintain procedures for recording, reporting, and submission of data to NMMSS.
- c. Facilities must ensure that when a reportable quantity of OANM is recovered during deactivation, decommissioning, or decontamination, the recovered OANM will be reported to NMMSS.

ATTACHMENT 3 DEFINITIONS AND ACRONYMS

This Attachment provides information associated with DOE O 474.2A as well as information applicable to contracts in which the associated CRD (Attachment 1 to DOE O 474.2A) is inserted.

1. Accountability Measurements. A quantitative measurement of the amount of nuclear material in an item or location made to establish initial book values for the material or to replace the existing book value with a more accurate measured value.
2. Accountable. Subject to the requirements of DOE MC&A policy.
3. Accountable Nuclear Material. All nuclear materials which are listed in Attachment 2, Chapters I and II, Tables I, II, and X. These materials differ in protection strategy and are reported electronically to the Nuclear Materials Management and Safeguards System (NMMSS).
4. Attractiveness Level. A grouping of special nuclear material types and compositions that reflects the relative ease of processing and handling required to convert that material to a nuclear explosive device.
5. Book Inventory. A book inventory for a given material balance area (MBA) is the list of information on material in the accountability system for that MBA at the time the list is generated (snapshot).
6. Categorization. The process of assigning a category designation to a building, area, item, or group of items based on the attractiveness level and quantity of the SNM present.
7. Collocated. Located within the same MBA or other geographic location as defined in the MC&A plan.
8. Confirmation Measurement. A qualitative or quantitative measurement made to confirm the presence of SNM in an item by testing whether some attribute or characteristic of the nuclear material in the item is consistent with the expected attribute or characteristic of the material. The measurement method used for confirmation measurements must be capable of determining the presence of a specific attribute of the material, consistent with valid acceptance, and rejection criteria.
9. Container. An object that can be used to hold or transport material.
10. Credible Substitution Material. Material that can be successfully used for theft and diversion in place of accountable SNM. Substitution is possible because one or more physical properties is shared by the substitution material and the SNM.

11. Daily Administrative Check (DAC). The DAC is a general walkthrough of a Category I MBA (or multiple MBAs where roll-up to a Category I quantity of SNM is credible) to detect gross abnormalities.
12. Documented in the Nuclear Material Control and Accountability (MC&A) Plan. Relevant information explicitly stated or included by reference to an ancillary document.
13. Facility. A facility consists of one or more security interests under a single security management responsibility or authority and a single facility security officer within a defined boundary that encompasses all the security assets at that location. A facility operates under a security plan that allows security management to maintain daily supervision of its operations, including day-to-day observations of the security program.
14. Field Elements. A term that includes operations offices, field offices, site offices, service centers, project management offices, area offices, and regional offices of federally staffed laboratories.
15. Highly Irradiated. Material sufficiently radioactive to ensure a high probability of failure of task(s) by an adversary. The determination of high probability of failure of task(s) must be coordinated with the sites risk assessment and/or other assessments performed by the site.
16. Inventory Difference (ID). The arithmetic difference between a book inventory and the corresponding physical inventory calculated by subtracting ending inventory (EI) from the combination of beginning inventory (BI) plus additions to inventory (A) minus removals from inventory (R). Mathematically, this can be expressed as:
$$ID = BI - EI + A - R.$$
17. Key Measurement Point. A location where nuclear material appears in such a form that it may be measured to determine material flow or inventory. This includes: 1) inputs and outputs for material balances areas, 2) measured discards, 3) locations in the process where accountability values are determined, and 4) holdup locations.
18. Material Balance Area (MBA). Used to identify the location and quantity of SNM and collocated credible substitution material in the facility. An area that is both a subsidiary account of materials within the accounting system at a facility and a specified geographical area that has defined boundaries.
19. Material in Process. Material that is undergoing an operation that changes the physical and/or chemical characteristics of an item (ex. splits/separates, dissolution, mechanical separation, etc.).
20. Material in Storage. Material in locked and alarmed (as applicable) storage location.
21. Material in Transit. Any material that is being transferred to another material balance area or to another reporting identification symbol (RIS). The material does not reside in an authorized location on-site.

22. Material in Use. Material out of locked and alarmed (as applicable) storage and not in process.
23. Not Amenable to Measurement. Material where the size, configuration, or characteristics of the nuclear material are such that a quantitative/qualitative measurement with acceptable precision and accuracy is not possible with measurement equipment and techniques that are commercially available and cost effective. Limited processing to obtain an accountability measurement is permitted, provided it is approved by the ODFSAs for both the shipper and receiver.
24. Nuclear Material.
 - a. All material so designated by the Secretary of Energy. At present, these materials are depleted uranium, enriched uranium, americium-241, americium-243, curium, plutonium 238, Plutonium-239-241, Plutonium-242, lithium-6, uranium-233, normal uranium, neptunium 237, deuterium, tritium, and thorium.
 - b. SNM, byproduct material, or source material as defined in 42 U.S.C. 2014 (aa), (e), and (z) [Sections 11(aa), (e), and (z), respectively, of the Atomic Energy Act of 1954 as amended], or any other material used in the production, testing, use, or assembly of nuclear weapons or components of nuclear weapons that the Secretary of Energy determines to be nuclear material in accordance with 10 CFR 1017.9.
25. Nuclear Materials Management and Safeguards System (NMMSS). The national database and information system for nuclear material controlled by the Government and created to support national safeguards and management objectives in the domestic and foreign use of nuclear resources.
26. Officially Designated Federal Security Authority (ODFSA). ODFSAs are Federal employees who possess the appropriate knowledge and responsibilities for each situation to which they are assigned through delegation. Delegation authority for these positions is originated according to direction from the accountable Program Secretarial Officer (or the Secretary or Deputy Secretary for Departmental Elements not organized under a Program Secretarial Office), who also provides direction for which of the ODFSA positions may be further delegated. Each delegation must be documented in written form. It may be included in other security plans or documentation approved by or according to direction from the accountable principal. Each delegator remains responsible for the delegate's acts or omissions in carrying out the purpose of the delegation.
27. Other Accountable Nuclear Material. In this Order, refers to nuclear material other than SNM that are listed in Attachment 2, Chapter II, Table X, OANM.
28. Predisposition MBA. Material Balance area containing material awaiting final disposition shipment onsite that has detailed requirements found in this Order. (Attachment 2, Chapter I, 2.d.(6))

29. Reportable. Subject to reporting to the Nuclear Materials Management and Safeguards System.
30. Site. One or more facilities operating under a centralized security management, including a site security officer with consolidated authority and responsibility for the facilities, and covered by a site security plan that may consolidate or replace, wholly or partially, individual facility plans.
31. Site/Facility Operator. The corporate or governmental entity responsible for the day-to-day operations involving storage, processing, or use of nuclear material at the site/facility. For contractor-operated facilities, this refers to the site/facility contractor. For DOE-operated facilities, this refers to the DOE organization operating the facility.
32. Special Nuclear Material. For this Order are defined as plutonium, uranium-233, uranium enriched in the isotope 235, and any other material which, pursuant to 42U.S.C. 2071, Determination of Other Material as SNM (Section 51, as amended, of the Atomic Energy Act of 1954), has been determined to be SNM, but does not include source material; it also includes any material artificially enriched by any of the foregoing, not including source material. These materials are listed in Attachment 2, Chapter I, Table I, SNM.
33. Subsidiary Material Balance Accounts (sub MBA). Accounts established within a MBA to provide for a more detailed accounting of SNM and collocated credible substitution material and to allow for further localization of inventory differences within the MBA.
34. Tamper-Indicating Device (TID). A device that may be used on items such as containers and doors, which because of its uniqueness in design or structure, reveals violations of containment integrity. These devices on doors (and fences) are more generally called security seals.
35. Verification Measurement. A quantitative re-measurement of the amount of nuclear material in an item made to verify the quantity of nuclear material present. Verification measurements, when used to adjust accountability records, must have accuracy and precision comparable to, or better than, the original measurement method.

ATTACHMENT 3
DEFINITIONS AND ACRONYMS
ACRONYMS

ATL	Attractiveness Level
CAT	Category
CFR	Code of Federal Regulations
CRD	Contractor Requirements Documents
DAC	Daily Administrative Checks
DBT	Design Basis Threat
DEAR	DOE Acquisition Regulation
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DU	Depleted Uranium
EHSS	Office of Environment, Health, Safety and Security
FAQ	Frequently Asked Question
G	Guide
IAEA	International Atomic Energy Agency
ID	Inventory Difference
IRS	Internal Review and Assessment
LA	Limited Area
LLW	Low-Level Waste
M	Manual
MAA	Material Access Area
MBA	Material Balance Area
MC&A	Nuclear Material Control and Accountability
NMIA	Nuclear Material Inventory Assessment

NMID	Nuclear Materials Integration Division
NMMSS	Nuclear Materials Management and Safeguards System
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
NU	Normal Uranium
O	Order
OANM	Other Accountable Nuclear Material
ODFSA	Officially Designated Federal Security Authority
P.L.	Public Law
PA	Protected Area
PIR	Policy Information Resource
PVD	Programmatic Value Determination
RA	Risk Assessment
RIS	Reporting Identification Symbol
S&S	Safeguards and Security
SNM	Special Nuclear Material
SRA	Security Risk Assessment
SSIMS	Safeguards and Security Information Management System
Sub MBA	Subsidiary Material Balance Area
TID	Tamper-Indicating Device
TRU	Transuranic
VA	Vulnerability Assessment