

U.S. Department of Energy
Washington, D.C.

ORDER

DOE O 474.1

Approved: 8-11-99
Sunset Review: 8-11-01

SUBJECT: CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS

1. **OBJECTIVES.**

- a. To prescribe Department of Energy (DOE) requirements for nuclear material control and accountability (MC&A) for DOE-owned and -leased facilities and DOE-owned nuclear materials at other facilities which are exempt from licensing by the Nuclear Regulatory Commission (NRC).
- b. To establish DOE M 474.1-1, MANUAL FOR CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS, which provides detailed requirements for implementing an MC&A program.

2. **CANCELLATION.** DOE 5633.3B, CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS, dated 9-7-94. Cancellation of this Order does not in itself modify or otherwise affect any contractual obligation to comply with DOE 5633.3B, which remains in effect until such contract is modified to delete reference to DOE 5633.3B.

3. **APPLICABILITY.**

- a. **General.** This Order applies to nuclear materials at DOE-owned and -leased facilities and DOE-owned nuclear material at other facilities which are exempt from licensing by the NRC.
- b. **Contractors.** Except for the exclusions in Paragraph 3c, any contractor who possesses, uses, or ships nuclear materials at DOE-owned or -leased facilities or possesses, ships, or uses DOE-owned nuclear material at other facilities exempt from NRC licensing and regulation must follow the Contractor Requirements Document (Attachment 1) to the extent its provisions are incorporated into a contract.
- c. **Exclusions.** This Order does not apply to DOE-owned nuclear materials at Department of Defense facilities or foreign facilities. To avoid duplicative or conflicting requirements, DOE facilities, projects, and programs under the cognizance of the Office of Civilian Radioactive Waste Management and/or subject to NRC regulation must use the requirements specified by the NRC or NRC Agreement State in lieu of this Order.

DISTRIBUTION:

All Departmental Elements

INITIATED BY:

Office of Nonproliferation
and National Security

- d. Deviations. Deviations from requirements prescribed by this Order must be processed in accordance with DOE O 470.1, SAFEGUARDS AND SECURITY PROGRAM.
- 4. REQUIREMENTS. DOE M 474.1-1 contains detailed requirements for control and accountability of nuclear materials covered by this Order.
 - a. Program Administration.
 - (1) Each facility must control and account for nuclear materials subject to this Order according to the strategic and monetary importance of the nuclear materials and the consequence of their loss. MC&A programs must deter and detect theft and diversion of nuclear material by both outside and inside adversaries.
 - (2) Planning for MC&A must address theft and diversion of special nuclear material (SNM) and the unauthorized control of a weapon, test device, or improvised nuclear device, where appropriate. Planning must also consider the potential for an insider threat, as detailed in *Design Basis Threat for Department of Energy Programs and Facilities (U)*, issued by the Office of Security Affairs (NN-50).
 - (3) DOE must consider MC&A requirements, systems, and technologies in the planning, design, construction, and operation of new or renovated DOE facilities. DOE must use techniques and equipment that maximize material loss detection sensitivity, increase the quality of accountability measurements, and reduce the magnitude of inventory differences and associated control limits.
 - (4) Each facility must conduct a performance testing program to verify MC&A procedures and practices and demonstrate that material controls are effective.
 - (5) MC&A measures must facilitate, to the extent practical, cost-effective integration of the operational mission of the program with environmental, health and safety, and physical protection considerations.
 - (6) MC&A systems must help prevent radiological and/or toxicological sabotage involving nuclear materials that could adversely affect national security, the health and safety of employees, the public, or the environment.
 - (7) MC&A programs must, unless excluded by provisions of implementing treaties and agreements, facilitate the development and implementation of foreign country and International Atomic Energy Agency safeguards systems.

- (8) Nuclear materials or equipment supplied to nations or persons abroad must be subject to measures designed to ensure that they are used for official purposes only, pursuant to an agreement for cooperation or other understanding with the United States.

b. Materials Accountability. Nuclear materials accountability programs must ensure that all nuclear materials are accounted for and that unauthorized acts are detected.

- (1) Accounting Systems. Nuclear material accounting systems must provide:

- (a) accurate nuclear materials information relating to receipts, transfers, inventories, and shipments sufficient to establish a complete audit trail from receipt through disposition and
- (b) accountability and control data in a timely and uniform manner as required for submission to the Nuclear Material Management and Safeguards System (NMMSS), the national nuclear materials data base.

- (2) Physical Inventories. Each facility must implement a nuclear material physical inventory program to demonstrate that materials are present in their stated quantities and to detect when unauthorized removals have occurred.

- (a) Each facility must perform periodic and special physical inventories according to the strategic importance of the material and the consequence of its loss.
- (b) Each facility must investigate differences between accounting records and physical inventory results to determine the cause. Accounting records must be updated and corrected based on results of physical inventories.

- (3) Measurement and Measurement Control. Each facility must implement graded nuclear material measurement and measurement control programs to establish and verify inventory quantities and to ensure the quality and reliability of the measurement data.

- (a) Each facility must be capable of measuring all nuclear materials in inventory, except for those documented as not amenable to measurement.
- (b) Measurement systems used for accountability purposes must be precise and accurate enough to minimize the contribution of measurement error to the limit of error of the inventory difference.
- (c) All measurement systems used for accountability purposes must have associated measurement control programs to ensure the quality of measurement data generated.

- (4) Material Transfers. Each facility must implement programs to control and account for nuclear materials during both internal and external transfers.
 - (a) External transfers of nuclear material must be documented on DOE/NRC Form 741 or other documentation approved by the cognizant operations office.
 - (b) Each facility must implement a graded system of measurements and records to monitor internal and external transfers of nuclear material and to deter/detect unauthorized removal of material during such transfers.
 - (c) When required, receiver's accountability measurements on external transfers must be performed in a manner that provides data as stipulated in DOE M 474.1-1, Table II-2.
- (5) Material Control Indicators. Each facility must be capable of detecting losses through evaluation and assessment of shipper-receiver differences, inventory differences, and other inventory adjustments.
- (6) Reporting to NMMSS.
 - (a) DOE Elements and contractors must document to NMMSS all nuclear materials transactions, material balances, and inventories in accordance with the instructions provided in DOE M 474.1-2, NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM REPORTING AND DATA SUBMISSION. The national data base must provide nuclear materials information relating to safeguards, materials management and production, inventory quantities and valuations, and other programs requested or required by DOE or NRC.
 - (b) Forms identified and described in DOE M 474.1-2, (or equivalent forms approved by the cognizant Field Element) must be used to document and report nuclear materials transactions, material balances, and inventories in accordance with the specific procedures contained in DOE M 474.1-2, Chapters I-X. A computer-generated form or other approved equivalent must contain all information necessary for proper documentation and reporting of nuclear materials transactions, material balances, and inventories, as appropriate.
 - (c) DOE M 474.1-2 contains detailed instructions for the transfers of nuclear material between the United States and foreign nationals, foreign regional organizations, or supranational organizations.

- (d) The national data base serves as the centralized reporting facility to provide the information required under the provisions of the U.S. IAEA Safeguards Agreement. DOE M 474.1-2 contains specific reporting and data submission procedures for facilities selected under the provisions of the U.S./IAEA Safeguards Agreement.
- c. Material Control. Nuclear material control programs must control nuclear materials sufficient to prevent or deter loss or misuse.
 - (1) Access Controls. Each facility must provide appropriate personnel access controls to nuclear materials, associated data, data-generating equipment, and other items or equipment where misuse could compromise the safeguards system.
 - (2) Material Surveillance. Each facility must provide materials surveillance programs to ensure that nuclear materials are in their authorized location and to detect anomalous nuclear material activities and conditions.
 - (3) Material Containment. Each facility must ensure that nuclear materials are used, processed, or stored in areas with appropriate physical and/or accounting controls.
 - (4) Detection and Assessment. Each facility must provide localized detection and assessment of unauthorized removals of nuclear materials within specified time limits and must notify appropriate response organizations.

5. RESPONSIBILITIES.

- a. Heads of Headquarters Elements.
 - (1) Provide oversight for the implementation of MC&A for all DOE activities under their jurisdiction in conformity with the requirements, procedures, and planning set forth in the DOE 470 series of directives and set requirements and procedures for nuclear materials not specifically covered in the DOE 470 series.
 - (2) Ensure that responsibilities and authorities for material control and accountability of nuclear materials are addressed in the Memorandums of Agreement and associated appendixes, where they exist, between heads of Headquarters Elements and managers of operations offices.
 - (3) For matters under their cognizance, ensure that self-assessment offices conduct independent assessments of the adequacy of DOE and contractor performance of their responsibilities for control and accountability of nuclear materials.

- (4) For matters under their cognizance, designate an individual(s) to be responsible for alerting the contracting officer to each procurement falling within the scope of this Order. Unless another individual is designated, the responsibility is that of the procurement request originator (the individual responsible for initiating a requirement on DOE F 4200.33, "Procurement Request Authorization").
- (5) Through contracting officers, require the following:
 - (a) Each contractor and subcontractor under their jurisdiction who may use or possess nuclear materials as identified in DOE M 474.1-1, Table I-1, is required by contract to develop and maintain current written procedures for MC&A.
 - (b) Each contract under which nuclear materials are to be supplied contains appropriate safeguards provisions consistent with DOE requirements.
 - (c) Inventory and scrap levels of nuclear materials held by contractors and subcontractors under their jurisdiction are minimized to be consistent with operational needs and good safeguards practices.
- (6) Ensure that MC&A requirements are considered in all phases of design of new facilities/operations under their cognizance.
- (7) Ensure that safeguards deficiencies at facilities under their cognizance are corrected.
- b. Director of Nonproliferation and National Security through the Director of Security Affairs.
 - (1) Establish DOE-wide requirements, procedures, and standards for the control and accountability of SNM and other designated nuclear materials.
 - (2) Submit reports to the Secretary on the status of the safeguards program in conjunction with the Annual Report to the President on the Status of Safeguards and Security of Domestic Nuclear Weapons Facilities.
 - (3) Establish DOE policies to monitor and control the transfer of safeguards and security technology and information to foreign states. Submit reports to the Secretary concerning safeguards and security technology and information that may pose unacceptable risks to domestic programs if transferred to foreign states.
- c. Director of Safeguards and Security.

- (1) Develop, after coordination with appropriate DOE Elements, DOE-wide requirements, procedures, and standards, and provide staff guidance for the safeguarding of nuclear materials.
 - (a) Develop and establish requirements, procedures, and standards concerning the documentation of nuclear materials transactions, inventories, and material balances affecting DOE Headquarters and Field Elements, contractors, and subcontractors.
 - (b) Develop and establish requirements, procedures, and standards for the submission of information on nuclear materials transactions, inventories, and material balances to the NMMSS.
 - (c) Ensure that DOE requirements, procedures, and standards for SNM safeguards are at least equivalent in their effectiveness to policies, procedures, and standards established by the NRC.
 - (d) Ensure that data documentation and collection policies, procedures, and standards of DOE with respect to nuclear safeguards are comparable to those of NRC.
 - (e) Provide technical advice, analyses, and recommendations in developing international safeguards policies and procedures. Provide for implementation of policies and practices at applicable DOE facilities to support international and multilateral treaties and agreements associated with inspections and monitoring of nuclear materials.
 - (f) Ensure the maintenance and currency of DOE M 474.1-2.
 - (g) Provide specific written guidance that would assist license-exempt contractors and subcontractors to design, evaluate, and validate MC&A systems.
 - (h) Provide specific written policy, guidance, and evaluations to determine if specific domestic safeguards and security technology and information may be transferable to foreign states without unacceptable risk to domestic programs and facilities. Provide recommendations to the Director of Security Affairs on technology, equipment, and information that should not be transferred to foreign states.
- (2) Conduct/participate in special investigations of activities of license-exempt contractors and other contractors possessing DOE-owned nuclear materials, as necessary.

Coordinate these special investigations with the heads of appropriate Headquarters Elements and operations offices.

- (3) In consultation with heads of Headquarters Elements, initiate and direct programs for providing required technology, equipment, and procedures to meet safeguards objectives and for ensuring that Government and industry are provided with chemical and isotopic reference standards and calibration and test materials which are supportive of safeguards programs.
- (4) In connection with activities of license-exempt contractors and subcontractors, recommend to the responsible authority corrective action to ensure compliance with overall safeguards requirements, procedures, and standards and, as appropriate, recommend other courses of action.
- (5) Prepare reports and provide data for reports, through the Director of Security Affairs and the Director of Nonproliferation and National Security, to the Secretary on the status of the safeguards program.
- (6) In connection with the maintenance of records and data to support the implementation of nuclear materials accountability, ensure the following:
 - (a) Collection and processing of data relative to nuclear materials for which the United States has a safeguards or management interest is accomplished as required by directives, U.S. statutes, and international treaties and agreements.
 - (b) When appropriate, reports are issued sufficient to support the nuclear materials safeguards needs of DOE, NRC, other Government organizations, and the IAEA.
 - (c) Headquarters level overview is exercised over key MC&A data, including materials control and materials accounting survey reports, inventory differences, and shipper/receiver differences.
 - (d) Proposed alternative methods for submission of nuclear materials data to the NMMSS by use of telecommunications systems in lieu of the required forms referred to in this Order are reviewed and approved. The proposed methods must satisfy all applicable requirements.
 - (e) Reporting Identification Symbols for organizations sponsored by heads of Headquarters Elements and operations offices are established and deactivated.

- (7) In connection with international agreements, recommend corrective action to ensure compliance with overall safeguards policies, procedures, and standards.
- (8) Develop and implement MC&A training programs for DOE and contractor safeguards personnel. Ensure that all personnel are accorded equal opportunity to receive this training.

d. Director of Arms Control and Nonproliferation.

For programs, projects, and facilities not excluded by provisions of the U.S./IAEA Safeguards Agreement:

- (1) Manage programs for technical cooperation with the IAEA as part of the Office of Arms Control and Nonproliferation's (NN-40) safeguards role in guarding against the diversion of nuclear materials and equipment which had been supplied for peaceful purposes to the manufacture of nuclear weapons, nuclear explosive devices, or any other military purpose.
- (2) Conduct on-site safeguards and security reviews of nuclear materials distributed abroad to the extent provided for in international, multinational, and bilateral agreements, and participate in international discussions regarding safeguards policies and procedures with other DOE organizations involved in international programs.
- (3) In coordination with heads of Headquarters Elements and the Director of the Office of Safeguards and Security, ensure compliance by DOE facilities with the terms of the "Agreement Between the United States of America and the International Atomic Energy Agency for the Application of Safeguards in the United States of America" and its associated Protocol.
- (4) In connection with international agreements, recommend corrective actions through the Office of Safeguards and Security which ensure compliance with overall safeguards policies, procedures, and standards, and when appropriate recommend suspension of any agreements that do not meet DOE policy in regard to such arrangements.
- (5) Provide technical advice, analyses, and recommendations in developing international safeguards policies and procedures. Manage programs for technical cooperation with the IAEA in its safeguards role in guarding against the diversion of nuclear materials and equipment to the manufacture of nuclear weapons, nuclear explosive devices, or any other military purpose.

- (6) Ensure the development, operation, and maintenance of the NMMSS by collecting data related to nuclear materials, including those for which the United States has a safeguards interest both domestically and abroad; processing the data; and issuing reports to support the nuclear materials safeguards and management needs of DOE, NRC, other Government organizations, and the IAEA.
 - (7) Ensure that historical records of nuclear material transactions, material balances, and inventories in support of safeguards and other programs of the Government are maintained by the Office of Arms Control and Nonproliferation, International Safeguards Division (NN-44).
- e. Director, Naval Nuclear Propulsion Program. In accordance with the responsibilities and authorities assigned by Executive Order 12344 [statutorily prescribed by Public Law 98-525 (42 U.S.C. 7158, note)] and to ensure consistency throughout the joint Navy/DOE organization of the Naval Nuclear Propulsion Program, implement and oversee all policy and practices pertaining to this Order for activities under the Director's cognizance.
- f. Heads of Field Elements.
 - (1) Implement MC&A programs for all DOE activities under their jurisdiction in conformity with the requirements, procedures, and planning set forth in the DOE 470 series and set procedures and requirements for nuclear materials not specifically covered in the DOE 470 series.
 - (a) Require that an MC&A Plan be developed for each facility possessing nuclear materials and approve that plan and subsequent changes. Require development of, and compliance with, procedural directives implementing the MC&A Plan.
 - (b) Ensure cost-effective overall protection at each site through integration, to the extent practicable, of MC&A systems, procedures, and operations with the associated physical protection systems, procedures, and operations.
 - 1 Use the DOE Design Basis Threat to formulate site-specific threat statements for inclusion in applicable site-specific safeguards and security planning documents.
 - 2 Ensure that vulnerability assessments are performed for Category I SNM locations and for other locations where roll-up to Category I is credible.
 - 3 Approve a site-specific classified list of threats and targets developed by each contractor under their jurisdiction as appropriate for design and/or evaluation and validation of MC&A systems.

- 4 Develop procedures for the conduct and reporting of nuclear materials surveys in accordance with DOE O 470.1 Chapter IX, SURVEY PROGRAM. Conduct oversight tests and evaluations of MC&A provisions of contractors' safeguards programs.
- (c) Ensure the maintenance of records and issuance of periodic reports reflecting nuclear materials transactions and inventories under their jurisdiction.
 - (d) Ensure that MC&A requirements are considered in all phases of design of new facilities and operations.
 - (e) Ensure that safeguards deficiencies are corrected.
 - (f) Ensure that system assessment requirements are identified and met for facilities possessing nuclear material.
- (2) Ensure that responsibilities and authorities for MC&A of nuclear materials are addressed in the Memorandums of Agreement and associated appendixes, where they exist, between heads of Headquarters Elements and Field Elements.
- (3) Monitor material control indicators and review and analyze reportable occurrences experienced in operations under their jurisdiction.
 - (a) Ensure that contractors and subcontractors under their jurisdiction evaluate all nuclear material control indicators, determine the probable cause of all nuclear material alarms, and take such corrective action as is deemed necessary.
 - (b) Report malevolent acts and other reportable occurrences to the Office of Safeguards and Security and affected heads of Headquarters Elements consistent with the requirements of this Order and DOE O 232.1A, OCCURRENCE REPORTING AND PROCESSING OF OPERATIONS INFORMATION.
 - (c) Require, as appropriate, each contractor, facility, and DOE Element under their reporting jurisdiction to determine the reasons for shipper/receiver differences, evaluate the significance of all such differences, and take appropriate corrective action.
- (4) Ensure that MC&A upgrade needs are identified, documented, and coordinated with affected heads of Headquarters Elements consistent with budgetary schedules.
- (5) Provide MC&A systems review and approval for all facilities prior to beginning new operations that might alter the performance of existing MC&A systems.

- (6) Require each DOE Element and contractor under their reporting jurisdiction to—
- (a) Prepare and distribute promptly the appropriate forms for documenting nuclear materials transactions, inventories, and material balances and for submitting the information to the NMMSS, in accordance with the DOE M 474.1-2.
 - (b) Prepare additional data and reports required by the Field Element in the performance of its mission.
 - (c) If notified of selection under the U.S.- IAEA Safeguards Agreement, prepare and submit Material Balance Reports (DOE/NRC F 742) indicating the sources of receipts shown on line 22 (“From Other Materials”) and the destinations of removals shown on line 71 (“Degradation to Other Materials”).
 - (d) Ensure that for exports other than for mutual defense, the receiver’s copies of DOE/NRC F 741, “Nuclear Material Transaction Report”; DOE/NRC F 741A, “Nuclear Material Transaction Report (Continuation Page)”; the special reprinted version of DOE/NRC F 740M, “Concise Note”; and other appropriate versions of DOE/NRC F 740M, as required, are included with the actual shipment.
 - (e) Ensure that both shipper’s and receiver’s transaction data are provided to the NMMSS if the shipper or receiver is a foreign entity.
 - (f) Provide review of NMMSS output sufficient to verify data processed by the system.
 - (g) Ensure that material balances held in contractors’ systems are reconciled with corresponding NMMSS balances and that data corrections are implemented to bring the systems into agreement.
 - (h) Review proposed internal or computer-generated equivalent forms referred to in Paragraph 4b(6)(b) of this Order, and if the proposed equivalents are found to provide all the information on nuclear materials transactions, material balances, and inventories in the proper format, approve their use in lieu of the specified forms.
- (7) Ensure that this Order is implemented under existing and new contracts for operating facilities under the scope of this Order. Designate an individual(s) to alert the contracting officer to each procurement falling within the scope of this Order. Unless another individual is designated, the responsibility is that of the procurement request originator (the individual responsible for initiating a requirement on DOE F 4200.33).

- (8) Through contracting officers, require that the Contractor Requirements Document be made a part of all appropriate contracts.
 - (9) Review and approve deviations to requirements of this Order according to procedures contained in DOE O 470.1, SAFEGUARDS AND SECURITY PROGRAM.
- g. Heads of Departmental Elements (the senior ranking official at a DOE office location).
 - (1) Include in a procurement request package, for each procurement requiring the application of this Order, the following:
 - (a) identification of the Order;
 - (b) identification of the specific requirements with which a contractor or other awarder is to comply, or if this is not practicable, identification of the specific paragraphs or other portions of this Order with which a contractor or other awarder is to comply; and
 - (c) requirements for the flowdown of provisions of this Order to any subcontract or subaward.
 - (2) For application to awarded management and operating or integrated management contracts, heads of Departmental Elements may set forth this information in a written communication to the contracting officer rather than in a procurement request package.
- h. Manager, Oak Ridge Operations Office.
 - (1) Comply with the requirements specified in Paragraphs 5f and g, above.
 - (2) Perform specific international tracking activities as delegated by the Office of Arms Control and Nonproliferation.
- i. Manager, Albuquerque Operations Office.
 - (1) Comply with the requirements specified in Paragraphs 5f and g, above.
 - (2) Report inventory data on nuclear material transferred to the Department of Defense under 42 U.S.C. 2121(b), as amended, with the exception of material specified in Paragraph 6j below.

- (3) Report inventory data on nuclear material lent by the United States. to a foreign nation under 42 U.S.C. 2121(c), as amended.
- (4) Maintain memorandum inventory accounts for all transfers of nuclear material to the Department of Defense under 42 U.S.C. 2121(b) and (c), with the exception of Navy cores and associated items. Provide guidance and instruction for the documentation and reporting, as necessary, to offices making such transfers.

j. Manager, Pittsburgh Naval Reactors Office.

- (1) Comply with the requirements specified in Paragraphs 5f, above.
- (2) Report inventory data on nuclear material transferred to the Department of Defense for non-weapons Naval reactor programs under 42 U.S.C. §2121(b), as amended.
- (3) Maintain memorandum inventory accounts for transfers of nuclear materials in Navy cores and associated items to the Department of Defense under 42 U.S.C. 2121(b).
- (4) Provide guidance, through the Director, Naval Reactors, for documenting and reporting to the Department of Defense transfers of Navy cores and associated items under 42 U.S.C. 2121(b), as amended.

k. Managers Schenectady Naval Reactors Office.

- (1) Comply with the requirements of Paragraph 5f, above.
- (2) Provide guidance, through the Director, Naval Reactors, for documenting and reporting to the Department of Defense transfers of Navy cores and associated items under 42 U.S.C. 2121(b), as amended.

- 6. REFERENCES. See DOE M 474.1-1 for a list of references.
- 7. CONTACT. Questions concerning this Order should be directed to the Manager, Materials Control and Accountability Program, at 301-903-2536.
- 8. IMPLEMENTATION. This Order will be implemented within 60 days after the effective date or when implemented under contractual agreement.

9. DEFINITIONS. Definitions of commonly used terms are provided in the *Safeguards and Security Glossary of Terms*, which is maintained by the Office of Safeguards and Security (NN-51).

BY ORDER OF THE SECRETARY OF ENERGY:



David M. Klaus
Director of Management
and Administration

CANCELED

ATTACHMENT 1

CONTRACTOR REQUIREMENTS DOCUMENT CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS

DOE M 474.1-1, MANUAL FOR CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS, contains detailed requirements for control and accountability of nuclear materials covered by DOE O 474.1, CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS.

1. Program Administration.

- a. Nuclear materials subject to DOE O 474.1 must be controlled and accounted for in a graded manner consistent with their strategic and monetary importance, and the consequence of their loss. Nuclear material control and accountability (MC&A) programs must deter and detect theft and diversion of nuclear material by both outside and inside adversaries.
- b. Planning for MC&A must address both the theft and diversion of SNM and the unauthorized control of a weapon, test device, or improvised nuclear device, where appropriate. Planning must also consider the potential for an insider threat, as detailed in *Design Basis Threat for the Department of Energy (DOE) Programs and Facilities (U)*, issued by the Office of Security Affairs.
- c. DOE must consider MC&A requirements, systems, and technologies in the planning, design, construction, and operation of new or renovated DOE facilities. DOE must use techniques and equipment that maximize material loss detection sensitivity, increase the quality of accountability measurements, and reduce the magnitude of inventory differences and associated control limits.
- d. Each facility must conduct performance testing programs to verify MC&A procedures and practices and to demonstrate that material controls are effective.
- e. MC&A measures must facilitate, to the extent practical, cost-effective integration of the operational mission of the program with environmental, health, and safety and physical protection considerations.
- f. MC&A systems must help prevent radiological and/or toxicological sabotage involving nuclear materials that could adversely affect national security, the health and safety of employees, the public, or the environment.

- g. MC&A programs must facilitate the development and implementation of foreign country and International Atomic Energy Agency (IAEA) safeguards systems, unless excluded by provisions of implementing treaties and agreements.
 - h. Nuclear materials or equipment supplied to nations or persons abroad must be subject to measures designed to ensure they are used for official purposes only, pursuant to an agreement for cooperation or other understanding with the United States.
2. Materials Accountability. Nuclear materials accountability programs must ensure that all nuclear materials are accounted for and that theft or diversion has not occurred.
- a. Accounting Systems. Nuclear material accounting systems must provide—
 - (1) accurate nuclear materials information relating to receipts, transfers, inventories, and shipments sufficient to establish a complete audit trail from receipt through disposition.
 - (2) accountability and control data in a timely and uniform manner as required for submission to the Nuclear Material Management and Safeguards System (NMMSS), the national nuclear material data base.
 - b. Physical Inventories. Each facility must implement a nuclear material physical inventory program to demonstrate that materials are present in their stated quantities, and to detect when unauthorized removals have occurred. Physical inventories must also serve as confirmation that physical controls are functioning as required.
 - (1) Periodic and special physical inventories must be performed according to the strategic importance of the material and the consequence of its loss.
 - (2) Differences between accounting records and physical inventory results must be investigated to determine the cause. Accounting records must be updated and corrected based on results of physical inventories.
 - c. Measurements and Measurements Control. Each facility must implement graded nuclear material measurement and measurement control programs to establish and verify inventory quantities and to ensure the quality and reliability of the measurement data.
 - (1) Each facility must be capable of measuring all nuclear materials on inventory, except those documented as not amenable to measurement.

- (2) Measurement systems used for accountability purposes must be precise and accurate enough to minimize the contribution of measurement error to the limit of error of the inventory difference.
 - (3) All measurement systems used for accountability purposes must have associated measurement control programs sufficient to ensure the quality of measurement data generated.
- d. Material Transfers. Each facility must implement programs to control and account for nuclear materials during internal and external transfers.
 - (1) External transfers of nuclear material must be documented on DOE/NRC Form 741 or other documentation approved by the cognizant operations office.
 - (2) Each facility must implement a graded system of measurements and records to monitor internal and external transfers of nuclear material and to deter/detect unauthorized removal of material during such transfers.
 - (3) When required, receiver's accountability measurements on external transfers must be performed in a manner that provides data as stipulated in DOE M 474.1-1, Table II-2.
- e. Material Control Indicators. Each facility must be capable of detecting losses through evaluation and assessment of shipper-receiver differences, inventory differences, and other inventory adjustments.
- f. Reporting to NMMSS.
 - (1) DOE Elements and contractors must document to NMMSS all nuclear materials transactions, material balances, and inventories in accordance with the instructions provided in DOE M 474.1-2, NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM REPORTING AND DATA SUBMISSION. NMMSS is used to accumulate and distribute information concerning nuclear materials transactions and inventories. The objective of the system is to report accurate and complete data as soon as possible after the events described by the data occur. The national data base must provide nuclear materials information relating to safeguards, materials management and production, inventory quantities and valuations, and other programs requested or required by DOE or NRC.

- (2) Forms identified and described in DOE M 474.1-2, NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM REPORTING AND DATA SUBMISSION, (or an equivalent form approved by the cognizant Field Element) must be used for the documentation and reporting of nuclear materials transactions, material balances, and inventories in accordance with the specific procedures contained in DOE M 474.1-2, Chapters I-X. A computer-generated form or other approved equivalent must contain all information necessary for proper documentation and reporting of nuclear materials transactions, material balances, and inventories, as appropriate.
 - (3) DOE M 474.1-2, NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM REPORTING AND DATA SUBMISSION, contains detailed instructions for the transfers of nuclear material between the United States and foreign nationals, foreign regional organizations, or supranational organizations.
 - (4) The national data base must serve as the centralized reporting facility to provide the information required under the provisions of the U.S. IAEA Safeguards Agreement. DOE M 474.1-2, NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM REPORTING AND DATA SUBMISSION, contains specific reporting and data submission procedures for facilities selected under the provisions of the U.S./IAEA Safeguards Agreement.
3. Material Control. Nuclear material control programs must control nuclear materials sufficient to prevent or deter loss or misuse.
 - a. Access Controls. Each facility must provide appropriate personnel access controls to nuclear materials, associated data, data-generating equipment, and other items or equipment where misuse could compromise the safeguards system.
 - b. Material Surveillance. Each facility must provide materials surveillance programs to ensure that nuclear materials are in their authorized location and to detect anomalous nuclear material activities and conditions.
 - c. Material Containment. Each facility must ensure that nuclear materials are used, processed, or stored in areas with appropriate physical and/or accounting controls.
 - d. Detection and Assessment. Each facility must provide localized detection and assessment of unauthorized removals of nuclear materials within specified time limits and must notify appropriate response organizations.