Fermi National Accelerator Laboratory

Fermilab

Fermilab Material Control and Accountability (MC&A) Plan

Safeguards & Security Program

ESHD-MCA01

5/1/2023

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Submission and Approval

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Revision History

Author	Description of Change	Revision Date
K. Graden	New Fermilab nuclear materials document based on requirements set forth in DOE O 474.2, Change 2, dated 11/20/2012. This document replaces Fermilab Nuclear Materials Control & Accountability Program and the Fermilab Nuclear Materials Control & Accountability Implementation Plan.	March 2012
K. Graden	Editorial changes.	April 2012
K. Graden	Added a detail to physical inventory and transaction procedures. Changed ES&H Section to ESH&Q Section.	February 2015
K. Graden	Changes include opportunity for improvement items resulting from the 2016 self-assessment of the Fermilab nuclear materials program. Incorporation of ESH&Q Section procedure template and new numbering system.	9/21/2016
K. Graden	Inclusion of DOE FSO ESH Team comments and suggestions.	11/22/2016
K. Graden	Change ESH&Q Section Radiation Physics Engineering Team to ESH&Q Section Radiation Physics Engineering Department.	1/17/2017
K. Graden	Change ESH&Q Section to ES&H Section. Change Radiation Physics Engineering Department to Radiation Physics Operations Department. Incorporation of R.P. Form # 114. Editorial changes.	4/3/2019
K. Graden	Edits to program based on Fermilab MC&A QA Assessment Opportunities for Improvement items.	6/17/2019
K. Graden	Revisions to program to incorporate DOE S&S MC&A Program Review observation and suggestions. Addition of MBA Custodians. Changed MBRs frequency to annual. Changed physical inventory to biennial. Incorporated Fermilab Site Security Plan information into MC&A Plan.	5/28/2020
K. Graden	Incorporation of DOE O 474.2A and updated format. Incorporation of observations and suggestions from Fermilab internal assessments.	4/24/2023

Table of Contents

List of Acronyms

AmBe	Americium-241 Beryllium
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CWA	Fermilab Reporting Identification Symbol Code
DBT	Design Based Threat
D&D	Decontamination and Decommissioning
DOE	Department of Energy
DOE SC	Department of Energy Office of Science
DOT	Department of Transportation
EBS	E-Business Suite
ES&H	Environment, Safety, & Health
FBI	Federal Bureau of Investigation
Fermilab/FNAL	Fermi National Accelerator Laboratory
FESHCom	Fermilab Environment, Safety, & Health Committee
FESHM	Fermilab Environment, Safety, & Health Manual
IA	Inventory Adjustment
ID	Inventory Difference
MBA	Material Balance Area
MBR	Material Balance Report
MC&A	Materials Control and Accountability
NMID	Nuclear Materials Integration Division
NMMSS	Nuclear Materials Management & Safeguards System
NMR	Nuclear Materials Representative
NNSA	National Nuclear Security Administration
NOL	Normal Operational Loss
NRC	Nuclear Regulatory Commission
NTC	National Training Center
OANM	Other Accountable Nuclear Materials
ODFSA	Officially Designated Federal Security Authority
OJT	On-the-Job Training
PAP	Performance Assurance Program
RIS	Reporting Identification Symbol
RPCF	Radiation Physics Calibration Facility
RP Form	Radiation Physics Form
SAMS	Safeguards Management Software
SEMD	Security and Emergency Management Division
SOC	Security Operations Center
SNM	Special Nuclear Materials
SRSO	Senior Radiation Safety Officer
TRAIN	Training Resources and Information Network

References

1. Fermilab Nuclear Materials Control & Accountability Training, ESHS-MCA02, current revision
2. Safeguards Management Software (SAMS) Data Entry Procedure, ESHS-MCA03, current revision
3. Fermilab Uranium Database Data Entry Procedure, ESHS-MCA04, current revision
4. Fermilab Site Security Plan, current revision
5. Fermilab Design Basis Threat, current revision
6. Fermilab Sealed Radioactive Source Control and Accountability Program, ESHS-RPO-SOURCE01, current revision

1.0 Introduction

1.1 Mission and Vision Statement

Fermilab is a high-energy physics research laboratory funded by the DOE and operated by Fermi Research Alliance, LLC (FRA) under Maintenance and Operations (M&O) contract to DOE. The laboratory mission encompasses high energy physics, particle physics, and accelerator research.

1.2 Location

Official site name: Fermi National Accelerator Laboratory

Location: Fermilab is located in Batavia, Illinois. DOE owned property encompassing Fermilab is located in Kane and DuPage counties in Illinois.

1.3 Reporting Identification Symbol

The Fermilab Reporting Identification Symbol (RIS) is CWA.

1.4 Fermilab Nuclear Material Description

Fermilab has no reportable quantities of special nuclear material (SNM). Fermilab has sealed neutron sources that are controlled and accounted for as SNM. Fermilab has Other Accountable Nuclear Material (OANM). All nuclear material in the Fermilab inventory is low grade. Fermilab has no credible substitution materials.

The Fermilab inventory of Am-241 Beryllium (AmBe) sealed neutron sources are controlled and accounted for as SNM in accordance with DOE O 474.2A, Attachment 2, Chapter I, Table II.

The Fermilab inventory of depleted uranium is accounted as OANM because it is not known if any of this material was imported before it was shipped to Fermilab from U.S. vendors. Therefore, in accordance with DOE O 474.2A, Attachment 2, Chapter II, 1.b.(1)(2), this material remains OANM.

1.5 Purpose and MC&A Goals

The purpose of the Fermi National Accelerator Laboratory (Fermilab/FNAL) Materials Control and Accountability (MC&A) Plan is to describe how the requirements set forth in applicable DOE Orders are implemented at Fermilab.

The MC&A program implements a defense-in-depth system. Nuclear materials program management, policies, and procedures are established to control and account for nuclear materials from receipt through disposition.

The Fermilab MC&A Plan provides the process for flowing down requirements of DOE Orders to the extent necessary to ensure that applicable MC&A functions and requirements are met.

The Fermilab MC&A Plan describes how materials that must be controlled and accounted for as Special Nuclear Material (SNM) and Other Accountable Nuclear Materials (OANM) as defined by DOE O 474.2A, *Nuclear Material Control and Accountability*, are accounted for and controlled on a graded safeguards basis (Table IV).

1.6 MC&A Plan Review, Related Procedures, and Approvals

The Fermilab Environment, Safety and Health Manual (FESHM) contains policies and procedures designed to manage environmental, safety, and health hazards in accordance with the requirements set forth in the DOE contract with Fermilab.

The MC&A Plan is reviewed biennially and updated as necessary. When MC&A Program changes of substantive nature occur or every three years, the MC&A Plan is revised. MC&A Plans must be approved by the Officially Designated Federal Security Authority (ODFSA). Editorial or administrative changes to the Fermilab MC&A Plan normally do not require ODFSA approval. The Fermi Site Office (FSO) is the ODFSA for Fermilab.

The Fermilab Materials Control and Accountability Plan, current revision, replaces all previous versions of Fermilab MC&A Plans.

Program element procedures are reviewed and revised by MC&A personnel to reflect changes in the Fermilab nuclear materials program, to ensure consistency, or to reflect changes in applicable DOE directives.

The Fermilab nuclear materials program documents are subject to change control. Change control is identified by the document revision date.

1.7 Applicable DOE Regulation

DOE Order 474.2A, *Nuclear Material Control and Accountability* (current revision) is applicable to the Fermilab MC&A program.

2.0 Program Management

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, and cost-effective MC&A program is implemented.

2.1 Objectives

a. The Fermilab MC&A Plan documents comprehensive, effective, and cost-efficient nuclear materials control and accounting procedures to control and account for materials.

b. Performance goals and objectives are based on a graded approach to detect and deter theft, diversion, loss, or misuse of materials, and to maintain accurate accounting systems.

c. To monitor the effectiveness of the Fermilab MC&A program, self-assessments and evaluation of the Fermilab nuclear materials program are established.

d. The MC&A Plan identifies procedures for response to loss indicators, anomalous conditions, and degradation of system performance. Applicable procedures and safeguards described in this Plan are included in the Fermilab Site Security Plan (SSP). The NMR is the primary author of the MC&A chapter of the Fermilab SSP.

e. The Fermilab MC&A program is fully integrated with Safeguards and Security. The MC&A program is part of Security and Emergency Management Division (SEMD). The Fermilab Nuclear Materials Representative (NMR) holds a matrixed position in SEMD. The NMR is a member of Environment, Safety, and Health (ES&H) Division.

2.2 General Program Requirements

a. Fermilab management allocates necessary personnel and resources to fulfill the objectives of the Fermilab MC&A Program. The Fermilab Security Department project/task code is used to track MC&A activities in the Fermilab Time and Labor system. Twenty-five percent of the NMR's activities are allocated to MC&A functions.

b. The Fermilab NMR does not have any operational responsibilities. MC&A objectives are met independently of Fermilab mission concerns.

c. The Fermilab MC&A program has periodic self-assessments and performance testing. These reviews are comprehensive, periodically scheduled, and evaluated against regulatory requirements, plans, and procedures.

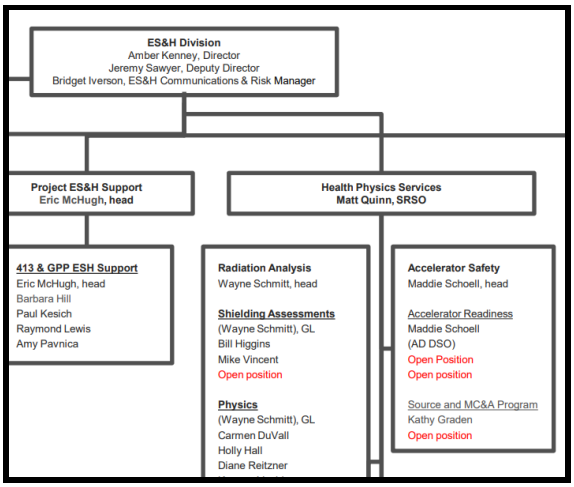
d. Performance goals and performance testing of performance elements are defined and described later in this Plan.

2.3 MC&A Roles and Responsibilities

2.3.1. Organization

The Fermilab MC&A program is part of the Security and Emergency Management Division (SEMD). The Fermilab Nuclear Materials Representative holds a matrixed position in SEMD as shown in the applicable portion of the SEMD organization chart below. Creation of the new SEMD provides full integration of MC&A with safeguards and security.

The Fermilab NMR resides in the ES&H Division, Accelerator Safety Department. The NMR/Source Physicist manages the Radioactive Source and MC&A Programs. The applicable portion of the ES&H Division organization chart is shown below.



2.3.2. NMR/NMR Alternate

a. The Chief Safety Officer appoints the NMR, the NMR Alternate, and the Source Physicist. The current NMR Alternate resides in the Accelerator Division until a time when another NMR Alternate becomes qualified.

b. While the MC&A role is separate from nuclear materials management role, the same individual fulfills responsibilities for both entities.

c. The NMR does not have sole authority to oversee, evaluate performance, or audit information for which they are responsible. NMR/NMR Alternate duties are documented in Fermilab MC&A training document (ESHS-MCA02).

d. The Fermilab NMR/NMR Alternate is responsible for maintaining accounting system records, nuclear materials inventory databases, data input to Safeguards Management Software (SAMS), data submission to the Nuclear Materials Management and Safeguards System (NMMSS), and completion of inventory reports.

e. The NMR/NMR Alternate coordinates nuclear materials physical inventories, on-site transfers, transaction reports, material balance reports, excess material declarations, inventory adjustments, updates to nuclear materials control and accountability procedures, and maintenance of nuclear materials logs.

f. The Source Physicist (or designee) is responsible for maintaining and updating the radioactive source inventory database. This database contains radioactive source-specific inventory data for sealed neutron sources. The NMR and Source Physicist responsibilities reside with the same individual.

2.3.3. Material Balance Area (MBA) Custodians

a. MBA Custodians are responsible to provide support to the Fermilab MC&A program and to serve as the eyes and ears of the Fermilab NMR/NMR Alternate. Every divisional area where nuclear materials are stored and used has an assigned MBA Custodian.

b. No material transfers cross MBA boundaries since Fermilab has only one MBA. Therefore, MBA Custodians may be responsible for multiple areas if the locations fall under the same divisional responsibilities. For example, one MBA Custodian may be responsible for materials at RPCF and Site 40.

c. MBA Custodians serve as an extension of the Fermilab MC&A organization by monitoring materials for which they are designated. MBA Custodians inform the NMR/NMR Alternate of any accountable nuclear material receipts, removals, or transfers into or out of their designated material balance area location(s).

d. With MC&A program assistance, MBA Custodians conduct physical inventories of materials in location(s) for which they are designated.

e. MBA Custodians ensure that materials are properly secured.

f. MBA Custodians inform the NMR/NMR Alternate of any abnormal or emergency situations involving materials within their designated location(s).

g. Fermilab MBA Custodians Designation and Responsibilities Form (Radiation Physics Form # 116) documents MBA Custodian designation and MBA custodian responsibilities/training as they pertain to the Fermilab MC&A program. This form provides documentation of NMR approval, Senior Radiation Safety Officer (SRSO) approval, and Chief Safety Officer approval.

2.3.4. Security Department

The Fermilab Security Department is responsible for Fermilab security systems and control of locks, material surveillance, and access controls.

2.4 Training and Qualification

a. The scope and level of nuclear materials control and accountability training is implemented on a graded approach and is tailored to assigned duties and responsibilities.

b. This training is based on a job task analysis of skills, prior experience, and training in nuclear materials control and accountability. MC&A training is documented in ESHS-MCA02.

c. The training may be selected from self-study, on-the-job training (OJT), attendance at DOE National Training Center (NTC) courses, completion of NTC correspondence courses, NTC computer-based training, or attendance at Annual NMMSS Users Training Meeting. DOE NTC training is documented in the Fermilab Training Resources and Information Network (TRAIN).

d. OJT for the NMR Alternate is validated and documented on the Fermilab MC&A program On-The-Job Training Validation Form (R.P. Form # 100).

e. Training functions for the NMR and NMR Alternate are reviewed annually and updated as necessary.

2.5 MC&A Threat Considerations

The Fermilab MC&A program implements a limited scope defense-in-depth system to ensure that all materials that must be controlled and accounted for as SNM and OANM are in their authorized location and being used for their intended purposes such that single component failures will not result in significant vulnerabilities.

Fermilab has a Design Basis Threat (DBT) plan in place. As referenced in the Fermilab DBT, buildings and areas where materials are located have been classified as low risk. The threat of material theft, loss, diversion, dispersion, or sabotage has been evaluated. To mitigate these threats, buildings where materials that must be controlled and accounted for as SNM and OANM are located are controlled with locked doors, locked fences, gates, padlocks, and a shield wall to control access. The Radiation Physics Calibration Facility (RPCF) has a lock and security system that is under ES&H Division control.

2.6 Categorization and Use of Graded Safeguards Table (DOE O 474.2A, Table IV)

a. Graded safeguards concept is used to provide the greatest relative amount of control and accountability for the types and quantities of material that can most effectively be used in a nuclear explosive device. Graded safeguards concept is based on the consequence of loss.

b. DOE O 474.2A, Table IV is used to determine attractiveness level and categorization of materials that must be controlled and accounted for as SNM and OANM. Determination of category involves grouping materials by type, attractiveness level, and quantity. Material quantities are element weight for Fermilab materials that are controlled and accounted for as SNM.

c. Fermilab materials that must be controlled and accounted for as SNM are low grade and low quantity materials. Fermilab materials controlled and accounted for as SNM fall under “All Other Materials,” “Reportable Quantities” as listed in DOE O 474.2A, Graded Safeguards Table IV. The lower limit for Category IV is equal to “Reportable Quantities” as shown in Graded Safeguards Table IV for

materials that must be controlled and accounted for as SNM. Therefore, these materials are graded as Category IV, Attractiveness Level E.

d. OANM at Fermilab are low grade materials comprising less than twenty percent U-235 in any form, any quantity. Fermilab OANM fall under "All Other Materials," "Reportable Quantities" as listed in DOE O 474.2A, Graded Safeguards Table IV. The lower limit for Category IV is equal to "Reportable Quantities" as shown in Table IV. Therefore, these materials are graded as Category IV, Attractiveness Level E.

e. Fermilab has documented hazard categorization (DOE-STD-1027-92, Hazard Categorization and Analysis Techniques) for materials that must be controlled and accounted for as SNM (sealed AmBe neutron sources). These materials have passed testing specified by Department of Transportation (DOT) 49 CFR.173.469 or the American National Standards Institute (ANSI) N43.6. These materials/sources meet the regulatory requirements of special form radioactive material as prescribed in the regulations of the International Atomic Energy Agency (IAEA) and the DOT. The hazard categorization of sealed AmBe neutron sources supports a graded safeguards level commensurate with Category IV, Attractiveness Level E materials. Special form certificates are maintained by the Fermilab Source Physicist.

f. Nuclear material controls at Fermilab assure that materials that must be controlled and accounted for as SNM and OANM are properly protected to prevent unauthorized access, receipt, removal, and transfer of Category IV, Attractiveness Level E materials.

g. Due to a site-wide limited-scope program, stable inventory, and no future plans for acquiring additional materials, roll-up from one Category to another (Category IV to Category III) is not credible for Fermilab.

h. In the highly unlikely event that the quantity/category of accountable nuclear material is ever to be increased, the Fermilab Site Security Plan and the MC&A Plan will be revised, and as necessary, upgraded in accordance with current DOE directives. The upgraded Site Security Plan and the MC&A Plan will require DOE Officially Designated Federal Security Authority Official (ODFSA) approval. DOE Fermi Site Office (FSO) serves as the ODFSA.

2.7 Less Than Accountable Quantities of SNM

Fermilab has no reportable quantities of SNM. Therefore, total combined quantities of SNM to cumulatively become an accountable quantity of SNM is not applicable.

2.8 Rounding

See DOE O 474.2A, Attachment 2, Chapter 1.d.5(a)(b) and Table III for rounding requirements.

2.9 MC&A Performance Assurance and Performance Testing

The MC&A Plan has identified three element 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 materials. System effectiveness is evaluated according to the performance testing schedule.

2.9.1 Physical Inventory

One critical system element tested at Fermilab is the performance of a physical inventory of materials that must be controlled and accounted for as SNM and OANM. This inventory is compared with accounting records. Any discrepancies between physical inventory and book inventory are corrected in a timely manner.

2.9.2 Accounting System Data Backup Restoration

The primary backup for the Nuclear Materials database is an inventory listing of book inventory of materials sorted by either FNAL number or location. A nuclear material inventory listing is generated several times per year.

The accounting system is capable of generating a book inventory listing of materials within 24 hours following an emergency. To test this capability, the NMR requests verification of backup restoration of accounting system data periodically (generally annually) by contacting the Core Computing Database Services Group.

2.9.3 Verification that Safeguards Management Software (SAMS) is Operational

Periodically (generally monthly), the NMR/NMR Alternate logs into the SAMs software program to ensure that the SAMs program is operational.

An email verifying that a login was conducted for this essential element is sent to the Security Department Performance Assurance Program (PAP) representative for inclusion in the monthly PAP report.

2.10 Internal Review and Assessment Program

A safeguards and security self-assessment of the Fermilab MC&A program is conducted every three years or as determined by Fermilab line management and/or DOE agencies. These self-assessments may be conducted in conjunction with the overall safeguards and security program self-assessments. Fermilab self-assessment reports are entered into the Fermilab iTrack reporting system. Non-conformities and recommendations identified from self-assessments are addressed and corrected in a timely manner. Self-assessments may include elements such as:

- Review of past self-assessment reports, past corrective actions, and recommendations
- Open findings from previous self-assessments and external reviews
- Accounting procedures
- Nuclear material transaction reports
- Material balance reports
- On-site transfer records, inventory adjustments, and nuclear material logs
- Checks to ensure the reliability and accuracy of MC&A data and information
- Performance testing in the form of physical inventory checks
- Material access and surveillance procedures
- Physical inventory program and reconciliation practices
- Review of timeliness of DOE required reports
- Identification of abnormal situations, loss mechanisms, loss detection capabilities, and inventory differences
- Change controls to detect unauthorized or inappropriate modification of procedures or data

Self-assessments are typically conducted by Radiation Physicists who are members of the radiological control organization (excluding the NMR) and/or members of the Quality Division.

2.11 Final Disposition of Materials that Must be Accounted for as SNM and OANM

The entire nuclear material inventory at Fermilab meets the criteria for Attractiveness Level E. DOE FSO will review and approve/disapprove Fermilab requests to terminate regulatory control of materials. Before final disposition of all materials in the Fermilab inventory, Fermilab will conduct a Programmatic Value

Determination for determination of programmatic value. Programmatic Value Determination is conducted in consultation with DOE FSO and the National Nuclear Security Administration (NNSA), Nuclear Materials Integration Division (NMID).

DOE may approve disposition of material if the following conditions are met:

a. Materials are of no programmatic value to DOE.

b. Ensure that all accountable material has been removed from Fermilab.

c. The level of security specified by DOE FSO as a condition of final disposition is implemented effectively until the material is transferred offsite.

d. Nuclear materials database is updated to reflect the removal/transfer of material.

e. DOE FSO will review and approve/disapprove requests to terminate regulatory control of materials.

2.12 Anomaly Resolution

If an apparent loss, theft, or diversion of material occurs, Fermilab conducts an immediate investigation/assessment of the incident, notifies laboratory management, and notifies DOE FSO.

Fermilab formally reports incidents in accordance with DOE O231.1B (current revision), FESHM Chapter 3010, and current DOE directives. The DOE Occurrence Report will include material location (if known), material description and classification, reason for suspicion of malevolent act, if any, steps to be taken to resolve the incident, and further investigational actions planned. The incident will also be evaluated against criteria for incidents of security concern as described in the Fermilab Site Security Plan.

If a loss of material is indicated the following information is reported:

- Date the material was last on hand
- Date the loss was reported to the Federal Bureau of Investigation (FBI)
- Status of the investigation
- Whether the loss of the material constitutes an environmental or public health hazard

3.0 Material Accounting

Fermilab has implemented an accounting system to assure accurate nuclear material inventory records and reports with sufficient controls to assure data integrity and compliance with applicable DOE requirements. All changes to the accounting system are supported by source documentation such as Nuclear Material Transaction Reports.

3.1 General Requirements

a. The nuclear materials inventory database contains data for each material type. The database fields contain one unique FNAL number for each item or material type, composition of ending inventory (COEI) code, element/isotope weight, dimensions (where applicable), location, shipment date, receipt date, and material description.

b. Additions, changes, and deletions to this database are documented on "On-site Transfer of Nuclear Materials" (R.P. Form # 57), source documents for shipment and receipt of materials (DOE/NRC Form 741), or Nuclear Materials Inventory Adjustment Form (R.P. Form # 79). Database additions, deletions, and changes are controlled by the system log-on password. Only persons authorized to make database entries have access to this password.

c. The accounting system provides continuity of knowledge for material from receipt through disposition by maintaining an audit trail that includes documentation of accounting system data entries. Fermilab Nuclear Materials Data Entry Procedure (ESHS-MCA04) provides detailed instructions for data entry to this database.

d. The NMR is responsible for entering inventory data into the nuclear materials inventory database. Data entries are made within 20 working days from the nuclear material activity.

e. The inventory sealed neutron source data is maintained in the Fermilab radioactive source inventory database. The Source Physicist is responsible for maintaining and updating this database. The Source Physicist enters all new sealed sources into the radioactive source inventory database, updates source loans, returns, transfers, transfers of sources on radiation detection instruments, and deletes any to-be-disposed sources.

3.2 Accounting System Description

a. Generally accepted accounting principles are used in the design and operation of the nuclear materials database.

b. The accounting system provides a check and balance for reconciliation of data based on physical inventories.

c. Data integrity is ensured by backing up nuclear materials and source data. Both systems are backed up and data restoration capability is tested on either of the databases periodically.

d. Only the NMR/NMR Alternate has access to the accounting system data. Data systems cannot be accessed or falsified by unauthorized persons.

3.3 MBA Description and Account Structure

Fermilab has no materials production or processing facilities. Fermilab has only one MBA due to the limited scope and low grade materials. The Fermilab MBA is defined as the geographical boundaries of the Fermilab site. Materials that must be controlled and accounted for as SNM (sealed AmBe neutron sources) are located in a Property Protection Area. No unauthorized access is allowed in Property Protection Areas.

a. Fermilab has one RIS (CWA). Fermilab has one Project Number. As of 10/1/2020, CWA Project Number is C-KA-1102-010.

b. Checks and balances to verify inventory and accuracy of accountability data are identified when the book inventory is compared to the physical inventory. All Fermilab nuclear materials are discreet items.

c. Because there is only one MBA, every divisional area where nuclear materials are stored and used has an assigned MBA Custodian. Some MBA Custodians are responsible for multiple areas if these locations fall under the same divisional responsibilities.

d. Fermilab has no plans to change the storage location of materials accounted for as SNM. No Predisposition MBA would be established prior to final disposition. AmBe sealed neutron sources will stay in the neutron storage cave located at RPCF and would be dispositioned from this location.

e. It is not practicable that any materials accounted for as SNM would be recovered during deactivation, decommissioning, or decontamination activities. This is not a credible scenario for Fermilab since there are no production or processing facilities and AmBe sealed neutron sources are stored in the neutron cave at RPCF.

3.4. Accounting Records and Procedures

Only the NMR/NMR Alternate can update accounting system records. Source documents provide the basis for accounting system data, and these records provide an audit trail for all transactions.

The nuclear materials inventory database and/or source documents include item identification, material type, form, quantity, attractiveness, location, element and isotope weight/mass, and enrichment (as applicable).

Nuclear materials database inventory lists sorted by FNAL number and/or Location can be generated within three hours to meet emergency needs.

a. Shipment Procedures

1) Prior to shipment of materials, the NMR/NMR Alternate notifies the receiving facility to obtain authorization to ship materials. The NMR/NMR Alternate records the authorization number assigned to the shipment on the Nuclear Material Transaction Report (DOE/NRC Form 741).

2) Nuclear Materials Transaction File

The NMR/NMR Alternate creates a new file for every transaction. The elements of a transaction file may include Nuclear Material Transaction Report (DOE/NRC Form 741), shipping papers, correspondence, records of independent weight measurements, and a description of item dimensions (as applicable). This file constitutes the source document. Transaction files are filed by RIS code. Within each RIS code, transactions are filed by transaction number and date. For transfers between two DOE or NRC facilities, a transaction number is created by the shipping facility. The format for the transaction number is RIS1RIS2XX. RIS1RIS2XX stands for:

RIS1: Shipper's RIS code (CWA)
RIS2: Receiver's RIS Code
XX: Sequential number of transactions between the two facilities to date. For example, if there have been five previous shipments of materials from Fermilab to Argonne National Laboratory (RIS: CZA), the sixth transaction from Fermilab to Argonne would be CWACZA06 or CWA-CZA-06 (dashes between sets of alpha

numeric symbols may be used).

The Checklist for Nuclear Material Receipt, Shipment, or Normal Operational Loss (NOL) (R.P. Form # 114) is a form that consolidates all required action items in a checklist format. This form may be used to track all actions required for shipment of materials. R.P. Form # 114 may be kept in the Nuclear Materials Transaction File.

3) Nuclear Materials Transaction Log

The NMR/NMR Alternate is responsible for data entry to and maintenance of the nuclear materials transaction log. The nuclear materials transaction log is a spreadsheet may contain the date of shipment or receipt, shipping or receiving facility's name, transaction number, air/trucking line, number and type of container(s), gross shipping weight, and the NMR/NMR Alternate's initials or signature at the bottom of the log.

The nuclear materials transaction log is used to determine transaction numbers for shipments.

4) Nuclear Material Transaction Report, DOE/NRC Form 741

The NMR/NMR Alternate completes the Nuclear Material Transaction Report (DOE/NRC Form 741). This form is completed in accordance with the NMMSS Users Guide. The completed Nuclear Material Transaction Report is sent to the receiver (except for one-party transactions). In turn, the receiver signs and returns a copy of the form to the shipper. If a completed and signed copy of the Nuclear Material Transaction Report (DOE/NRC Form 741) has not been returned to the shipper within 10 working days of transmittal, the NMR/NMR Alternate will contact the receiver to ask for the receiver's data. Documentation of this communication should be included in the Nuclear Materials Transaction file.

5) Upon shipment of materials, the NMR/NMR Alternate enters materials shipment data into the nuclear materials or radioactive sources database(s). See Fermilab Nuclear Materials Data Entry Procedure (ESHS-MCA04) for data entry instructions.

6) The NMR/NMR Alternate enters transaction data into SAMS. This data is entered under the *Transaction* menu of SAMS. The

NMR/NMR Alternate sends the SAMS data file to NMMSS via email. Safeguards Management Software Data Entry Procedure (ESHS-MCA03) provides step by step instructions for entering materials transaction data.

b. Receipt Procedures

1) Advance written approval (email) from the NMR/NMR Alternate is required before any accountable nuclear material can be shipped to Fermilab. Purchase requisitions for materials require SRSO and NMR/NMR Alternate approval. The Fermilab E-Business Suite (EBS) electronic approval system is used to approve purchase requisitions. If the EBS electronic approval system is not available, purchase requisitions may be approved via ES&H Division Nuclear Materials Purchase Requisition Notes and Approvals form (R.P. Form # 109).

2) Upon notification of shipment date from the shipping facility, the NMR/NMR Alternate informs the ES&H Division Hazard Control Technology Team (HCTT) and the division/section that will take control of the material. The ES&H Division controls nuclear material while at the Receiving Department. Security arrangements are made on a graded safeguards basis dependent on the type of material.

3) The NMR/NMR Alternate creates a transaction file for the receipt of materials. For transfers between two DOE or NRC facilities, a transaction number is created by the shipping facility. The format for the transaction number is RIS1RIS2XX. RIS1RIS2XX stands for:

RIS1: Shipper's RIS code
RIS2: Receiver's RIS Code (CWA)
XX: Sequential number of transactions between the two facilities to date. For example, if there have been three previous shipments from Argonne National Laboratory (RIS: CZA) to Fermilab, the fourth transaction from Argonne to Fermilab would be CZACWA04 or CZA-CWA-04 (dashes between sets of alpha numeric symbols may be used)

4) The Checklist for Nuclear Material Receipt, Shipment, or Normal Operational Loss (NOL) (R.P. Form # 114) is a form that consolidates all required action items in a checklist format. This form may be used to track all actions required for receipt of materials. R.P. Form # 114 may be kept in the transaction file.

5) Upon receipt of materials, the NMR/NMR Alternate enters appropriate data into the nuclear materials transaction log.

6) Upon receipt of materials, the NMR/NMR Alternate assigns a unique FNAL number to each discrete item or enters data into the FNAL number record designated for a particular material type.

7) The NMR/NMR Alternate completes the On-site Transfer of Nuclear Materials Form. This form is forwarded to the appropriate Division for signature and then returned to the NMR/NMR Alternate.

8) The NMR/NMR Alternate enters appropriate data into the on-site transfer log.

9) The NMR/NMR Alternate completes the receiver's portion of the Nuclear Material Transaction Report. The NMR/NMR Alternate accepts shipper's weights because Fermilab does not have a measurement control program. These forms are submitted to DOE FSO. The NMR/NMR Alternate signs nuclear material transaction reports.

10) For nuclear material receipts from facilities with no USNRC/Agreement State Radioactive Material license or receipt of materials from non-DOE facilities, a one-party transaction must be reported on Nuclear Materials Transaction Report (DOE/NRC Form 741). For one-party transactions, the NMR/NMR Alternate completes the **shipper's data** on Nuclear Materials Transaction Report (DOE/NRC Form 741). A nuclear materials transaction file must be created. The format for a one-party nuclear materials transaction number is CWACWAYYMMXX. YYMMXX stands for:

    YY: Last two digits of the calendar year
    MM: Month of the year
    XX: Sequential one-party transaction for that year. When the year changes, this sequence number resets to 01

    Note that dashes between sets of alpha numeric symbols may be used.

11) The Checklist for Nuclear Material Receipt, Shipment, or Normal Operational Loss (NOL) (R.P. Form # 114) is a form that

consolidates all required action items in a checklist format. This form may be used to track all actions required for one-party transactions (shipper's data). The Checklist for Nuclear Material Receipt, Shipment, or Normal Operational Loss may be kept in the Nuclear Materials Transaction File.

12) Upon receipt, a material verification is conducted. This verification consists of confirmation of shipping container and/or an item count. The physical verification is compared with shipping documentation to provide assurance that the shipment was received intact. This verification is documented on Checklist for Nuclear Material Receipt, Shipment, or Normal Operational Loss (NOL) (R.P. Form # 114). If the nuclear material is radioactive, the verification is also documented on Record of Radioactive Material Receipts and Shipments (R.P. Form # 20). If there is a discrepancy in the container or item count, the NMR/NMR Alternate notifies the shipper to resolve the problem. If a significant discrepancy cannot be resolved, Fermilab notifies DOE FSO to report the discrepancy.

13) Upon receipt of materials, the NMR/NMR Alternate enters receipt data into the nuclear materials and/or radioactive sources database(s). The NMR/NMR Alternate assigns a unique FNAL number to each discrete item or enters data into the record designated for a particular material type with an assigned FNAL number. For example, if the shipment contains individual depleted uranium plates, then each plate is assigned an FNAL number. If there are numerous plates within one module or detector that are not disassembled at Fermilab, then the module or detector is assigned one FNAL number. In the case where materials other than depleted uranium are received, data is entered into the record for a particular material type that has an assigned FNAL number. In the case of receipt of materials not already having an assigned FNAL number, a new FNAL number for that material type will be created.

    Fermilab has a unique system of radioactive source identification. Each sealed source is assigned an individual radioactive source inventory number commonly known as the source ID. For sealed neutron sources, the scheme is as follows:

    - An AmBe neutron source producing $4x10^5$ neutrons per second is identified as 241Be-5.4-1
    - A Californium-252 neutron source producing $2x10^7$ neutrons per second is identified as 252-7.2-1

14) The NMR/NMR Alternate enters transaction data into SAMS. This data is entered under the *Transaction* menu of SAMS. The NMR/NMR Alternate sends the SAMS data file to NMMSS via email. Safeguards Management Software Data Entry Procedure (ESHS-MCA03) provides step by step instructions for entering transaction data.

c. Shipment of Depleted Uranium Contaminated Waste

1) In addition to the above procedures, the following procedure for shipment of depleted uranium contaminated waste is outlined in this section. This section does not apply to discreet items or scrap pieces of depleted uranium, but only to waste contaminated as a result of contact with depleted uranium.

2) A declaration number for excess depleted uranium will be assigned. The declaration number log is used to determine the next sequential declaration number. This log includes the material type, declaration number, shipment date, transaction number, weight, receiving facility, and the NMR/NMR Alternate's initials or signature at bottom of log. This number is referenced on transaction reports and scrap evaluation requests. A declaration number is a three-part identifier using the following form where CWA-YYYY-XXX stands for:

YYYY: Calendar year
XXX: Sequential declaration number for that year. When the year changes, this sequence number resets to 001

3) Contact DOE Office of Science point of contact to obtain a scrap declaration authorization number.

4) Complete Nuclear Material Transaction Report (DOE/NRC Form 741), nuclear materials log, on-site transfer log, and on-site transfer form as described in other sections of this document. Nuclear Material Transaction Report, block number 24.B, type of inventory change, should be listed as 74 to indicate normal operating losses (NOL).

5) The physical inventory and database inventory remains unchanged for waste shipments. Therefore, an inventory adjustment form is

completed to reflect a debit/removal of material as normal operating losses. At the same time, a credit or addition under code 65, cumulative rounding, is completed for the same amount of material which was removed. In this way, there is no net removal of depleted uranium from the physical inventory or book inventory.

6) Complete the quarterly material balance report, Nuclear Material Balance Report (DOE/NRC Form 742) to reflect no net change in the depleted uranium inventory. This is accomplished by recording the shipment on line 51 as a removal. Then complete item number 77, inventory difference as a code 65, cumulative rounding. This number should be in parentheses to indicate a gain. This value is equal to the amount of material removed on line 51 of this form.

8) The NMR/NMR Alternate enters shipment data into the nuclear materials database.

7) The NMR/NMR Alternate enters transaction data into SAMS. This data is entered under the *Transaction* menu of SAMS. The NMR/NMR Alternate sends the SAMS data file to NMMSS via email. Safeguards Management Software Data Entry Procedure (ESHS-MCA03) provides step by step instructions for entering transaction data.

3.5 Accounting Reports

3.5.1 Nuclear Material Balance Report

a. The Nuclear Material Balance Report (MBR) is completed in accordance with the NMMSS Users Guide. The report is recorded on Nuclear Material Balance Report (DOE/NRC Form 742). The MBR is submitted to DOE FSO by the sixth workday after September 30 each year. Completion of this report involves several steps outlined below.
   - The NMR/NMR Alternate performs decay calculation corrections for applicable materials using decay spreadsheets; The spreadsheet calculation data is compiled in accordance with the NMMSS Users Guide
   - The NMR/NMR Alternate enters material balance inventory data into SAMS
   - Inventory adjustments are reviewed for the period being reported
   - Material in transit at the end of a reporting period is reported as being received within the reporting period

- The NMR/NMR Alternate signs Material Balance Reports

3.5.2 Inventory Adjustments and Review of Inventory Adjustments Report

The Fermilab NMR/NMR Alternate conducts a review of inventory adjustments at the end of each fiscal year. The review is conducted in accordance with current DOE requirements. The Review of Inventory Adjustments Report is submitted to the DOE FSO by September 30 each year.

3.5.3 Nuclear Materials Management & Safeguards System (NMMSS) Reports

Periodically, NMMSS sends Fermilab several types of inventory reports. The reports are described below.

a. A-200, Summary of Ending Inventory report. This report shows the ending inventory for each material type. This is a quarterly report.

b. A-210, Project Material Balance report. This report shows beginning inventory, ending inventory, and totals for each material type. This is a quarterly report.

c. M-742, Material Balance Report by Facility report. This report shows the beginning inventory, ending inventory, and totals for each material type. This report covers a period of time from the beginning of the fiscal year through the end of the calendar year. This is a quarterly report.

d. T-141, DOE Project Number – Project Title Index by Programmatic Operations Office/Organization report. This report shows project numbers, new project numbers, and project titles for each DOE Programmatic Operations Office. Fermilab (CWA) project number can be found on the "DOE Chicago Operations Office" page.

3.6 Inventory Difference and Shipper/Receiver Differences

Inventory difference is the arithmetic difference obtained by subtracting the quantity of material tabulated from a physical inventory from the book inventory quantity. Book inventory quantity is equivalent to the beginning inventory plus additions to inventory, minus removals from inventory.

Because all nuclear materials at Fermilab are discreet items, no MC&A activities occur that change the quantity of materials in the inventory (such as processing or sampling). Item counts conducted during physical inventory are checked with book inventory. If there is a difference, the book inventory is corrected.

A system of checks and balances provides assurance that unauthorized removal of material and material losses are detected. A significant shipper/receiver difference occurs when there is a discrepancy in the shipper/receiver item count, regardless of the quantity of nuclear material. If a discrepancy in item count occurs, the NMR/NMR Alternate notifies the shipper to resolve the problem. If the discrepancy cannot be resolved, the receiver notifies DOE FSO to report the shipper/receiver difference.

Note that Fermilab does not have a measurement control program. Therefore, independent measurements are not conducted at Fermilab. Fermilab accepts shipper weights. So, the likelihood of a shipper/receiver difference is extremely remote.

The NMR/NMR Alternate performs all corrections to the Nuclear Materials inventory database and transaction reports. Corrections of data previously submitted and found to be in error are submitted to NMMSS within one working day following notification of the error.

4.0 Nuclear Material Control

4.1 Nuclear Material Control Objectives and General Requirements

The Fermilab material control program ensures that materials that must be controlled and accounted for as SNM and OANM are properly protected and that they are not removed from their authorized location without approval or timely detection. Objectives of the Fermilab nuclear material control program are listed below.

a. Detect, assess, and deter unauthorized access to materials that must be controlled and accounted for as SNM and OANM.

b. Detect, assess, and communicate abnormal circumstances, alarms to Fermilab Security Department in time to impede unauthorized use of materials.

c. Provide loss detection capability for materials. If materials are not in their authorized location, the NMR/NMR Alternate provides accurate information to assist in locating materials in a timely manner.

d. Material surveillance program in conjunction with other security program elements has the capability to detect, assess, and respond to unauthorized activities and anomalous conditions/events.

e. In coordination with the Fermilab Security Department, ensure that appropriate protection and controls are applied to Category IV, Attractiveness Level E materials.

4.2 Access Controls

Fermilab has a graded program for controlling personnel access to material and material accountability processes. Fermilab has implemented material access controls to ensure that only authorized personnel gain access to material that must be controlled and accounted for as SNM and OANM. Locked buildings, fences, gates, and padlocks control unauthorized access to materials. Some materials installed in calorimeters are not accessible to personnel. Materials that must be accounted for as SNM are located within a Property Protection Area.

4.3 Radiation Physics Calibration Facility (RPCF) Controls

a. Materials that must be controlled and accounted for as SNM (AmBe sealed neutron sources) are stored at the RPCF. A real-time monitoring system is installed using motion detection cameras, and artificial intelligence to alert Security Operations Center (SOC) and/or Security Department personnel of any unwanted occurrence. This system improves the laboratory's ability to protect, respond, and recover from security incidents. An emergency backup power system with a lifetime of approximately twelve hours is used in the event of power outages. During system failures, Security Department provides guard inspections of RPCF integrity at two-hour intervals. Door locks at RPCF are controlled through the Laboratory's key system and by card access. Fermilab Security Department provides exterior site inspection at least twice per eight-hour shift.

b. Guards conduct rounds to various locations. These rounds may be recorded in the FELIX bar code system or manual paper records. If buildings are scanned, data is stored in the FELIX database.

c. All sealed neutron sources are stored in a concrete container called the neutron storage safe. The neutron storage safe is part of the poured concrete walls of Cave #1 inside of RPCF. Keys to the outside door of RPCF are issued

only to select members of the ES&H Division and are retrieved upon termination or transfer out of the ES&H Division.

d. Access to the neutron storage safe is controlled by use of a combination lock. Only authorized personnel are granted the combination to this lock. Visitors or other Laboratory personnel do not have authorization to access the neutron storage safe. Upon removal of any neutron source, the authorized personnel are required to sign a log sheet noting what source is being signed out.

e. A list of authorized personnel is maintained by designated ES&H Division personnel. The ES&H Division Source Physicist, or designee, has the overall responsibility for the combinations. Random changing of combinations is prohibited. If deemed appropriate, the Source Physicist may reset combination locks.

f. Arrangements may be made for neutron source irradiations during off-hours at RPCF. ES&H Division personnel ensure that the facility is properly secured, monitored, and posted during these irradiations. A member of the radiological control organization notifies the SOC each time one of these irradiations occurs. Because radiation doses to personnel must be maintained as low as reasonably achievable, the building must be unoccupied. Therefore, the RPCF building itself is considered the locked storage area in these cases.

4.4 Controls for Less Than Accountable Quantities of Material that Must be Controlled and Accounted for as SNM

Only non-accountable sealed neutron sources no longer used for instrument calibrations may be approved for use in areas other than the ES&H Division. Radiological controls for use of a sealed neutron source in experimental areas is documented in a Job-Specific Radiological Work Permit. Non-accountable sealed neutron sources must be transported by ES&H Division personnel in a government vehicle to experimental areas. Experimental areas where non-accountable sealed neutron sources are used must implement controls to prevent unauthorized access or be under continuous supervision by authorized users. Non-accountable sealed neutron sources may only be used during normal working hours and are returned to the RPCF at the end of the working day.

4.5 Information Systems and Data Access Controls

Data access control is used to prevent unauthorized access to inventory data. A log-on password is required to access inventory data. The NMR/NMR Alternate establishes and controls the login password. Radioactive sources and nuclear

materials databases are contained on the Fermilab network, which is backed up every evening during the workweek. The databases are contained in an Oracle APEX system. Only the NMR/NMR Alternate can access, enter, and change data in these databases.

4.6 Material Surveillance

A material surveillance program is concerned with detection of insider adversary activities. Therefore, a surveillance program consists of a collection of information through devices and/or personnel observation to detect unauthorized movement of nuclear material or falsification of information related to location and quantities of materials. Physical security controls, access controls, material controls, accounting systems, procedures, and physical inventories are in place to mitigate these circumstances.

Fermilab has automated capabilities such as key card access and cameras for monitoring access to materials, unauthorized activities, or anomalous conditions.

4.7 Material Containment

Nuclear materials at Fermilab are discreet items either in the form of metal plates, sample pieces, or sealed neutron sources. OANM are encased in steel plates within containers, calorimeters, prototype modules, cryostats, modules, other storage containers, or stored in the Site 40 source room safe.

All materials that must be accounted for as SNM are located in a Property Protection Area, within one MBA that is the geographical boundary of Fermilab.

Fermilab Areas Authorized for Accountable Nuclear Materials Use and Storage (R.P. Form #122) documents material types, forms, and quantities in each location where materials are used and stored. This form also identifies MBA Custodians for each location.

4.8 Material Transfer Controls

Materials that must be accounted for as SNM do not cross MBA boundaries. If a receipt of material that must be accounted for as SNM occurs, the material will remain under the control of ES&H Division personnel from receipt until it is placed in secure storage.

4.8.1 Internal Transfers

The on-site transfer system monitors transfer of material from one location to another on-site. This system is designed to deter and/or detect unauthorized movement of material. When material is transferred from one location to another, an On-site Transfer of Nuclear Materials Form (R.P. Form # 57) is completed. The NMR/NMR Alternate initiates this form. Signatures of Division Heads are required in the shipper/receiver blanks. The NMR/NMR Alternate signs the form to validate the transfer. The NMR/NMR Alternate maintains a file for all on-site transfers. On-Site Transfer of Nuclear Materials forms constitute source documents.

4.8.2 On Site Transfer Log

An On-Site Transfer Log is used to track each on-site transfer. The NMR/NMR Alternate is responsible to complete data entry to and maintenance of the on-site transfer log. The information contained in this log includes the year, FNAL number, material type, material description, container weight/volume (if known), location from which the material originates, transfer date, transaction number (if applicable), and the NMR/NMR Alternate's initials or signature at the bottom of the log.

4.8.3 Transfer Checks

A transfer check is a confirmation of shipping container or an item count and must be completed upon receipt of materials.

Transfer checks include item count, container integrity verification, and identification.

Because Fermilab performs no operations that change the nature of the nuclear material under its control, the nuclear material content is determined by an item count. Shipper's certification is accepted for all nuclear material receipts.

Confirmation of shipping container and item count is compared with shipping documentation to ensure that the shipment was received intact. If there is a discrepancy in the item count, the NMR/NMR Alternate contacts the shipping facility to resolve the issue.

If a discrepancy cannot be resolved, the NMR/NMR Alternate notifies DOE FSO to report a possible diversion of materials. Transfer checks of radioactive material are documented on the On-Site Transfer form and/or Record of Radioactive Receipts and Shipments form.

Due to the fact that Fermilab materials are Category IV, Attractiveness Level E, low grade, and of limited scope, a tamper-indicating-device program is not deemed to have a clear benefit in achieving additional MC&A program effectiveness.

Portal monitoring, process waste stream monitoring, and daily administrative checks are not applicable to the Fermilab MC&A program.

4.9 New Fermilab Projects and Experiments

All new Fermilab projects, experiments, experimental runs, and studies are evaluated for impact on the MC&A program by a Technical Scope of Work (TSW) process. Experimenters must have a TSW documented which describes the test experiment in detail. A TSW is a written plan put in place to establish a clear understanding of how an experiment will practically function and each party's roles and responsibilities. Each TSW has a category called "Nuclear Materials" which must be addressed to indicate whether or not nuclear materials will be involved.

Fermilab has a work planning and control hazard analysis process in place that identifies all hazards associated with a particular task. One of the sections includes a category for identification of nuclear materials.

An Operational Readiness Clearance (ORC) must be obtained before projects, experiments, and studies are conducted at Fermilab. An ORC consists of an inspection of the experimental apparatus by qualified safety specialists. The NMR is a member of the ORC Committee.

4.10 Exceptions

Exceptions to any of the above procedures may be made by the Laboratory's Chief Safety Officer (or designee) with the approval of DOE, after conferring with the Fermilab Security Department.

5.0 Measurements and Measurement Control Program

The Fermilab nuclear material inventory consists of discrete items. Fermilab has no processing facilities. Fermilab accepts shipper's values on item weights and does not conduct independent verification measurements. No measurements are made for MC&A purposes. Therefore, a measurement control program is not applicable to the Fermilab MC&A program.

6.0 Physical Inventory

6.1 Physical Inventory Objectives and General Requirements

a. The Fermilab physical inventory reconciliation program is designed to provide assurance that materials that must be controlled and accounted for as SNM and OANM are in authorized locations.

b. The physical inventory program ensures that material is accounted for and that the accounting records system reflects the physical inventory. It serves to identify and resolve any discrepancies between the physical inventory and the accounting records system (book inventory).

c. The physical inventory process includes planning/preparation, conduct, and reconciliation.

d. Fermilab material is not amenable to measurement since all material is the form of discreet items. Also, Fermilab has no credible substitution material.

6.2 Plans and Procedures

a. With assistance from the MC&A Program (NMR/NMR Alternate), MBA Custodians conduct physical inventories of material within their designated locations. The nuclear materials and/or radioactive sources database inventories are compared with the physical inventory by systematic verification. Accounting system records are compared with the physical inventory by correlating FNAL numbers at each location where materials are stored. Each accessible item or accessible container is inventoried to verify materials.

b. Due to the potential to spread radioactive contamination, containers holding individual pieces of depleted uranium are not opened. Instead, the container itself is inventoried. Because the DZero calorimeter is located in the DZero collision hall, it is not accessible. Therefore, physical inventory is conducted by verifying that the shield wall outside the collision hall is in place. If the DZero calorimeter is moved out of the collision hall into to the DZero pit, the calorimeter itself is verified since individual calorimeter wedges containing depleted uranium are not accessible.

c. The total quantity of the AmBe neutron sources in the nuclear materials inventory database is listed as FNAL number 9000. Nuclear materials database FNAL number 9001 is reserved for the total quantity of Calfornium-252

neutron sources. Because these nuclear materials are also radioactive sources, more detailed information is contained in the radioactive sources database. Sealed neutron sources are physically inventoried, and leak tested monthly by the ES&H Division Hazard Control Technology Team (HCTT) in accordance with the Fermilab Sealed Radioactive Source Control and Accountability Program (ESHS-RPO-SOURCE01). The radioactive source database inventory is compared to the physical inventory by correlating the source inventory number (Source ID) with the labeling tag attached to each sealed neutron source. This inventory is recorded on the Neutron Source Physical Inventory Log (R.P. Form # 47). The log sheet is forwarded to the NMR/NMR Alternate/Source Physicist.

d. Fermilab has no inventory of deuterium gas. If Fermilab ever receives a reportable quantity of deuterium gas in the future, FNAL number 9002 is reserved for 99% or greater purity deuterium gas. If any individual accountable cylinders of deuterium are in use, the cylinder number and location is noted in the comment field of the nuclear materials database. Each individual accountable cylinder is inventoried at the location where it is being used.

e. Fermilab has no bulk materials, no holdup, and statistical sampling plans are not applicable. There is no SNM movement into or out of MBAs. Verification measurements are not applicable.

6.3 Periodic Physical Inventories

In accordance with DOE O 474.2A, Attachment 2, Table VII, Physical Inventory Periods, Fermilab conducts physical inventories of OANM every two years. As stated previously, materials that must be accounted for as SNM (AmBe neutron sources) are inventoried monthly.

Physical inventories identify FNAL numbers as listed on the nuclear materials inventory list (as applicable), location of materials, and item integrity (as applicable).

Physical inventories include a systematic walk-through of areas to ensure all items are identified (as applicable).

6.4 Reconciliation and Anomaly Resolution

The NMR/NMR Alternate is responsible for reconciliation of materials that must be controlled and accounted for as SNM and OANM. The NMR/NMR Alternate

reconciles the Fermilab nuclear material inventory by evaluating nuclear materials database and/or radioactive sources database inventory, entries made to the inventory adjustment log, the material transaction log, and transaction data. The Nuclear Materials Physical Inventory Report is sent to DOE FSO.

Inventory Differences (ID), uncertainties, ID control limits, ID trend analysis of cumulative IDs over multiple inventory periods, and limits of error of the ID are not applicable to the Fermilab MC&A program.

Inventory reconciliation must be completed within thirty days from initiating the physical inventory.

6.5 Special Inventories

Emergency or special inventories are conducted as needed to support detection of loss of nuclear material during emergency conditions, changes in MBA custodial responsibilities, or as otherwise directed by DOE.

In certain circumstances, Fermilab conducts non-routine physical inventories. Conditions requiring an additional physical inventory may include a change in management responsibilities, apparent missing items, an abnormal occurrence, or a breach or failure in the RPCF security system. Additionally, non-routine physical inventories may be conducted at the request of authorized facility personnel or the ODFSA.

If Fermilab is in a reduced operations mode with minimal staffing, Fermilab may request a waiver from DOE FSO to delay physical inventories until MBA Custodians are on-site, the laboratory returns to normal operations, and/or it is deemed safe to conduct physical inventories.