

INTERNAL ASSESSMENT REPORT

Department of Energy (DOE) Order 474.2 Change 4, Nuclear Material Control and Accountability (MC&A) Self-Assessment of MC&A Plan Database Descriptions, Categorization, Incident Reporting, Emergency Response, Material Transfer Records, NMMSS Reports, MBA Account Structure, Internal Controls, Material Access, and Facility Procedures

Start Date	End Date	Area Assessed
February 2, 2022	2/24/2022	MC&A Plan database descriptions, categorization, incident reporting, emergency response, material transfer records, NMMSS reports, MBA account structure, internal controls, material access, and facility procedures

Assessment Team

Name	Role ¹ (L, A, O)	Fermi ID#
Mary Curtis	Lead	37683N
Kathy Graden	Lead	08304N

¹ Role on assessment team: L=Lead, A=Assessor, O=Observer

Interviewees

Name	Title
Lori Limberg	06197N

Assessment Type

- | | |
|--|---|
| <input type="checkbox"/> QA Assessment
<input checked="" type="checkbox"/> Line Organization Self-assessment
<input type="checkbox"/> Management System Assessment | <input type="checkbox"/> Tripartite Assessment
<input type="checkbox"/> Triennial Assessment
<input type="checkbox"/> FESHCom Assessment
<input type="checkbox"/> Other: |
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INTERNAL ASSESSMENT REPORT

Report

Title

Same as above.

Scope

This self-assessment was evaluated against DOE Order 474.2 Change 4, dated September 13, 2016, *Nuclear Material Control and Accountability*. This self-assessment specifically focused on the following elements of the Fermilab MC&A Plan as approved by the DOE Fermi Site Office:

- Database descriptions
- Categorization process documentation
- Incident reporting process and procedures
- Emergency response plans and facility procedures
- Material transfer records
- Nuclear Materials Management & Safeguards (NMMSS) reports
- Material Balance Area (MBA) account structure
- Internal control procedures/system assurance
- Material access program
- Facility procedures

Note: MC&A Plan procedures were previously reviewed as part of Assessment #1548/iTrack Review #54086 (MC&A Self-Assessment of MC&A Plans, Procedures, Performance Tests, and Training).

Criteria

Provide reasonable assurance of compliance with DOE O 474.2 Change 4, *Nuclear Material Control and Accountability* with respect to MC&A Plan elements as listed in the Scope section above.

Report

Previous External DOE Reviews and Internal Self-Assessments

All recommendations and opportunities for improvement items identified in the 2019 DOE Office of Science (SC) Consolidated Services Center (CSC) Periodic Safeguards and Security Survey and the Fermilab Nuclear Materials Program Self-Assessment of June

INTERNAL ASSESSMENT REPORT

2019 have been addressed. iTrack Review #51526, Safeguards and Security Audit, Opportunity for Improvement (OFI) item from the 2019 DOE CSC survey has been closed.

iTrack Review #50726, MC&A Program Assessment items from the 2019 MC&A Program self-assessment have been closed.

DOE O 474.2, Nuclear Materials Control & Accountability Self-Assessment of Access Controls for OANM and Protection of the Public (iTrack Review #53587) resulted in four iTrack findings. Three are closed and one remains open. iTrack item #104722 has a due date for completion of 12/31/23.

DOE O 474.2, Nuclear Materials Control & Accountability Self-Assessment of MC&A Plans, Procedures, Performance Tests, and Training (iTrack Review #54086) conducted in July of 2021 resulted in one best practice and three opportunities for improvement items. Two of the three iTrack opportunities for improvement items have been closed. iTrack item #106107 remains open until the Fermilab MC&A Plan is revised (scheduled due date is 5/31/23).

This self-assessment addresses MC&A Plan elements as listed in the Scope section above.

MC&A Plan Overview

The purpose of the Fermilab MC&A Plan is to describe how the requirements set forth in applicable DOE Orders are implemented at Fermilab. The Fermilab DOE-Approved MC&A Plan describes how the MC&A program at Fermilab is documented, implemented, and maintained.

The Fermilab MC&A Plan describes how nuclear materials are accounted for and controlled on a graded safeguards basis. The Fermilab MC&A Plan documents comprehensive, effective, and cost-efficient nuclear materials control and accounting procedures to control and account for nuclear materials. The Fermilab MC&A performance goals are designed based on a graded approach for the control and accounting of nuclear materials to detect and deter theft, diversion, loss, or misuse of materials, and to maintain accurate accounting systems.

The MC&A Plan was reviewed. MC&A program management, policies, and procedures to control and account for Other Accountable Nuclear Materials (OANM) were verified to be in place.

INTERNAL ASSESSMENT REPORT

Database Descriptions

Fermilab MC&A Plan Sections C.4 and E.3 provide database descriptions. The Nuclear Materials (formerly named Depleted Uranium) database contains data for each discrete item of depleted uranium and total quantities of deuterium and Americium-241 Beryllium (AmBe). The Radioactive Sources database contains data for each AmBe neutron source. These databases are updated when there are any changes to the nuclear materials inventory status such as on-site transfers of nuclear materials, shipments, or receipts.

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

The Fermilab Uranium Database Data Entry Procedure (ESHS-MCA-04) provides detailed instructions for data entry. The Depleted Uranium database has been renamed the Nuclear Materials database since the MC&A Plan and the above referenced procedure have been revised. See Opportunity for Improvement item 1.

Safeguards Management Software (SAMS) Data Entry Procedure (ESHS-MCA03) is used to enter data into SAMS in order to create an xml. file for data submission to the Nuclear Materials Management and Safeguards System (NMMSS). All transaction and inventory data is submitted to NMMSS.

Categorization Process Documentation

Fermilab MC&A Plan Sections B.4 and C.2 address nuclear materials categorization. Fermilab was verified to be graded as a Category IV, Attractiveness Level E facility per DOE Order 474.2 Change 4, *Nuclear Material Control & Accountability, Table B, Other Accountable Nuclear Materials Table and Table C, Graded Safeguards Table*. This categorization and Attractiveness level will remain unchanged for the foreseeable future. Fermilab has no plans to acquire additional nuclear materials.

This self-assessment reviewed DOE O 474.2 Table A, *Special Nuclear Materials*. Review of Table A verified that Fermilab does not have any reportable quantities of special nuclear material.

Fermilab is not a nuclear facility as defined by DOE-STD-1027-2018, *Hazard Categorization of DOE Nuclear Facilities* dated November 2018. Section C.2 does not describe how DOE O 474.2 Tables A, B, and C are used to in the categorization process to determine reportable quantities and Attractiveness Level. See Opportunity for Improvement item 2.

INTERNAL ASSESSMENT REPORT

Incident Reporting Process and Procedures

Fermilab MC&A Plan Section B.13 describes incident investigation and reporting. If an apparent loss, theft, or diversion of nuclear material occurs, Fermilab conducts an immediate investigation/assessment of the incident, notifies laboratory management, and notifies DOE Fermi Site Office (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, circumstances of nuclear material alarms, 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.

Emergency Response Plans and Facility Procedures

Fermilab MC&A Plan Sections B.10, B.12, B.16 (b), and C.3 address emergency response plans and procedures. Fermilab emergency response plans are contained in the Fermilab Environment, Safety, and Health Manual (FESHM). Material Balance Area (MBA) Custodians are required to inform the Nuclear Materials Representative (NMR) of any abnormal or emergency situations involving nuclear material.

The accounting system data is capable of restoring backup data within 24 hours of an emergency. The most recent database restoration was conducted in February of 2022.

Material Transfer Records

Fermilab MC&A Plan Sections C.7 and E.4 describe internal (on-site) transfers, shipment and receipt procedures, transfer and transaction logs and reports, and transaction files, and transfer checks. The on-site transfer of nuclear material system monitors transfer of materials from one location to another on-site. This system is designed to deter and/or detect unauthorized movement of nuclear materials on-site. When nuclear materials are transferred from one location to another on-site, an On-site Transfer of Nuclear Materials Form (R.P. Form #57) is completed. On-Site Transfer of Nuclear Materials forms constitute source documents.

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.

INTERNAL ASSESSMENT REPORT

This form is used to track all actions required for shipment, receipt or NOL transfers. R.P. Form #114 is kept in the Nuclear Materials Transaction File or maintained in electronic format. R.P. Form #114 contains some information that is not up to date. See Opportunity for Improvement item #3.

For nuclear materials shipments, the NMR/NMR Alternate completes the Nuclear Material Transaction Report (DOE/NRC Form 741), and the completed report is sent to the receiver.

For nuclear materials receipts, 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 an approved measurement program. A transfer check is a confirmation of shipping container or an item count and must be completed upon receipt of nuclear materials. 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 MBA Custodian notifies the NMR/NMR Alternate to resolve the problem. If a discrepancy cannot be resolved, the NMR/NMR Alternate notifies DOE FSO to report a possible diversion of nuclear materials. Transfer checks of radioactive material are documented on Radiation Physics Form #20, Record of Radioactive Receipts and Shipments.

The most recent On-Site Transfer of Nuclear Material (R.P. Form #57) was completed on 10/12/2018.

The most recent Nuclear Materials Transaction Report (DOE/NRC Form 741) was completed on 10/16/2018.

The June 2019 MC&A Program self-assessment Review #50726 was reviewed to verify that the above records were reviewed and found to be complete.

NMMSS Reports

Fermilab MC&A Plan Section E.5 describes how to complete a Nuclear Material Balance Report (MBR). 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.

The Fermilab NMR/NMR Alternate conducts a review of inventory adjustments at the end of each fiscal year. The Review of Inventory Adjustments Report is submitted to the

INTERNAL ASSESSMENT REPORT

DOE FSO by September 30 each year.

NMMSS provides the NMR various reports on a quarterly basis. NMMSS reports reflect NMMSS data for each Reporting Identification Symbol (RIS) based on Fermilab data submission to NMMSS. The NMR reviews these reports for accuracy and notifies NMMSS of any discrepancies. This process of receiving NMMSS reports is not included in the current MC&A Plan. See Opportunity for Improvement item 4.

Nuclear Material Balance Reports (MBRs) were completed, and material balance inventory data was subsequently submitted to NMMSS on the following dates:

- 3/19/2019
- 6/19/2019
- 9/20/2019
- 12/9/2019
- 9/21/2020
- 9/15/2021

NOTE: After the Fermilab MC&A Plan revision was approved by DOE FSO on July 27, 2020, the MBR reporting frequency changed from quarterly to annually to align with DOE O 474.2, Chg. 4 requirements.

The most recent Review of Inventory Adjustments Reports were completed on 9/20/2019, 9/15/2020, and 9/15/2021.

MBA Account Structure

Fermilab MC&A Plan Section B.6 explains that Fermilab has only one Material Balance Area which is defined as the Fermilab geographical boundary. This is because Fermilab has no processing facilities, is limited scope, and has only low-grade materials.

Internal Control Procedures (System Assurance)

Fermilab MC&A Plan Section E.6 addresses nuclear materials internal control procedures. Fermilab has a set of checks and balances to provide assurance that losses or unauthorized movement of nuclear materials are detected. The key internal controls used to evaluate the Fermilab nuclear materials accounting system are timeliness, completeness and accuracy of records and reports, monitoring, access authorization, cost-effectiveness, and successful prevention of loss of nuclear material.

INTERNAL ASSESSMENT REPORT

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 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.

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.

Material Access Program

Many types of material access controls are described in the Fermilab MC&A Plan. See Sections B.8, C.3, C.4, and C.6. The Fermilab Security Department is responsible for security systems including material surveillance, card readers for access to buildings, locks, and keys.

Fermilab has a graded program for controlling personnel access to nuclear materials and accountability processes. Fermilab has implemented material access controls to ensure that only authorized personnel gain access to nuclear materials. Locked buildings, fences, gates, padlocks, card readers, and surveillance cameras control and monitor unauthorized access to materials.

To monitor access to the Radiation Physics Calibration Facility, a real-time monitoring system is installed using motion detection, cameras, and artificial intelligence to alert Security Operations Center (SOC) personnel of any unwanted occurrence. The Security Department provides exterior site inspection at least twice per eight-hour shift. The MC&A Plan should be revised to reflect the current access control monitoring system. See Opportunity for Improvement item 5.

Access to the neutron storage safe is controlled by use of a combination lock. Only authorized personnel are granted the combination to this lock. A list of authorized personnel is maintained by designated ES&H Section personnel.

Data access control is used to prevent unauthorized access to nuclear materials data. A log-on password is required to access inventory data. The NMR/NMR Alternate establishes and controls the log-on password. The radioactive sources and nuclear materials databases are contained on the Fermilab network, which is backed up every evening during the workweek.

INTERNAL ASSESSMENT REPORT

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

Facility Procedures

The Fermilab MC&A Plan references specific procedures that have been developed to support activities and reports required by the MC&A Plan and applicable DOE Orders. A cross-walk of DOE O 474.2, *Nuclear Materials Control and Accountability* (current revision) was conducted to ensure that the Fermilab MC&A Plan includes descriptions of all applicable MC&A elements, maintenance of associated procedures, operating conditions, and compliance with applicable DOE requirements.

The Fermilab MC&A Plan *Documents and Procedures* Section provides a list of applicable procedures that support the Fermilab MC&A Plan. These procedures were found to be complete and up to date.

Refer to iTrack Review #54086 (MC&A Self-Assessment of MC&A Plans, Procedures, Performance Tests, and Training) for more information on Facility Procedures review element.

Results

(Describe items found and categorize according to definitions below.)

Item Types

Non-conformance - The nonfulfillment of a specified requirement. This is limited to substantive issues that are worthy of being addressed. Word them as **statements of fact** rather than instructions.

Management Concern - An issue that management has identified as a concern requiring action to be taken to mitigate associated risk.

Recommendation - A suggestion or proposal for the best course of action to take on the identified topic.

Opportunity for Improvement - Suggestion on how to improve the identified topic.

Best Practice - A positive example of a work process or innovative approach with the potential to be the basis for significant operational improvements or cost savings.

INTERNAL ASSESSMENT REPORT

Lesson Learned – A best practice that is captured and shared to promote repeat application, or an adverse work practice or experience that is captured and shared to prevent recurrence.

Non-Conformances

None

Management Concerns

None

Recommendations

None

Opportunities for Improvement

1. When the Fermilab MC&A Plan and ESHS-MCA04 are revised, change the database name from Depleted Uranium to Nuclear Materials to reflect the new database name.
2. Revise the Fermilab MC&A Plan to include a more detailed description of the nuclear materials categorization process (include references to DOE O 474.2, Tables A, B, and C).
3. Update Checklist for Nuclear Material Receipt, Shipment, or Normal Operational Loss (NOL) (R.P. Form #114) to include up to date information.
4. During the next MC&A Plan revision, include a description of NMMSS reports that are received on a quarterly basis.
5. The MC&A Plan should be revised to reflect the new RPCF access control monitoring system.

Best Practices

None

Documents Reviewed

(List procedures, manuals, forms, etc. reviewed.)

- ESHS-MCA01 Fermilab Nuclear Materials Control & Accountability Plan
- ESHS-MCA03, SAMS Data Entry procedure
- ESHS-MCA04, Fermilab Uranium Database Data Entry Procedure
- 2019 DOE SC CSC Safeguards and Security Survey (iTrack Review #51526)
- 2019 Fermilab Nuclear Materials Program Self-Assessment (iTrack Review #50726)

INTERNAL ASSESSMENT REPORT

- 2021 Fermilab MC&A Self-Assessment (iTrack Review #54086)
- 2021 Database Restoration within 24 Hours documentation
- 2022 Nuclear Materials Database Restoration Verification
- Nuclear Materials Log
- On-Site Transfer Log
- RP Form #20 Record of Radioactive Material Receipts and Shipments
- Nuclear Material Balance Reports
- Fermilab Review of Inventory Adjustments Reports (FY20 and FY21)

Distribution

RPO Department Head
Quality Section Head/Liaison
CSO
SRSO
Security Chief

References

DOE O 474.2, Change 4, dated September 13, 2016, Nuclear Material Control and Accountability: <https://www.directives.doe.gov/directives-documents/400-series/0474.2-BOrder-chg4-pgchg>

DOE O 474.2, Change 4, dated September 13, 2016, Nuclear Material Control and Accountability Cross-Walk: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=6434>

ESHS-MCA01, Fermilab Nuclear Materials Control & Accountability Plan: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=2024>

ESHS-MCA03, SAMS Data Entry procedure: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=144>

ESHS-MCA04, Fermilab Uranium Database Data Entry Procedure: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=3240>